An acoustic-phonetic perspective on the phonological behavior of the rhotic tap

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In this paper I argue, drawing on data from an experiment on /r/ in Romanian and data from other languages, in favor of the hypothesis that the rhotic tap ([ɾ]) contains one vocoid preceding, and another one following the constricted interval (cf. Stolarski 2011, among others). Specifically, these vocalic elements are mid-high and relatively central, as the acoustic analysis shows.

I then discuss how this segment’s encompassing vocalic elements might make the phonological behavior of the sound clearer. The argument put forth is that this structure is precisely what allows the tap to exhibit sonorant behavior and even pattern with vowels.

1. Introduction

This paper is a study on the rhotic tap, [ɾ], aiming to determine what its structure is and if this structure could shed light on its sonorant and even vowel-like behavior in many Slavic languages.

The main goal is to probe into the internal phonetic structure of this sound, drawing on data from studies of it in various phonetic contexts. The tap is argued to be of the (complex) structure ‘vocalic element – constricted interval – vocalic element’. Different phonetic contexts may show only one of these vocalic elements, which I argue is the reason most studies detect this one vocoid and try to explain it in various ways. Another aspect of the tap’s structure which is addressed in this paper concerns the quality of the vocoids. Using data from a detailed experiment on this sound in Romanian, as well as data from Polish for [ɾ] flanked only by consonants and pauses, I show the tap’s vocoids to be, on average, mid-high and central.

The phonological implications of the tap having vocalic elements are then discussed. I argue that the sound’s strong vocalic component may be linked to its ability to function as a syllabic nucleus, and even pattern with vowels, as it does in Slavic languages like Serbo-Croatian and Slovak.

The paper is structured as follows: Section 2 discusses previous studies on [ɾ], which attest the systematic presence of vocalic elements with the tap. The quality of the vocalic elements these studies report and the interpretations they give for the one vocoid appearing in most phonetic contexts are also presented. This section contains the reasons I consider said interpretations to not be satisfactory. Section 3 discusses the general structure of the tap
paper argues for (vocoid – constriction – vocoid), as emerging from putting together data from all the phonetic contexts. Section 4 is dedicated to the study of [ɾ] in Romanian, which aims to determine the area of the vowel space the vocoids of the tap occupy. Polish data from Stolarski (2011) are also used for the aforementioned purpose. Another aim of the Romanian experiment is to determine if the vocoids of the tap may be discerned in context VrV, where the phonetic context should hide both of them. Section 5 discusses some phonological implications of the tap’s structure as presented in the previous sections, focusing on the sound’s ability to function as a syllable nucleus and behave like a vowel. Section 6 concludes.

2. What previous studies on the rhotic tap show

2.1 The presence of vocalic elements

When the rhotic tap ([ɾ]) occurs in intervocalic position, spectrograms show it to be a short constricted interval. However, acoustic studies on the tap have revealed that whenever [ɾ] does not border with a nuclear vowel, but with a consonant or a word-boundary instead, there are vowel-like elements that consistently intervene between the constricted interval of the tap and said consonant or word-boundary. Therefore, one vocoid following the constriction has been reported for contexts Vr# and VrC(V) (see Spectrograms 1 and 8), while contexts #rV and (V)CrV show a vocalic element preceding the constricted interval (see Spectrograms 2, 6 and 7). The picture emerging from these studies shows that the vocoid appears on the side on which the tap borders with anything other than a vowel.

The phenomenon described above is well attested cross-linguistically (see Baltazani 2009; Baltazani & Nicolaidis 2011 for Greek, Vago & Gósy 2007 for Hungarian, Ramírez 2006 among others for Spanish, Recasens & Espinosa 2007 for Catalan, Avram 1993 for Romanian).

The Spanish word *importante* ‘important’ (context rC):

*Spectrogram 1 (from Schmeiser 2009:196)*
The Greek word *krama* ‘alloy’ (context Cr):

![Spectrogram](image)

*Spectrogram 2 (from Baltazani 2009)*

### 2.2 The interpretation of the vocalic elements and data from Slavic languages

The interpretation of the vocalic elements mentioned above is still discussed in the literature. Ramírez (2006) sees these vowel-like parts as epenthetic, which would imply that they are not expected to appear. However, I consider that their systematic cross-linguistic attestation diminishes the chance that we are dealing with epenthesis, as does Schmeiser’s (2009) observation that an epenthetic vowel is part of the syllabic make-up of the word (it would, for example, add a syllable to the word), while these vocoids are not\(^1\).

