

*Minimalism and French /R/: Phonological representations in phonetically based phonology**

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ABSTRACT

This paper examines the phonological structure of French rhotics and their treatment in a production grammar. Assuming emergent featural specification, it is argued that the underlying representation of /R/ contains only values for sonorance, continuance and place of articulation. Grammatical analysis is undertaken in an Optimality Theoretic framework, where evaluation highlights the effect of effort reduction and perceptual augmentation on /R/, also demonstrating that more richly specified segments are unaffected by these constraints. The proposal is shown to be compatible with antecedent analyses and data from regional forms and registers.

INTRODUCTION

This article examines the phonological representation of French /R/.¹ Based on the premise that form emerges from language use and that abstract structure is acquired, rather than innate, it is argued that /R/ is structurally minimal, including only values for continuance and dorsality in most varieties of French. Variable surface forms are shown to be the product of phonetically based constraints, the interaction of which is formalised in a broadly Optimality Theoretic (OT; Prince & Smolensky 1993) grammatical model. It is noted that the unique representational minimalism of /R/ renders this segment particularly sensitive to phonetically based constraints.

The article proceeds as follows. The first section examines the phonetic and phonological characteristics of French /R/, surveys previous accounts, and addresses larger issues associated with rhotic sounds. An alternative specification of /R/ is advanced in the second section, drawing upon non innatist and emergent featural theories. The third section focuses on grammatical treatment

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¹ Throughout this paper, /R/ is used in reference to the French rhotic without further place or manner specification.

of minimal underlying representations. It is shown that constraints targeting positional augmentation, interacting with those promoting effort reduction are crucially ranked in the production grammar; this successfully predicts surface forms and provides a template for the analysis of data from regional forms and registers. A discussion section underscores the theoretical and methodological advantages of this approach, also highlighting related questions and paths of future research.

I. BACKGROUND

The sound represented by the grapheme *r* is one of the most variable segments in French. This section provides a short background to /R/, focusing on its phonetic characteristics, distributional regularities and association with phonological classes.

1.1. The phonetics of French R

In most varieties of convergent French, /R/ is articulated as a fricative or approximant, having a uvulo-velar or velar place of articulation, and may be voiced or voiceless, as in (1) (Tranel, 1987, forthcoming; Fougeron and Smith, 1993; Walker, 2001; Russell Webb, 2002, 2004a, 2004a; Rose 2003).² In (1a) and throughout this article, the diacritics [◌_◡] and [◌_◣] indicate a relatively narrower and wider aperture at the point of oral constriction, corresponding to fricative and approximant articulations, respectively. In (1b), [◌_◣] and [◌_◡] indicate voiced and voiceless surface forms, respectively.

(1) Surface forms of /R/: Convergent French

a. aperture

<u>orthography</u>	<u>translation</u>	<u>surface form(s)</u>
<i>me</i>	'street'	[g _◡ y]
<i>brue</i>	'daughter-in-law'	[b _◡ g _◡ y]
<i>dru</i>	'thick'	[d _◡ g _◡ y]
<i>grue</i>	'crane'	[g _◡ g _◡ y]
<i>bourru</i>	'gruff'	[bu _◡ g _◡ y] [bu _◣ g _◡ y]
<i>pur</i>	'pure'	[py:ɣ _◡]
<i>turc</i>	'Turkish'	[tyɣ _◡ k]
<i>absurde</i>	'absurd'	[apsyɣ _◡ d]

² The term *convergent French* is used to refer to varieties lacking in particular regional characteristics, i.e. those used in most national or international media and those which are typically the object of second language instruction. While categorical distinction between varieties is difficult, if not impossible to make, this and other terms are used for purposes of discussion. It is noted that the proposed analysis is not dependent on this classification and is, indeed, amenable to a wide range of speech data.

b. voicing

<u>orthography</u>	<u>translation</u>	<u>surface form(s)</u>
<i>grue</i>	'crane'	[gʁy]
<i>cru</i>	'vine'	[kʁy]
<i>grande race</i>	'greater species'	[gʁɑ̃dʁas]
<i>perde</i>	'lose-3S-subj.'	[pɛʁd]
<i>perte</i>	'loss'	[pɛʁt]
<i>petite race</i>	'lesser species'	[pɛtitʁas]
<i>rage</i>	'rage'	[ʁa:ʒ]
<i>car</i>	'bus'	[ka:ʁ]
<i>cadre</i>	'frame'	[kadʁ]

Most speakers produce surface forms of /R/ as fricative [ʁ] in word initial onsets and as approximant [ʁ̥] in codas, as in (1a). In intervocalic environments a good deal more variability is observed. In a phonetic study involving both spontaneous and careful speech tokens, Russell Webb (2002) notes that speakers produce more approximant like segments in these contexts, an observation also echoed in Tranel (1987, forthcoming) and O'Shaughnessy (1982), among others. At the same time, it is noted that fricative [ʁ] in intervocalic positions is far from extraordinary, especially in emphatic or careful speech styles.³ /R/ aperture also varies in hyper- or hypoarticulate speech styles, e.g. final /R/ may be fricated for emphasis, whereas initial /R/ may be lenited due to enchainment, i.e. the sequential resyllabification of speech. As noted in (1b), /R/ is also subject to patterns of passive voicing (Tranel, 1987: 21; Walker, 2001: 137–139; Russell Webb, 2004b).

Regional forms of French testify to additional surface forms and distributions. For many Brussels French (BF) speakers, for instance, aperture variation is largely absent (Grootaerts, 1953; Baetens Beardsmore, 1971: 84–85, 437–439); /R/ almost always surfaces as a fricative, regardless of position or context, as in (2). Trilled [R] is also noted, although with far less regularity.

(2) Brussels French

<u>orthography</u>	<u>translation</u>	<u>surface forms</u>
<i>par</i>	'by'	[paʁ]
<i>parc</i>	'park'	[paʁk]
<i>parce que</i>	'because'	[paʁskœ]
<i>parrain</i>	'God father'	[paʁɛ̃]

Tranel (PC) observes that trilled [R] is marginal in modern French (see also Delattre, 1966: 206), although it does occur in a number of highly marked speech styles,

³ Data made available by ongoing research under the aegis of *Phonologie du français contemporain* (www.project-pfc.net) contains several tokens of intervocalic [ʁ̥]. It is unclear whether these examples result from emphatic style, are lexically specified or are more idiosyncratic in nature.

e.g. singing. Other examples of dialectal particularity are noted in Southwestern France, where /R/ is often realised as a voiceless fricative (Tranel, 1987: 143); in Montréal, where /R/ was until recently produced as [R] or [r], although fricatives are now most common (Tousignant, Sankoff and Santerre, 1989; cf. Sankoff and Blondeau, 2007); and in Francophone Africa, where /R/ is most often produced as an apical vibrant [r], although velar articulations are not unknown (Dumont, 1979; Duponchel, 1979; Manessy, 1984; Renaud, 1979; see also Walter, 1977).

Coda /R/ vocalisation is noted in a handful of dialects, e.g. Quebecois (QF) and St. Thomas French (STF). In QF, /R/ can surface as a homorganic vowel in syllabic codas.⁴ In STF (3b), /R/ vocalisation only occurs in post-vocalic clusters (i.e. complex codas); in simple codas, /R/ is elided.