Avram (1993) and Baltazani (2009) treat the vocoids as part of another realization of the rhotic segment. While the situation may be viewed as such, it is interesting that the vocoid appears either to the left or to the right of the constriction and, as I show below, both to the left and to the right when there are no vowels around the tap. This would mean that there are four different realizations of [ɾ]. However, I counter this claim below when I show that, when putting together what the tap looks like in all these contexts, [ɾ] has only one realization, with different parts of it being emphasized in different phonetic contexts.

Yet another treatment of the vocalic elements associated with the tap is that of Bradley & Schmeiser (2003). They offer an articulatory explanation for the phenomenon in which the vocoids appear as a consequence of there being less overlap between the consonantal gestures. If the tongue gesture produced in order to articulate the tap and the gesture of the preceding (or following) consonant do not overlap tightly, a vowel-like element emerges. This would be what Schmeiser (2009) calls an ‘intrusive’ vowel. This explanation might work for Cr and rC clusters, but according to it we would not expect vocoids in #rV and Vr#, since there is no other consonantal gesture for the gesture of the tap to overlap with.

The authors mentioned above look at languages which offer only contexts where [ɾ] is always flanked by at least one nuclear vowel (#rV, rV#, VrC(V), (V)CrV, VrV). Slavic languages which allow contexts where [ɾ] does not border with a nuclear vowel on either side (CrC, #rC, Cr#) show that in such cases two vowel-like elements flank the constricted interval (see Spectrograms 3-5). This structure (a constricted interval with one vocalic element on each side) appears on spectrograms in the case of syllabic /ɾ/ (see Gudurić & Petrović 2005 for Serbian and Pavlík 2008 for Slovak) and non-syllabic /ɾ/ alike (see Stolarski 2011 for Polish).

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\(^1\) I take Schmeiser’s argument to be valid, since in most contexts the vocoids are indeed not part of the syllabic make-up of the word. Schmeiser does not address contexts in which the tap is flanked only by consonants and pauses.
The Serbo-Croatian word *crn* ‘black’ – syllabic /r/: 

Spectrogram 3 (from Gudurić & Petrović 2005:145)

The Polish word *rdza* ‘rust’ – non-syllabic /r/: 

Spectrogram 4 (from Stolarski 2011:9)

The Slovak word *navrh* ‘proposal’ – syllabic /ɾ/: 

Spectrogram 5 (from Pavlík 2008)

2.3 The quality of the vocalic elements

The quality of the vocalic elements has been reported to be, on average, similar to that of [ə] and [ɨ] (Avram 1993; Vago & Gósy 2007; Stolarski 2011), which places them in the mid-high, central area of the vowel space. Other authors (Quilis 1993 cited in Schmeiser 2009; Baltazani 2009) compare the quality of the vocoids rather to that of the nuclear vowels flanking [ɾ]. Though somewhat centralized, the vocalic element is strongly influenced by the full vowel in its vicinity.

3. The interpretation of the vocalic elements – the complete picture

When putting the different contexts outlined above in perspective, the emergent picture is that of a rhotic segment with the structure ‘vocalic element – constricted interval – vocalic...’
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The reason why most contexts only reveal part of this picture is that the vocoid only appears saliently when (and where) \[\text{ɾ}\] does not border with a full vowel. In contexts #rV and (V)CrV only the vocoid on the left is salient, since there is no nuclear vowel on that side of the constriction. The one on the right would be indistinguishable from the full vowel. The vocalic element on the right would be salient (i.e. clearly delimited) in contexts Vr# and VrC(V) because in this case the full vowel is on the left.

The contexts that allow for both vocalic elements to be salient on the spectrogram are those contexts where there are no full vowels in the vicinity of the tap for the vocoids to ‘blend into’. These are the rarer contexts CrC, Cr#, #rC, which are to be found in some Slavic languages.

The full structure of the tap would be most difficult to see in context VrV. In this case, the only salient part of the tap is the constriction, since the full vowels on both sides of the constricted interval do not render salient the vocoids of the tap.

4. Romanian /r/: experiment purpose, setup and results

The Romanian language has one rhotic phoneme, which has been subject to acoustic analysis previously (see Avram 1993). The analysis has revealed that this phoneme is in most cases realized as a tap, with the (expected) conspicuous vocalic element appearing where /r/ does not border with a nuclear vowel.