(3) /R/ vocalisation

a. Quebecois French (Côté, 2004: 169–170)

<u>orthography</u>	<u>translation</u>	<u>surface form</u>
<i>arme</i>	'weapon'	[aʁm] [aəm]
<i>port</i>	'harbor'	[pɔʁ]
<i>pire</i>	'worse'	[piʁ]

b. St. Thomas French (Highfield, 1979: 45)⁵

<u>orthography</u>	<u>translation</u>	<u>surface form</u>
<i>gourd</i>	'gourd'	[guʁd]
<i>porte</i>	'door'	[pɔʁt]
<i>pour</i>	'for'	[pu]
<i>pour elle</i>	'for her'	[puʁɛl]

Similar to STF data in (3b), coda /R/ vocalization or erasure is common in regional French, as well as in non-standard registers and fast speech. This phenomenon is especially frequent when /R/ is found in final, post-obstruent /R/ position, e.g. *cadre* 'frame' [kad].

1.2. R distribution

A crucial issue with regard to the phonological status of /R/ is the participation of this segment in phonetic and phonological classes, i.e. groups of sounds which behave in similar manners or take part in common processes. Like voiced fricatives, but distinct from /l/ and glides, /R/ triggers phonetic vowel lengthening, as in (4).

⁴ Several instances of QF /l/ vocalization are also noted; these involve the optional lengthening of the preceding vowel and are limited to /lm/ clusters, of which there are relatively few (Côté, 2004: 168–169, 170–171); /l/ vocalization is not noted in STF. Walker (1984) reports several instances of systematic /R/ and /l/ elision. Similarly, in a sociolinguistic study of Franco-Ontarian, Thomas indicates that /R/ erasure is linked to register and speech style, among other variables (1986: 82–91). It is not clear the extent to which such erasure is lexical.

⁵ STF /R/ vocalization is similar to that of Maurician French (Baggioni and de Robillard, 1990: 86–87), as well as the regional French of Réunion (Ledegen and Bordal, 2005, PC).

- (4) Vowel lengthening (Colantoni and Steele, 2005; Laeufer, 1992; Walker, 2001: 42–44)

<u>orthography</u>	<u>translation</u>	<u>surface form</u>
<i>pire</i>	‘worse’	[pi:ʁ]
<i>pive</i>	‘pine nut’	[pi:v]
<i>Pise</i>	‘Pisa (city)’	[pi:z]
<i>pige</i>	‘understand-3S’	[pi:ʒ]
<i>pile</i>	‘battery’	[pil]
<i>pille</i>	‘pillage-3S’	[pij]

The question of whether vowel lengthening is best attributed to phonetic implementation or the phonological grammar is not taken up here (see e.g. Lindblom, 2006 for discussion of the phonetics–phonology divide). Rather, what can be noted here is that /R/ is associable with voiced fricatives and not /l/ and glides.

Despite the above, /R/ distribution is most closely aligned with that of /l/, as exemplified in (5). Both segments frequently occur as the rightmost constituent in complex onsets; both also precede obstruents in complex codas or occur in final, post-obstruent codas.⁶

- (5) Liquid Distribution

a. complex onset

<u>orthography</u>	<u>translation</u>	<u>surface form</u>
<i>branche</i>	‘branch’	[brɑ̃ʃ]
<i>blanche</i>	‘white-F’	[blɑ̃ʃ]
<i>sprint</i>	‘sprint’	[sprɛ̃nt]
<i>spleen</i>	‘melancholy’	[splɛ̃n]

b. coda

<u>orthography</u>	<u>translation</u>	<u>surface form</u>
<i>carte</i>	‘card’	[kɑʁt]
<i>balte</i>	‘baltic’	[balt]

c. final post-obstruent

<u>orthography</u>	<u>translation</u>	<u>surface form</u>
<i>sabre</i>	‘saber’	[sabʁ]
<i>sable</i>	‘sand’	[sabl]

It should be noted that in complex codas such as (5b), /R/ and /l/ also pattern with fricative /s/, e.g. *vaste* ‘vast’ [vast].⁷

Other continuants surface as the rightmost element of onsets following schwa elision, e.g. *s’maine* (*semaine* ‘week’), *d’sous* (*dessous* ‘under’). Likewise, /R/ may

⁶ Nasals are also licensed in the latter position, although this is limited to a restricted set of lexical items (e.g. *hypne* ‘hypnus’) and derivational suffixes (e.g. *communisme* ‘communism’).

⁷ Coda /f/ is noted in a small number of lexical items, many of which are loanwords of Germanic origin (e.g. *loft*).

appear as the leftmost element in a surface onset, e.g. *r'venir* (*revenir* 'return'). Onset tokens such as these do not obviate the regularities noted in (5), however, as similar processes result in clusters of any consonant types, including plosives (e.g. *d'venir/devenir* 'become') and nasals (e.g. *n'veu/neveu* 'nephew', *v'nu/venu* 'come-PART'). With the exception of certain loans and scholarly words (e.g. *pseudonyme*, *tsar*), which may be analysed as affricates, fricatives are only the rightmost member of surface branching onsets resulting from schwa elision.

Similarities seen in (5) notwithstanding, /R/ and /l/ distributions are not identical. /R/ occurs in complex onsets following any plosive, regardless of the latter's place specification, while /l/ does not occur following coronal plosives. Conversely, /l/ may follow coronal fricative /s/ in a complex onset (e.g. *slave*, [slav] 'Slavic'). /R/ only appears in these positions due to schwa elision (e.g. *s'ra/sera* 'be-3Sing'), as well as in a handful of loanwords (e.g. *Srebrenica*). While many /sl/ tokens are indeed loanwords, these are arguably more frequent and better integrated in the contemporary lexicon than are /sR/ tokens. Tellingly, data from Russell Webb (2002) indicates that approximant [ʁ] is heavily favoured in both isolated tokens and sequential speech when such onsets arise from schwa elision.

Additional phonological data regarding possible statuses of /R/ are observed in several regional varieties. Côté (1997, 2000, 2004) presents expanded analyses of QF final cluster simplification, as in (6), which is blocked by /R/.

(6) QF Cluster Simplification (Côté, 2004: 154–155, 168–169)

<u>orthography</u>	<u>translation</u>	<u>surface forms</u>
<i>corde</i>	'string'	[kɔʁd] *[kɔʁ]
<i>orge</i>	'barley'	[ɔʁʒ] *[ɔʁ]
<i>Donald</i>	—	[donal] [donald]
<i>Week-end</i>	'weekend'	[wiken] [wikend]
<i>vaste</i>	'vast'	[vas] [vast]

In coda clusters the final consonant is not elided when preceded by /R/; according to her analysis, /R/ patterns with /j/ and is distinct vis-à-vis /l/, nasals and fricatives.⁸

/R/ is an oddity in the phonological inventory of French, highlighting a central question of the present work. This is the only segment whose surface forms alternate along a continuum from fricative to approximant, also inheriting voice quality from the phonotactic environment. /R/ is historically one of the few segments which have undergone a radical shift in place of articulation (i.e. from coronal to dorsal) and which is phonetically and phonologically variable in regional forms and registers. This is not to say that other French consonants are invariable. Liquids and nasals are also subject to voice assimilation, for example, but do not show fortis-lenis variability like /R/. By the same token, intervocalic voiceless obstruents are often

⁸ While providing that cluster reduction is primarily attributable to perceptually motivated constraints, Côté (2004) notes the intervention of lexical factors in the case of /ld/ simplification (e.g. *solde* 'sale' cannot be simplified, whereas *calme* 'calm' may be).

partially voiced (e.g. *été* [eʔe] ‘summer’) and final voiced obstruents may be partially devoiced (e.g. *cède* [seɖ] ‘cede-3Sing’) (Russell Webb, 2002, 2004a). These data are, however, phonologically distinct from the above, as obstruents are contrastive for voicing (viz. *aider* [ede] ‘aid-INF’; *cette* [set] ‘demonstrative-FEM’), whereas liquid voicing and /R/ aperture are never contrastive.