4.1 Purposes of the current analysis

The first aim of the acoustic analysis outlined below is to determine the range within which the quality of the vocalic elements may vary. The analysis draws on data from the current experiment on /r/ in Romanian for contexts (V)CrV, VrC(V) and #rV. In order to get a clearer picture, the quality of the vocoids in these contexts available in Romanian will be compared to that of the vocalic elements in contexts CrC, #rC and Cr#, the Polish data in Stolarski (2011).

The second purpose of the acoustic analysis is to attempt to see if the structure ‘vocalic element – constriction – vocalic element’ may be detected in context VrV. As argued above, this context makes the internal structure of [ɾ] most difficult to discern on a spectrogram.

4.2 Experiment setup

Recordings were made of real Romanian words in isolation with /r/ in the phonetic environments #rV, (V₁)CrV₁ and V₁rC(V₁), where V is one of the seven monophthongal vowels of Romanian (/a, e, i, o, u, ə, ɨ/) and C is a stop (/p, t, k, b, d, g/). The words were chosen such that the clusters containing /r/ are flanked by the same vowel. The idea behind this is that having two different vowels in the environment of a tap could keep the quality of the vocalic element different from that of both vowels. Therefore, with two vowels with different qualities influencing the tap’s vocoid, we would not be able to see the most extreme
positions said vocoid can reach in the vowel space. For this reason, a word containing /r/ in an environment like V₁rC# was preferred to V₁rCV₁ where no word was found for V₁rCV₁.

<table>
<thead>
<tr>
<th>Context</th>
<th>Example</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>#rV</td>
<td>/radu/</td>
<td>proper name</td>
</tr>
<tr>
<td>Cr</td>
<td>/braʃisarə/</td>
<td>‘bracelet’</td>
</tr>
<tr>
<td></td>
<td>/deˈkre/</td>
<td>‘decree’</td>
</tr>
<tr>
<td>rC</td>
<td>/aˈlɛrg/</td>
<td>‘I run’</td>
</tr>
<tr>
<td></td>
<td>/pɔɾtoˈkals/</td>
<td>‘orange’</td>
</tr>
</tbody>
</table>

*Table 1: Examples of words used in the experiment*

In addition to the words above, recordings of nonsense VrV sequences and tokens of the seven vowels of Romanian were obtained from every participant.

The participants (four females, one male) were asked to read the words and sequences that appeared on Power Point slides into a microphone. The slides changed every four seconds. The recording session was repeated three times for each of the speakers. These recordings were made using the software Audacity 1.2.6 and the acoustic analysis was conducted with Praat, version 5.2.14.

4.3 Results: vocalic elements in taps and their quality

Spectrograms show that the expected clearly delimited vocalic elements do appear when the rhotic segment has one constricted interval. One such vocoid appears on the left of the constriction in contexts #rV and Cr and on the right in context rC:

The word *reducere* ‘reduction’ – context #rV:

![Spectrogram 6](image)

The word *brătară* ‘bracelet’ – context Cr:

![Spectrogram 7](image)
The word *pirg* ‘defense tower’ – context Cr:

![Spectrogram 8](image)

4.3.1 Vocalic elements in Romanian taps as compared to the Romanian monophthongal vowels pronounced by the same speakers:

As mentioned above, the Romanian language only offers contexts where at least one nuclear vowel must be in the immediate vicinity or /r/, so the taps showed just one salient vocalic element per word. The formant structure of each vocoid was subject to acoustic analysis in order to determine its quality.

Graph 1 below plots the average quality of the vocalic element in [ɾ] flanked by each vowel, for the three contexts analyzed in Romanian, as well as the average formant values for the monophthongal vowels of Romanian uttered by the same speakers. For clusters Cr and rC, the vocoids in words with C at the same place of articulation (i.e. /t/ and /d/, /p/ and /b/, /k/ and /g/) were averaged together, resulting in three squares and three diamonds for each of the seven vowels. The color of the vocalic elements in the tap matches the color of the full vowel in the vicinity of the tap. For example, the blue diamonds represent words containing the sequence /arC(a)/, and the blue squares represent words containing /(a)Cra/.
As may be observed from Graph 1, for each nuclear vowel, the vocalic element in its vicinity tends to approach the quality of said nuclear vowel: the vowel-like elements of \([\mathbf{r}]\) tend to be front and high when surrounded by \([i]\) (especially in context \(\text{Cr}\)), front and mid when it borders with \([e]\), etc. The generalization appears to hold for all three contexts.