Systemic associations become more complicated when similarities between /R/ and glides are taken into account. Approximant [ʁ] and glides share similar phonetic profiles (vowel like formant structure with the highest resonance peaks below 3000 Hz), but, unlike both stable and derived glides, /R/ is never a constituent of the syllable nucleus. And whereas glide formation involves changes to an underlying vowel, /R/ lenition results in the partial vocalisation of a consonant (and complete vocalisation in certain regional forms and registers). It is also worth noting that [j] (the only glide licensed in codas) blocks vowel lengthening, whereas the opposite obtains in the case of coda [ʁ], as in (4).⁹

1.3. Accounting for R: featural theory

It emerges from the above discussion that /R/ is somewhat of a chameleon. Phonetically, it resembles either an obstruent or a sonorant, depending on its position and (for some speakers at least) speech style, while phonologically it participates in natural classes with fricatives and liquids, as well as with glides in some regional forms and registers. At the same time, /R/ is unique vis-à-vis both obstruents and all other sonorants, which are resistant to aperture variation. The variability characterised by French /R/ is hardly unique and, perhaps for that reason, interest in rhotics is recurrent within the phonological community. This section provides a brief overview of selected works which account for behaviour of /R/ and the cross-linguistic grouping of rhotics in different languages. Those which do not address representational and/or featural issues (e.g. Lindau, 1985; Widdison, 1997) are not reviewed, although their consultation may be useful to readers unfamiliar with questions of rhotic classhood.

Most phonological accounts of French /R/ surface patterns are founded on abstract representations constructed from a relatively small set of distinctive features, e.g. Chomsky and Halle (1968; see also Jakobson, 1939; Jakobson, Fant and Halle, 1952). A survey of phonological literature from the past three decades reveals that the putative structure assigned to /R/ is far from uniform. Three examples, among the dozens of possible accounts, are provided in (7).

⁹ Several studies of second language learners of French (e.g. Colantoni and Steele 2007) note that speakers target the fricative like qualities of /R/ in all positions. Interestingly, first language studies indicate complementary outcomes, where /R/ is often elided or vocalized until a relatively late period, although this is not always the case (see e.g. Edwards, 1973; Kehoe and Hilaire-Debove, 2004; Rose, 2000, 2003; Goad and Rose 2004). The extent to which preference for the fricative in second language learning is due to pedagogical practice is unclear, as is the influence of perception and habituation on child acquirers.

(7) Featural Specifications of /R/

a. Bibeau (1975: 39)	b. Dell (1980: 79)	c. Brousseau and Nikiema (2001: 77)
+ consonant	+ consonant	+ consonant
– coronal	– coronal	– coronal
– front	– front	– front
+ back	+ back	+ back
– round	– round	– round
– nasal	– nasal	– nasal
+ continuant	+ continuant	+ continuant
+ voice	+ voice	+ voice
+ closed	– delayed release	+ syllabic
+ vocalic	– syllabic	
– anterior	+ sonorant	
– open	– high	
– strident	– low	
– lateral		

Each underlying representation calls upon different units in its account of /R/. Bibeau (1975) groups /R/ with non obstruents by virtue of the feature and value [+vocalic]. On the other hand, Dell (1980) employs more traditional featural notation ([+sonorant]) to facilitate this classhood, whereas Brousseau and Nikiema (2001) provide that /R/ is [+syllabic], alluding to autosegmental issues. Little discussion of /R/ surface variability is undertaken by these authors, despite acknowledgement of the intermediate nature of /R/. The exception to this is voice assimilation, attributed to sonorant underspecification for laryngeal features by Dell (1980: 57–58).

A handful of recent works address the phonological status of /R/ with more limited focus. Côté is primarily interested in cluster simplification in QF, ignoring both distribution and representation (2004: 159). Her classification of /R/ as a glide considers only final and pre-final positions, rather than onsets (in which she acknowledges /R/ to pattern with fricatives). Colantoni and Steele (2005) also question the grouping of /R/ and /l/ among liquids. Given historical asymmetries between the two sounds, as well as frequent vowel intrusion in QF complex onsets, they conclude that /R/ is a fricative (2005). Russell Webb presents a distinct approach to French /R/ representation, taking into account voice (2004b) and aperture (2004a), as well as the systemic relations between phonemes and their input (2002). He assumes that underlying representations may be minimal, but proposes no formal structure to this end.

Looking beyond the question of French /R/, a review of works focusing on the cross linguistic status of rhotics underscores the difficulties associated with the phonological status and content of these segments. Walsh Dickey (1997) argues for an abstract class [rhotic] as a structural byproduct. According to her analysis, formalised along the lines of Clements' (1985) feature geometric model, different rhotics share a secondary laminal node under the coronal sub-node. The relatively rich featural content of rhotics explains their cross-linguistic patterning, most

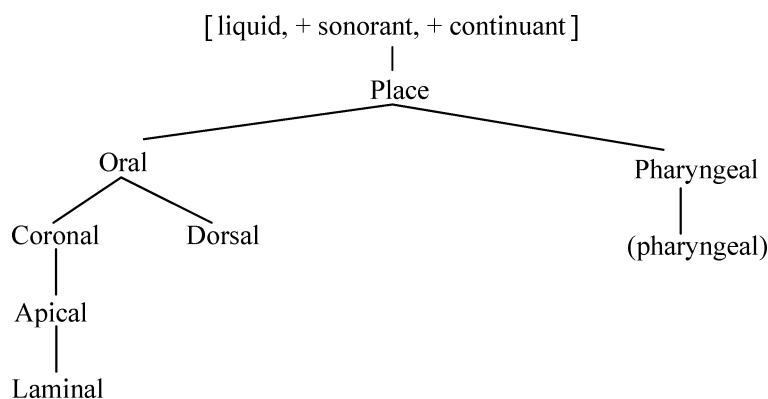


Figure 1. *Dorsal Rhotic Featural Representation* (Walsh Dickey, 1997: 138, her 3.18, modified).

notably resistance to palatalisation. In her analysis, dorsal rhotics are specified as having both coronal and dorsal place specification, as well as pharyngeal specification, as in Figure 1. Under such an interpretation, all rhotics contain a secondary laminal node and are structurally both coronal and dorsal.

A distinct approach is taken by Wiese (2001), who accounts for cross-linguistic patterning as the result of rhotics' unique position on a sonority scale, derived from Clements (1990), as in (8).

- (8) Rhotic Sonority (Wiese, 2001: 355, emphasis of the original)
 obstruent < nasal < lateral < /r/ < glide < vowel

Following his formalisation, rhotic patterning is attributable to this segment's situation intermediate to /l/ and glides. As a logical extension, distinct sonorities might be combined or interleaved if a given rhotic patterns with another segment (e.g. /l/) in a given language. It is, however, unclear what precise representational structure should be viewed as the foundation of rhotic sonority.

Van Oostendorp (2001) presents the case for the Dutch rhotic as a placeless, empty consonant in Brabant and Limburg dialects, also reviewing varieties of English. He argues that rhotics do not occupy a fixed point on the sonority scale, but are chameleonic with regard to consonantality, i.e. may or may not be a consonant and thus may pattern with sonorants. Variability is attributed to the relative ranking of the markedness constraint FINAL-C ('a phrase (word) should end in a consonant'), and proposes that the Dutch rhotic is 'particularly sensitive to this because /r/ is not predetermined for place' (2001: 116, 114). In essence, van Oostendorp posits that rhotics lack featural content and that their surface forms are determined by the grammar. While he alludes to representational emptiness or minimalism in other languages, he makes no formal proposal to this end. A similar proposal is made by Rose (2003) concerning QF /R/ based on child acquisition data, although it is unclear as to whether the placelessness of a child's representation

changes over time, eventually including specification for dorsality or the like. It should be noted that, upon grammatical maturation, the vast majority of French speakers do not show place variation similar to that seen among Dutch speakers.

2. RETHINKING THE PHONOLOGY OF /R/

The preceding section raises the question of the abstract representational structure of /R/, as well as the implications of such structure for phonological classes and formal grammars. On the one hand, there is a good deal of phonological evidence (not to mention disciplinary tradition) associating /R/ and /l/ under the umbrella of liquids. On the other hand, /R/ surface forms are relatively dissimilar to those of /l/, more closely resembling fricatives or glides. This section focuses how to best conceive of the psychological reality of /R/ in a formal model built around distinctive features.

One plausible approach to the structural question establishes distinct /R/ phonemes, each of which includes a set of features motivating its grouping with /l/, glides, or fricatives. The assumption of multiple /R/ phonemes is descriptively infelicitous, however, as it ignores complementary distribution and stylistic variation, not to mention derivational and historical associations, as well as evidence from dialects and regional forms. The presumption of distinct underlying representations (i.e. /ʀ/ and /ʁ/) furthermore approaches the sharp edge of Occam's Razor, requiring both a heavier phonemic inventory and a more complicated grammar.

A second possibility assumes a unique underlying representation and accounts for input-output transformations within a formal grammar. Accordingly, /R/ would be associable with either liquids or fricatives by virtue of its representation and grammatical processing would be responsible for the selection of surface forms. The question remains as to whether /R/ is fundamentally an obstruent, i.e. a fricative which undergoes lenition, or a sonorant, i.e. an approximant which undergoes fortition. This approach results in a dilemma of circularity similar to the well known 'chicken and egg' problem, at least for speakers of convergent French. While eluding Occam's Razor – regardless of the selection of underlying representation – the choice between an underlying fricative or approximant relies on prioristic reasoning.¹⁰

A final option, pursued here, establishes a single /R/ representation absent of particular values relating to surface aperture and voicing. This approach is founded on emergent features and values and assumes that post lexical representations contain only those features which promote systemic contrast, i.e. the psychological reality of

¹⁰ It should be noted that acquisition data are not particularly helpful in this regard, as child language indicates that /R/ patterns with both fricatives and approximants (see note 9). Likewise, historical data is not particularly enlightening as it concerns the status of /R/, as positional fortis-lenis variations are seen throughout the history of French (see e.g. Delattre, 1966; Bourciez & Bourciez, 1974; Giauque, 1976; Lozachmeur, 1976; Straka, 1979).

a segment includes only information pertinent to its distinction from other segments within the phonological system. A test of this approach is the ability of a grammar to select attested outputs without either over-predicting, i.e. providing outputs which do not occur, or under-predicting, i.e. failing to account for a surface true output. The remainder of this section is given to discussion of non innate featural theory and the promotion of representational minimalism. A formal grammatical account, in which surface forms are predicted by constraint interaction, is proposed in a subsequent section.

2.1. Theoretical Background

The traditional and nearly unanimous assumption (see e.g. Clements and Hume, 1995: 245) that features are universal has come under increasing scrutiny in recent years. Boersma, for example, acknowledges the quasi-universal nature of articulatory and perceptual space, but denies the universality of featural values. Accordingly, the phonological building blocks of a language are defined by use and segmental representations include only relevant values (1998: 172). A similar approach is taken by Mielke, who argues against the primacy of phonetic universals in the establishment of features, positing the latter as 'abstract categories based on generalisations that emerge from phonological patterns' (2004: 7). According to EFT, features are born of generalisations made during acquisition, based on phonological evidence, and are only indirectly grounded in diachronic change or phonetic form (2004: 118–121, 126–127). The apparent universality of certain featural distinctions such as place (e.g. [labial]) or manner (e.g. [continuant]) is motivated by segmental participation in phonologically active classes, and putative cross linguistic universals are considered epiphenomenal, rather than innate (2004: 141–142).

Focusing on the question of rhotic cross linguistic patterning, Russell Webb (2002) begins with the presupposition that features are not universal, based in large part on Boersma (1998). Similar to EFT, he proposes that features derive from learned patterns of similarity and difference within a system, essentially from the holistic productive and receptive input made available to language users. It is hypothesised that a given segment may be defined according to intrinsic features (e.g. backness or dorsality), as well as the absence of features (e.g. the lack of high frequency noise), both of which provide for systemic contrast. Following the stated denial of featural universality, the rhotic of one language cannot be directly defined in reference to another or its form motivated by cross linguistic patterns. Cross linguistic comparison may be made between inventories and phonological dynamics (i.e. systems of similarity and distinction), rather than unique segments, but this only indirectly establishes rhotic classhood (2002: 163–175).

The implications of abandoning innate features are far reaching, especially in cases such as the one at hand. Rather than depend upon a fixed set of universal phonological units, requiring that a segment be fit to the set, it is possible to construct a phonological representation dependent on surface data, essentially

deriving the feature set from surface forms and their observable phonetic and phonological characteristics. Unlike approaches founded on innate features and values, where function is induced from form, an emergent approach provides that form is deduced from function (function being allegorically understood as linguistic performance). From this perspective, it is perfectly feasible that one speaker's /R/ is distinct from that of another, even if both are speakers of a common language. Similarly, the features and values assigned to the rhotic of one language or regional variety of a language need not be assumed of others. In the following section, it is argued that the chameleonic nature of /R/ in convergent French leads to the establishment of a minimally specified abstract representation, i.e. one which contains little featural information. It is further proposed that different surface forms and distributions seen in regional forms of French may lead to the emergence of variant representations in some cases.

Before examining emergent features and their application to French, brief mention should be made of the repercussions of this approach for contemporary phonological analysis. The presumption that features are not innate poses a distinct problem for OT, especially given its principle of Richness of the Base (ROTB; Prince and Smolensky, 1993: 207). This provides that no constraint holds at the level of input and implies that all grammars should contend with all possible input. At the heart of this matter are representational underspecification and the status of redundant phonological features in the input. Itô, Mester and Padgett (1995) demonstrate that OT's non-derivational framework denies any serial ordering or minimalism, providing that underspecification is an output – rather than an input – property. This approach to indeterminate representations is distinct from that taken by Kirchner (1998) and Russell Webb (2004a), who argue that input may be assumed to lack structural information as a means of avoiding circuitousness (see also Boersma 1998). This implies a weak understanding of ROTB. At a lexical level, input is unconstrained, but productive input, such as that under discussion here, is finite. The present approach assumes full specification at a lexical evaluative level, which is filtered by declarative constraints (see Myers, 1999; Gess, 2003, 2004). While full treatment of this question far surpasses the scope of the present work, it should be noted that emergent features are compatible with OT and the proposal made here does not, a priori, invalidate ROTB, although this is necessarily considered a theorem, rather than a principle of linguistic production (see e.g. Hale & Reiss, 1998; Reiss, 2000; see also McMahon, 2000, 2007).