There appears to be, however, a strong tendency for the vocalic parts to cluster in the mid-high central-front area. There seem to be certain thresholds the quality of the vocoids cannot surpass. Graph 1 clearly shows that the vocalic elements in the vicinity of \([a]\) are mid rather than low and slightly more front, while in the case of \([o]\) and \([u]\) the corresponding vocoids are central, rather than approaching the backness of the full vowel.

It would appear that the only Romanian vowel with which the vocalic elements of \([\mathbf{r}]\) overlap is \([\mathbf{ɨ}]\). The vocoids near \([u]\) in particular exhibit a tendency to approach the quality of \([i]\). Another vowel which the vocoids seem to be close to is \([\mathbf{ə}]\), which is lower and more back.

### 4.3.2 Vocalic elements in Polish words as compared to the Romanian vowels

For the purposes of comparison, as well as taking into account as many contexts as possible in order to get a complete picture, Graph 2 plots the quality of the vocalic elements in contexts \(#rC\), \(\text{CrC}\) and \(\text{Cr}\#\) in Polish words, again compared to the vowels of Romanian. These three contexts are the ones in which both vocoids of the tap are salient on a spectrogram, which means two vocalic elements for each word could be measured. The formant values for the Polish vocalic elements come from the tables in Stolarski (2011:18-20).

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Graph 2 (Polish data from Stolarski 2011)

\(^2\) The averages given in these tables for the vocalic elements in \(/\mathbf{r}/\) in Polish words took into account cases of trilling (which were not included in the study on Romanian), in which case the values for the first and second vocoids were given; however, this is not expected to significantly influence the averages.
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Compared to the vocoids in Romanian words, those in Polish words appear to cluster together in an even tighter area, which could be the effect of them not having any full vowels around. Specifically, the vocoids in contexts #rC, CrC and Cr# stay mid-high and central, with no tendency towards the front vowels, like Graph 1 shows for the vocalic elements in Romanian words. These vocoids are also closest to the Romanian [ɨ] and tend to be, on average, higher than the vocalic elements influenced by nuclear vowels shown in Graph 1.

Together, Graphs 1 and 2 take into account contexts #rV, #rC, (V)CrV, VrC(V), CrC and Cr#. If we consider the quality of the vocoids of [ɾ] as evidenced by the two graphs, we can determine the area of the vowel space where the vocalic elements cluster: the mid-high, central (to front) area. It would, therefore, be reasonable to expect that the vocoids of a tap will always have a formant structure which places them in this aforementioned area.

4.4 Results: detecting the structure in context VrV – the nonsense sequences

In order to determine if the structure ‘vocalic element – constricted interval – vocalic element’ may be detected where the tap is in intervocalic position (context VrV) as well, let us look at the way the formants change towards the constriction in the nonsense sequences. In the VrV context, abrupt changes have been reported to occur before the constricted interval (Baltazani & Nicolaidis 2011).

Since the vocoids appearing in the other contexts cluster in the mid-high, central to front area of the vowel space, the expectation is that in context VrV the formants would change such that towards the constricted interval their configuration would be that of a mid-high central vowel, departing from the full V in question. In other words, immediately before and after the constriction, there would be mid-high central vocalic elements.

Looking at spectrograms of the nonsense sequences, this appears to be indeed the case:

**Nonsense sequence [ara]:**

In Spectrogram 9, the tap is flanked by the vowel [a], which has a high F1 and a low F2, as may be seen on the left and right sides of the spectrogram. What may be observed in Spectrogram 9 is that, near the constriction, F1 drops slightly and F2 rises. A lower F1 suggests a vowel higher than [a], while a higher F2 is the mark of a more front vowel.

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3 The words /a'ra/ and /'ere/ are words of Romanian, meaning ‘to plough’ (imperf.) and ‘eras’ respectively. In the current experiment [ara] and [ere] were presented to the speakers as nonsense sequences, on par with the others. The participants were not told to stress one or the other of the syllables. When asked later, the participants confirmed not having realized that there were two real words among these sequences. However, even if they had, the expected formant changes would have still taken place in any V_rV_1 sequence.
Together, the formant changes suggest that near the constriction there is a vowel part which is more mid-central than [a].

Nonsense sequence [ere]:

Spectrogram 10

The vowel [e] is characterized by a relatively low F1 and a relatively high F2. Near the constriction, Spectrogram 10 shows a rising F1 and a falling F2, which means a vowel that is a little lower and more back than [e], leading to the central area of the vowel-space.

Nonsense sequence [oro]:

Spectrogram 11

[o] has both F1 and F2 relatively low. Spectrogram 11 shows a rise in F2, while F1 does not change, meaning that towards the constriction the part of the vowel is as high as [o], but somewhat more front than said back vowel, reaching the central area.