2.2. Emergent R

In order to contextualise discussion of /R/ and related segments, the consonantal phoneme inventory of French is provided in Table 1, noting place and manner characteristics. A first step in accounting for /R/ particularity is the establishment of features and featural values promoting its distinction and similarity vis-à-vis other segments. Given the phonological and phonetic evidence confronting language

Table 1. French Consonant Inventory: adapted from Walker (2001: ix)

	labial	alv./dent.	palatal	velar/uvular
plosives	p, b	t, d		k, g
fricatives	f, v	s, z,	ʃ, ʒ	
nasals	m	n	ɲ	ŋ
liquids		l		ʁ
glides	ɥ		j	w

users and focusing for the moment on convergent French, a series of unary place and binary manner and major class features is employed. Foremost among these is [vowel], accounting for segments which may feature in syllabic nuclei (note that glides are specified as [+vowel] and [+sonorant]).

Place (e.g. [coronal]) and most manner features (e.g. [nasal]) are straightforwardly posited from the assumptions outlined above, i.e. that language users posit features and the values assigned to them based on their acquisition and use of the language. For example, a user is attentive to the contrast between *poux* [pu] 'lice', *tout* [tu] 'all' and *cou* [ku] 'neck,' leading to distinct place values. Likewise, the feature [vowel], is assigned to segments which appear in syllabic nuclei (i.e. vowels and semi-vowels) and which thus constitute the necessary element of a rhyme. Voicing is assumed to be specified only for those segments that are contrastive in this regard, i.e. fricatives and plosives. This is presented as [\pm voice], although emergent values might also be subsumed under privative headings such as [voice] and [spread glottis] (see e.g. Jessen and Ringen, 2002).

The manner feature [sonorant] is posited based on phonotactic evidence available to users, notably the ability of some segments to take part in complex onsets and codas. From this it is assumed that a language user distinguishes between nasals and liquids on the one hand and fricatives and plosives on the other. The former are frequently in complex syllabic structures and are relatively unrestricted in this regard; by contrast, the latter are far more restricted in their distribution (the question of /s/ not withstanding). This represents a departure from traditional definitions of sonorance, which derive from notions of spontaneous voicing (e.g. Chomsky and Halle, 1968: 302) or aperture (e.g. Clements, 1990). The major manner feature [obstruent] is associated with the class of segments whose surface forms require constriction in the oral cavity. Complementary to the definition of [sonorant], [obstruent] is further assumed to emerge from the relative restriction placed on a sound's distribution and potential to constitute complex syllabic structures. Finally, [continuant] is assumed to emerge from the distributional, articulatory and perceptual properties of sounds that do not require an oral cavity constriction. This is similar to Chomsky and Halle, who ascribe [continuant] to segments having an unimpeded oral airstream, providing uninterrupted source noise (1968: 317–318), although considerations outlined below add precision as to the nature of constriction in question.

A preliminary featural specification of French continuants is given in Table 2. In this matrix, values are assigned following Radical Underspecification Theory

Table 2. *French Consonant Inventory: features and values*

	PLACE	vowel	obstruent	continuant	sonorant	nasal	voice
p	labial		+				–
b	labial		+				+
t	coronal		+				–
d	coronal		+				+
k	dorsal		+				–
g	dorsal		+				+
f	labial		+	+			–
v	labial		+	+			+
s	coronal		+	+			–
z	coronal		+	+			+
ʃ	coronal dorsal		+	+			–
ʒ	coronal dorsal		+	+			+
m	labial		+			+	
n	coronal		+			+	
ɲ	coronal dorsal		+			+	
l	coronal			?	+		
ʀ	dorsal			?	+		
j	coronal	+		+	+		
ɥ	labial	+		+	+		
w	coronal labial dorsal	+		+	+		

(Archangeli, 1988; Stemberger, 1991; Cohn, 1995), according to which an underlying representation contains only those specifications promoting distinction, with surface values being filled in by the grammar. As noted by question marks in Table 2, the status of /R/ and /l/ with regard to [continuant] requires additional discussion. In the case of convergent French /R/, language users are confronted with a sound which can never be in a syllable nucleus, i.e. a sound which does not contain the value [+vowel], but which differs from all other non-vowel segments as it does not involve specific constriction or closure target and is contextually variable for both manner and voice quality. Importantly, only /R/ implies surface forms whose aperture or major manner characteristics track closely to context. Distinction of /R/ from fricatives and /l/ derives from the latter sounds' relatively stable articulatory targets and contextual aperture invariability.

The status of /R/ and, especially, /l/ with regard to [continuant] has long been a subject of debate in the phonological community (see e.g. van de Weijer, 1995) and serves as an important illustration of EFT (Mielke, 2004: 241–246, 267–270). In the present work, [continuant] is posited based on vowel lengthening and cluster restrictions, indirectly reflecting phonetic considerations. In the first instance, as in (4a), it is noted that vowels are lengthened before voiced fricatives and /R/, but not before voiceless fricatives and /l/. Assuming that differential patterning involving

Table 3. /R/ and /l/ specification

	PLACE	obstruent	continuant	sonorant	nasal	voice
l	coronal		–	+		
ʀ	dorsal		+	+		

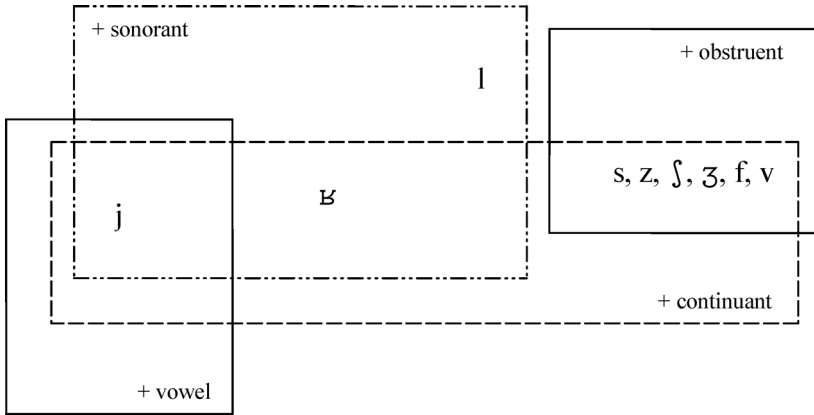


Figure 2. Phonological classes.

fricatives is due to anticipatory laryngeal constriction impeding vowel lengthening, the crucial distinction lies between /R/ and /l/. /R/ surface forms do not result in complete contact between the articulator and articulatory target, allowing a central airstream channel, similar to that of vowels. In contrast, surface forms of /l/ (as well as /j/) involve mid-sagittal closure and a lateral air channel, more closely resembling that of plosives (Hirose, 1997; Stevens, 1998: 543–555). Additional phonological evidence for /l/ specification as [–continuant] is gleaned from its distribution within onset and coda clusters, as in (5). /R/ is more widely licensed in triple branching onset clusters as compared to /l/. Confronted with phonological input similar to this, it is plausible that learners posit /R/ and fricatives as [+continuant] and /l/ and [–continuant]. These considerations lead to the representational values given in Table 3, where /l/ is specified as [–continuant, +sonorant] and /R/ as [+continuant, +sonorant].

A visual model accounting for phonological classes is provided in Figure 2. Using only the values [+sonorant], [+continuant], [+obstruent] and [+vowel], it is possible to account for the phonetic and phonological patterns discussed in §1. Consistent with Table 3, a liquid is any non-nasal, non-vowel segment containing the value [+sonorant], whereas a fricative is any non-sonorant specified as [+obstruent, +continuant]. /R/ patterns with fricatives, as both are specified as

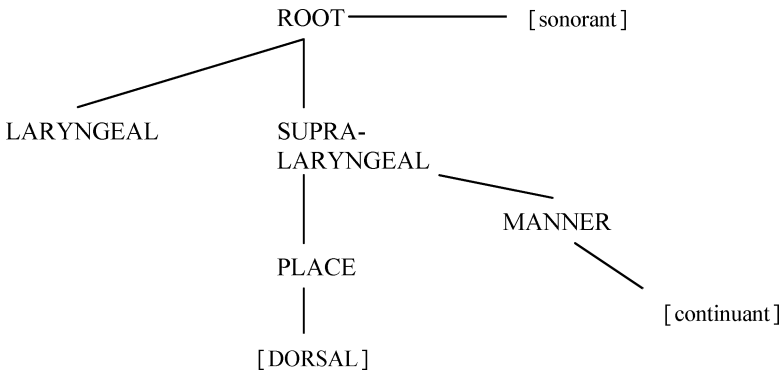


Figure 3. *Feature geometric representation of /R/.*

[+continuant], while the conjunction of /R/, /l/ and glides (exemplified by /j/) is attributed to the value [+sonorant]. /R/ may also be represented in a feature geometric model, following Clements (1985), as in Figure 3. It is worth noting that minimalism in this instance should not be conflated with emptiness, akin to van Oostendorp (2001) or Rose (2003), as /R/ is specified for a major root, as well as place and manner features. Furthermore, /R/ does not demonstrate the phonological behavior characteristic of so called empty consonants, e.g. epenthetic status or major place variation, as in Dutch, where rhotics can be coronal or dorsal.

3. CONSTRAINTS AND THE PRODUCTION GRAMMAR

This section tests the minimal representations articulated above and develops a production grammar in which /R/ surface forms are successfully predicted, with particular attention given to convergent French data in (1); additional surface variation (e.g. coda elision) is not covered in any detail, although the proposal may be readily adapted to these ends (see e.g. Russell Webb, 2004a).

The grammatical model outlined here captures linguistic competence involved in speech production. Like all OT grammars, the proposal makes use of two constraints types: faithfulness, statements governing the formation relationship between the input and output; and markedness, statements concerning output form. Here, constraints target the adjudication of abstract underlying structure, i.e. the correspondences between underlying representations and surface structural descriptions (faithfulness), and the productive implications of surface structural descriptions, themselves (markedness). The proposal combines constraints militating for the preservation of underlying phonological information alongside constraints promoting modifications to features and feature values in response to the tension between articulatory economy and perceptual salience. This formalisation of productive competence results in a significant blurring of the phonetics – phonology

divide, advocating the integration into the grammar of constraints derived from phonetic factors.¹¹

As it concerns the questions at hand, faithfulness is captured by PRES(ERVE) (Kirchner 1998), a cover constraint promoting the maintenance of input structural information in the output, as in (9). Although similar in its effect to correspondence constraints (e.g. MAX(IMALITY)), PRES is formally and implicationally distinct. Where correspondence refers (in most analyses) to the faithful preservation of segments, PRES refers to the faithful adjudication of segmental featural content.

(9) PRES: input information is preserved in the output, i.e. features and featural values of the input should be conveyed in the output

PRES may be targeted to specific features, e.g. PRES(OBSTRUENT), which provides that underlying values for obstruence should be present in the output. It should be noted that a complementary faithfulness consideration militating against the presence of information in the output that is not contained in the underlying specification, e.g. DEP(ENDENCE), is not included in the present analysis. Given the minimal content of inputs in the case of this segment, it can be assumed that pertinent DEP constraints (e.g. DEP(OBSTRUENT)) are relatively low ranked and are therefore without effect on the selection of productive output.

As proposed below, markedness constraints are motivated by two factors: productive effort, understood as an abstract measure of muscular force required for articulator displacement over time and the relative precision required of articulators during displacement (Boersma, 1998 et seq.; Kirchner, 1998: 39–44, 50–52, 2004); and perceptual salience, implying the relative perceptibility of candidate surface structural descriptions (Côté, 2000; Steriade, 2001; Wright, 2001, 2004). In the present analysis, constraints referring to articulatory forces are subsumed under –EFFORT, adapted from Kirchner's LAZY, which states that 'articulatory effort should be minimized' (1998: 38, his 2–1).¹² Constraints referring to perceptual augmentation are modeled along the lines of Smith (2002, 2004; see also Wright, 2001, 2004), providing that productive output should be enhanced in prominent positions.

A primary markedness consideration targets the relative articulatory effort involved in the abduction or adduction of vocal cords. In a given sequence of segments $X_1 X_2 X_3$, where X_1 and X_3 have specific glottal targets (i.e. are specified for $[\pm\text{voice}]$), positive effort reduction obtains when X_2 takes on the glottal features of one or both adjacent sounds. At the same time, subglottal pressure decreases in the production of word final and, especially, utterance final obstruents. Two factors are at play in the promotion of vocal fold abduction: an increase in supraglottal pressure

¹¹ The reader is referred to Hayes, Kirchner and Steriade (2004), Hayes (2004) and Lindblom (2006) for more complete discussion of the issues surrounding the phonetics – phonology divide and the place of phonetically based constraints within contemporary phonological theory.

¹² Similar constraints have been formalized as *GESTURE (Boersma, 1998) and CONSERVE ARTICULATORY EFFORT (Gess, 2003, 2004), inter alia.

caused by occlusion and a corresponding decrease in sub-glottal pressure, perhaps exacerbated by the end of pulmonic egression and the corresponding requirement of pulmonic ingression. With final occlusives, unconstrained pressure differentiation provides for the passive abduction or spreading of the glottis, impeding vocal fold vibration (Westbury and Keating, 1986: 156–157; Kirchner, 1998: 56–58). Final devoicing as a means of effort reduction is also supported by data demonstrating that post vocalic instantiations of voiced consonants are longer than those of voiceless ones (Dunn, 1993; Maddieson, 1997). In this instance, effort reduction is predicated upon the assumption that articulatory effort is greater during a relatively longer occlusion.

Taken as a cover constraint promoting passive voicing, or the lack of specific gestural control of glottal muscles, -EFFORT(GLOT) penalises active control of the glottis, as in (10).

(10) Passive Voicing (Russell Webb, 2004b: 144–145)

-EFFORT(GLOT): do not actively control glottal gestures (allow passive voicing and devoicing)

The ranking of -EFFORT(GLOT) above faithfulness provides that no contraction of laryngeal muscles should be made to counter the passive glottal adduction or abduction, as might obtain in intervocalic or word-final positions, respectively (Hirose, 1997; Steriade, 1997; Bradley and Delforge, 2006). For a hypothetical ranking -EFFORT(GLOT) \gg PRES(VOICE), voice assimilation obtains in all circumstances. Assuming PRES(VOICE) \gg -EFFORT(GLOT), only segments having no input value [\pm voice] are affected.