The systematic formant changes described above suggest that in context VrV the same ‘vocalic element – constricted interval – vocalic element’ structure of the tap may be observed. The vocalic elements are more mid-central than [a], lower and more back than [e] and slightly more front than [o], which indicates the mid-high central area of the vowel space. This matches the area in which Graphs 1 and 2 place the salient vocoids of other contexts.

5. The phonological behavior of such a structure

Phonetically, [ɾ] has been assumed to be a simple constricted interval, the appearance of an obstruent which is a sound produced with a complete or almost complete constriction in the vocal tract. This sound does indeed contain a brief, but complete constriction, which, on a spectrogram, is translated into a brief interruption of the acoustic energy.
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Phonologically, however, the tap exhibits sonorant behavior, which is easily explained if its phonetic structure is the complex one I have argued for in this paper, one that includes vocalic parts. This would make the tap more similar to other sonorants like liquids and nasals, which are similar to vowels on a spectrogram.

5.1 Syllabic /r/ – vocalic /r/

/r/ can act as a syllabic nucleus (which is typically the function of vowels) in Slavic languages like Czech, Slovak, Serbo-Croatian, Macedonian and (possibly) Slovenian (Sussex and Cubberley 2006). While none of these languages have syllabic nasals, Czech and Slovak include syllabic /l/ as well. Acoustic studies on /r/ in Serbian and Slovak have revealed that /r/ is often pronounced as [ɾ] (see Gudurić & Petrović 2005 for Serbian, Pavlík 2008 for Slovak). The vocalic elements described in this paper have been observed in these two studies as well.

In Serbo-Croatian and Slovak, aside from being a possible syllabic nucleus, /r/ patterns with the vowels of the language in other interesting aspects as well. In Slovak, /r/ (and /l/) can be the bearers of length distinctions and participate in the same alternations that vowels can participate in (Pouplier & Beňuš 2011). Table 2 below exemplifies vowels and /r/ undergoing lengthening and shortening:

| Lengthening through suffixation (acute accent means length+)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1a) vowel</td>
<td>hrad ‘castle’</td>
<td>hrád-ok (dim.)</td>
</tr>
<tr>
<td>(1b) syllabic /r/</td>
<td>vrch ‘hill’</td>
<td>vřš-ok (dim.)</td>
</tr>
</tbody>
</table>
| Shortening through suffixation
| (2a) vowel | zváž-i-t’ ‘think’ | zváž-ova-t’ |
| (2b) syllabic /r/ | vykřím-i-t’ ‘feed’ | vykřím-ova-t’ |

In Serbo-Croatian, /r/ can bear length and pitch distinctions (Sussex & Cubberley 2006:187), producing minimal pairs such as those in Table 3:

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4 The Slovak words are given here in their orthographic form, since this is how they appear in the original work. Likewise, the Serbian words that follow are in their dictionary form.
As mentioned above, acoustic studies indicate that in Serbo-Croatian and Slovak, /r/ is often realized as a tap. Table 4 shows how the words in Tables 2 and 3 would be pronounced in this case:

| (3a) grâdj (short falling) | ‘hail’ | vowel |
| (3b) grâd (long falling) | ‘town’ | vowel |
| (4a) väljati (short rising) | ‘to be good’ | vowel |
| (4b) väljati (long rising) | ‘to roll’ | vowel |
| (5a) Tṭst (short falling) | ‘Trieste’ | syllabic /t/ |
| (5b) tṭst (long falling) | ‘cane’ | syllabic /t/ |
| (6a) tṉutit (long rising) | ‘to become numb’ | syllabic /t/ |
| (6b) tṉutit (short falling) | ‘to extinguish’ | syllabic /t/ |
| (7a) grădu (long falling) | ‘city’ – DAT.SG. | vowel |
| (7b) grădu (long rising) | ‘city’ – LOC.SG. | vowel |
| (8a) sčca (short falling) | ‘heart’ – GEN.SG.; NOM., VOC., ACC., PL. | syllabic /t/ |
| (8b) sčcă (long falling) | ‘heart’ – GEN.PL. | syllabic /t/ |
| (9a) b зр (long rising) | ‘quick’ – (adjective) NEUT.SG. | syllabic /t/ |
| (9b) b зр (long falling) | ‘quickly’ – (adverb) | syllabic /t/ |