A second type of markedness concerns the aperture of output candidates. In this instance, perceptual considerations play a primary role, namely the availability of auditory cues and their relative robustness (see Steriade, 1997, 2001; Wright, 2001, 2004; Smith 2002, 2004). Here, it is important to contrast the cues contained in approximant [ɣ] with those of fricative [ʁ] (Rialland, 1986; Ladefoged and Maddieson, 1996; Russell Webb, 2002: 115–122, 2004a). In the case of approximant [ɣ], these include the presence of source noise and diffuse spectral peaks, resembling weak vowel formants. In the case of fricative [ʁ], cues include more intense and more distributed resonance peaks with significant high frequency noise at or above 3000 Hz.

Additional evidence for the relative output salience of different rhotic surface forms comes from studies showing an increased sensitivity to transitions of greater amplitude prior to vowels, especially in syllabic onsets (Wright, 1996, 2001; Delgutte, 1997). These considerations do not ipso facto result in [ɣ] being perceptually better output than [ʁ]; rather, the former provide more robust cues and greater perceptual salience, increasing the likelihood of cochlear stimulation, as they produce more intense noise spectra. Further cues to the contextual perceptibility of the different output candidates are found in transitions occurring either pre- or post-vocalically, and are more abundant in transitions resulting from distally greater articulatory movements (e.g. from a close aperture to a vowel). In the case of pre-vocalic /R/, [ɣ] is more discriminable and less confusable than [ʁ]. The putative

knowledge underlying the preferential production of fortis variants in prominent positions is captured by ONSET(OBS), in (11).¹³ This states that segments in the onset should be obstruents, i.e. they should have specific articulatory targets which result in more robust perceptual cues.

(11) Onset Fortition

ONSET(OBS): segments in the onset should be obstruents

ONSET(OBS) is supported by empirical data from other languages. In many dialects of Dutch, for example, rhotics may surface as a fricative, tap, trill or approximant, while more sonorant outputs (i.e. approximants) are only seen in coda (van Reenen, 1994; van de Velde 1994). Likewise, the German rhotic surfaces as a low-back vowel [ɐ] in codas, but as a fricative in onsets (Hall, 1992, 2000; Wiese 2001).

Onset fortition does not apply without exception in French, as /r/ often surfaces as [ʁ] in intervocalic positions. Here, articulatory considerations favour effort reduction in vowel-consonant-vowel transitions, frequent sites of consonant lenition (Bauer, 1988; Kirchner, 1998: 180–213, 2004). This is captured in -EFFORT(V_V), as in (10). Fricative [ʁ] is relatively more effortful than approximant [ɹ], as the former involves greater displacement from a neutral position and more precise gestural coordination (Delattre, 1971; Ladefoged and Maddieson, 1996: 217–230).

(12) Intervocalic Effort Minimisation

-EFFORT(V_V): minimise articulatory effort in intervocalic position

Due to its minimal representational content, /r/ is effectively the only consonant of modern French sensitive to -EFFORT(V_V), reflected in the ranking PRES ≫ -EFFORT(V_V); other consonants are predicted to remain blind to intervocalic lenition. Despite a relative reduction in acoustic intensity, intervocalic perceptual robustness is assured by formant transitions and source resonance, offering additional cues regarding segment identity (Steriade, 2001; Wright, 2004). Essentially, intervocalic positions permit the conspiracy of articulatory and perceptual factors, providing that lenition may occur and that less effortful gestural sequences may be realised with little perceptual penalty. The interaction of -EFFORT(V_V) with ONSET(OBS) additionally allows the grammar to neatly capture the effects of style shifting or emphatic stress, as might obtain in a hyper (careful or emphatic) speech style.

3.1. Accounting for Surface Forms

Constraint interaction in French highlights two important points concerning the formalisation of linguistic competence in a production grammar. Firstly, the representational minimalism of /r/ renders it particularly sensitive to effort reduction and positional augmentation. Secondly, other segments, whose

¹³ ONSET(OBS) is closely related to Prince and Smolensky's principle of the best onset (1993: 99–101).

Table 4a. /r/ in complex onset following voiced obstruent, grue 'crane'

/gry/	PRES	-EFFORT(V_V)	-EFFORT(GLOT)	ONSET(OBS)
[☞] gɣy				
gɣy			*!	
gɣy				*!
gɣy			*!	*

Table 4b. /r/ in complex onset following voiceless obstruent, cru 'raw'

/kry/	PRES	-EFFORT(V_V)	-EFFORT(GLOT)	ONSET(OBS)
kɣy			*!	
[☞] kɣy				
kɣy			*!	*
kɣy				*!

Table 4c. Intervocalic /r/, arabe 'arab'

/arab/	PRES	-EFFORT(V_V)	-EFFORT(GLOT)	ONSET(OBS)
aɣab		*!		
aɣab		*!		
[☞] aɣab				*
aɣab			*!	*

Table 4d. Word-final /r/, perte 'loss'

/pɛrt/	PRES	-EFFORT(V_V)	-EFFORT(GLOT)	ONSET(OBS)
pɛɣt				
pɛɣt				
pɛɣt			*!	
[☞] pɛɣt				

representations are relatively richer, are unaffected by these factors. Discussion and tableaux presented in this section concern the relative ranking of productive markedness and faithfulness, highlighting the effect of these on /r/ inputs and their lack of effect on other segments, notably fricatives, /l/ and glides.

The relative ranking of markedness constraints is noted in Tables 4a through d (here, voiceless /r/ is represented by [ɣ] in the output). In Table 4a, only [gɣy] satisfies -EFFORT(GLOT); approximant and vocalised candidates are eliminated by ONSET(OBS). The converse obtains in Table 4b, where the optimal output contains a voiceless fricative, this a consequence of the relative ranking of -EFFORT(GLOT). Interaction in Table 4c establishes the crucial ordering of -EFFORT(V_V), -EFFORT(GLOT) ≫ ONSET(OBS), predicting the attested output [aɣab] for input /arab/ and blocking onset fortition in intervocalic environments (e.g. *[aɣab]). Here, the grammar predicts an outcome mirroring data from Russell Webb (2002) and Tranel (1987). In syllabic codas, as in Table 4d, the grammar predicts that the minimally specified /r/ will be interpolated as an approximant [ɣ].

Table 5. *Intervocalic /R/, arabe ‘arab’: Co-optimality*

/arab/	PRES	–EFFORT(V_V)	ONSET(OBS)	–EFFORT(GLOT)
aʁab		*!		
aχab		*!		*
[☞] aʁab			*!	
[☞] aχab			*!	*

Table 6a. *Word-initial /l/, blanche ‘white-FEM’*

/blāf/	PRES	–EFFORT(V_V)	–EFFORT(GLOT)	ONSET(OBS)
[☞] blāf				
blāf			*!	
bļāf				*!

Table 6b. *Word-final /l/, calte ‘flee-3S’*

/kalt/	PRES	–EFFORT(V_V)	–EFFORT(GLOT)	ONSET(OBS)
[☞] kalt				
kałt			*!	
ka:t	*!(–cont)			

Table 5 presents an alternative possibility involving the ranking of –EFFORT(V_V) vis-à-vis ONSET(OBS). This grammar predicts equally optimal outputs, [aʁab] and [aχab]. The question is purposefully left unanswered as to whether these constraints should be coranked or variably ranked, following proposals concerning output variation, such as Auger (2001) and the possibility of floating constraints or Espinosa (2004), who follows integrates work by Boersma (1997), Hayes (2000) and Boersma & Hayes (2001) by situating competing constraints within a constriction band (see also Anttila, 1997, 2002). These sources consider style shifting in registers or regional forms of a heteronomous language, while the present work endeavours to articulate a framework within which either constriction bands or floating constraints can be accommodated.

Because the /R/ input representations contain no information relative to manner of articulation, PRES has little effect on the selection of productive output structural descriptions. This constraint proves crucial for prediction of attested outputs involving /l/, /j/ and fricative inputs, however, as shown in Tables 6a through e. Following Tables 2 and 3, fricatives, glides and /l/ have relatively richer phonological content. Highly ranked Pres is crucial to output selection in these instances, as this constraint militates against the non-correspondence of input features to output form. In Tables 6a and b, PRES violations eliminate candidates in which the feature [obstruent] is unfaithful to input values. PRES also rules out possible changes in voicing and militates against infidelity to input featural information, e.g. candidates having a fricated semi-vowel, as in Table 6c, or those containing a lenited fricative, as in Tables 6d and e.

Table 6c. /j/, paye 'pay-3S'

/pej/	PRES	-EFFORT(V_V)	-EFFORT(glott)	ONSET(OBS)
pej				
pei	*!(son)			
pej	*!(vowel)			

Table 6d. /s/, peste 'plague'

/pest/	PRES	-EFFORT(V_V)	-EFFORT(GLOT)	ONSET(OBS)
pest				
pezt	*!(-voice)			
pešt	*!(-obstr)			

Table 6e. /s/, plaça 'place-3S/PAST'

/plasa/	PRES	-EFFORT(V_V)	-EFFORT(GLOT)	ONSET(OBS)
plasa		*	*	
plaza	*!(-voice)	*		
plaša	*!(-obstr)		*	*

3.2. Regional Variation

This section discusses the compatibility of the proposed grammatical model with data from regional forms of French. While it is far beyond the scope of the present article to address all regional variation, it is noted that the approach to both emergent representation and grammatical formalism is amenable to different input and divergent constraint rankings.

One possible solution to the question raised by alternate surface forms is predicated on the assumption that the phonological /R/ representations may be more richly specified in some instances. The lack of aperture allophony in BF, for example, might be accounted for by /R/ being specified as [+obstruent], as would obtain were learners to include /R/ in the category of sounds having specific articulatory targets involving oral cavity stricture. This follows from data in (2) and the discussion of the feature [obstruent] in §2. Assuming for the purpose of discussion that the underlying representation of BF /R/ contains the values [dorsal], [+continuant] and [+obstruent], no changes to the grammar articulated in Tables 4 or 6 need be made; this input would not be insensitive to phonetically-based constraints such as -EFFORT(V_V), as these are dominated by PRES. Questions of register shifting notwithstanding, this approach requires that BF speakers always produce /R/ as a fricative and that positional or stylistic variation is absent, a possibility supported by the cited sources as well as anecdotal evidence. Assumption of more richly specified representations does not account for the surface forms of /R/ in QF or STE, however, indicating that the difference between these and other varieties French may be due to grammatical distinction (i.e. a constraint ranking that is different from that given in Tables 4 through 6).

In her analysis of QF cluster simplification, Côté (2004) refers to the relative perceptual salience of consonants in the output. She notes that consonants adjacent to a vowel or to a consonant which is vowel like are maintained. This is explicated in reference to the acoustic transition from one segment to another in output, which either provides cues to consonant identity (e.g. from vowel or approximant to stop) or does not inhibit the transmission of segment internal cues (e.g. from vowel or approximant to fricative). She also shows that elision of plosives is more frequent and is more likely in the case of input sequences having the same place of articulation (2004: 178–180). This is analysed in an OT grammar comprising constraints targeting the optimal position of consonants (2004: 185–190).

While the approach to features and featural specification in Table 3 and Figure 2 is distinct from that included in Côté (2004), emergent, minimal specification of the input is not incompatible with her analysis (theoretical and formal differences regarding features notwithstanding). Following the proposal, post-vocalic /R/ -obstruent clusters do not violate markedness constraints promoting output well-formedness as a measure of perceptual salience. /R/ minimal specification presents the added advantage of capturing both the vowel like qualities of /R/ (i.e., /R/ is not an obstruent, but is a continuant), which are directly called upon in her perceptual account of cluster simplification (Côté, 2004: 176). Minimal representation also facilitates the distinction of /R/ vis-à-vis /l/, accounting for the differential treatment of clusters containing /R/ and /l/.

A final issue that can be addressed is the vocalization of /R/ in syllabic codas in QF and STF. Côté (2004) analyses QF vocalisation as the effect of markedness constraints promoting featural similarity among adjacent segments, input-output correspondence targeting featural specification (e.g. stop vs. non-stop) and position (notably vowel adjacency), and output-input uniformity, militating against multiple output-input correspondents. Data such as (3a) are predicted in her analysis by the ranking of MAX-C ('input consonants should have an output correspondent') above UNIFORMITY-V ('No vowel in the output corresponds to itself and another segment in the input') and C↔V ('a consonant is adjacent to a vowel'), the latter of which are co-ranked (2004: 187–190). While the featural terminology and formalisation are different from those advanced above, a minimally specified /R/ representation is compatible with Côté's analysis. The distinction between QF and STF vis-à-vis French is captured in the relative ranking of either PRES (as in Table 4a) or UNIFORMITY.

4. DISCUSSION AND CONCLUSIONS

The present analysis argues that /R/ representation is, in many cases, minimal, i.e. lacking in abstract structural information regarding manner of articulation. In a production grammar including constraints promoting effort minimization and perceptual augmentation, alongside those advocating the preservation of input information in the output, /R/ surface forms are successfully predicted (Tables 4a

through 4d and 5), indicating that the abstract weight (or lack thereof) of this phoneme makes it particularly sensitive to phonetically based constraints. By contrast, phonemes having more richly specified representations are insensitive to these forces, establishing both the uniqueness of /R/ and the relative stability of other consonants within the phonological inventory of French (Tables 6a through 6e). The minimal representation ascribed to /R/ responds to several questions, most notably whether this segment should be considered a liquid, approximant or fricative. This approach advocates the view that, while /R/ is congruous to each of these, it is fundamentally distinct. This conceptualisation of underlying phonological structure offers a compelling formalisation of the relationship of /R/ to other continuant consonants, obviating the otherwise necessary choice between competing underlying statuses (i.e. between the view of /R/ as either fundamentally fricative or liquid).

Beyond the immediate concern of French /R/ phonological status, the present analysis also demonstrates that minimal specification can account for data in related grammars, most notably those of regional forms and dialects. While /R/ may be more richly specified, e.g. in BE, it is also possible to account for regional surface particularities within the grammar. A minimally specified /R/ is compatible with analysis of QF in Côté (2004) and other regional forms of French, where /R/ distribution and phonotactics are conceived of as the output effect of constraints referring to cue preservation and output-input uniformity.

The present work suggests additional questions specific to historical change and dialectal divergence which are not addressed here. For instance, has this phoneme always been minimally specified in French and, if so, how should particular phonological evolutions (e.g. mid vowel lowering, the shift from apical to dorsal places of articulation) be described and explained? How might the proposal contend with varieties of French in which /R/ is apical (e.g. rural forms) or where /R/ has historically alternated between apical and dorsal sounds? And what is the form and phonological status of /R/ in languages closely related to French, such as Haitian and Mauritian, in which /R/ surfaces as [ʁ] and [w] in onsets and fails to surface in codas? Continued examination of these questions serves not only to enrich our understanding of French, but to nourish debate about and research into related questions in other languages.

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