Table 3

As shown in Table 4, [ɾ] bears the phonemic length and pitch distinctions when the realization of the rhotic segment is the tap. It may be that its ability to appear in onset and coda position, as well as in the nucleus, and to exhibit vowel behavior, is linked to vocalic elements being part of this sound’s internal phonetic structure. Since the tap itself contains two vocoids flanking a complete constriction, the lack of other nuclear vowels in the vicinity of the tap may enable it to be treated like a vowel of the language (in Slovak and Serbo-Croatian). The
vocalic elements become ‘perceptually salient’ when there are no full vowels surrounding the tap, since the consonantal environment in contexts like CrC would contrast with the vocoids. In this situation, speakers can control them for linguistic purposes. The vocoids would, therefore, be the bearers of the length and pitch distinctions.

When [ɾ] borders with full vowels, the tap will not be a syllabic nucleus, since its own vocalic elements are not salient, but overshadowed by the nuclear vowels. This concurs with Dłuska’s mention that speakers are usually unaware of the vowel-like elements in the rhotic segment (Dłuska 1983, cited in Stolarski 2011).

The Polish language provides the situation in which a tap would not be a syllabic nucleus even in contexts where it has no full vowels in the vicinity, like CrC. This would make a counterargument to the line of reasoning outlined above and opens up an interesting question for further research: what is the phonetic difference between syllabic taps and inter-consonantal taps that are not syllabic?

Another avenue for further research is brought by context VrV. Here, the tap is flanked on both sides by nuclear vowels, so the only ‘conspicuous’ part of the rhotic segment in this case would be the constriction, the obstruent ‘part’ of the tap. It would be interesting, therefore, to see if in context VrV the tap displays obstruent behavior5.

5.2 /ɾ/ or /əɾ/?

An analysis /əɾ/ of instead of /ɾ/ has been proposed for Slovenian and Macedonian (Sussex and Cubberley 2006:156-7), despite the lack of /ə/ in the Macedonian vowel inventory and in other contexts in the language. In fact, it appears to be the case that Slavic languages with syllabic /r/ do not distinguish /ə/ or /ɨ/, according to the vowel inventories in Sussex and Cubberley (2006:154). An exception is Slovenian, a language in which the existence of syllabic /r/ is debatable. Bulgarian, which does not have syllabic /r/, has /ə/ in its inventory.

It is worth noticing that Slavic languages with syllabic /ɾ/ do not distinguish precisely the vowels with qualities that would place them in the area of the vowel space where the vocoids of the tap tend to cluster. This would solve the dilemma of /əɾ/ versus /ɾ/ for Macedonian. Since [ɾ] itself partly consists of vocalic elements in the mid-high, central area, the absence of /ə/ or /ɨ/ in other contexts would make speakers unable to recognize a mid or high, central vocoid as separate from [ɾ]. Any vocalic part interfering between the consonant and [ɾ] in a CrC context would pass as part of the tap. Therefore, the syllabic /ɾ/ analysis would make the best choice for Macedonian, while remaining problematic for Slovenian, since this language does have /ə/ in its inventory and other phonetic contexts, rendering speakers able to parse it in a CrC sequence.

5 Indeed, an interesting research question is that concerning the featural specifications of the structure ‘vocoid-constriction-vocoid’. This kind of structure appears to be that of a sonorant at the edges and an obstruent in the middle. An anonymous reviewer points out that /ɾ/ does not always behave like a sonorant. While this avenue of research is beyond the scope of this paper, I would like to argue that, in the case of the tap, it would not be surprising to see it behave as an obstruent, since according to its structure it should have that ability. Another issue is how the tap would be characterized with respect to the feature [continuant]. This feature distinguishes between stops and fricatives. Given that part of the tap’s structure looks exactly like that of a very short stop, the sound may have the specification [−continuant]. However, Chomsky & Halle (1968) consider that trills, which are similar to taps but contain several interruptions of acoustic energy, may be [+continuant]. It remains to be seen whether the tap may also be [+continuant], given its similarity to the trill.
6. Conclusion

In this paper I argued in favor of the hypothesis that the internal phonetic structure of the rhotic tap is ‘vocalic element – constricted interval – vocalic element’. According to the results of the acoustic analysis of these vocoids in contexts #rV, Cr and rC in Romanian, as well as Polish data for contexts Cr#, CrC, #rC, the vocalic elements of [ɾ] exhibit the strong tendency to cluster in the mid-high, central to front area of the vowel space. This makes the vocoids similar to [ɨ] and [ə], and, it is precisely these two vowels that are missing from the inventories of Slavic languages with syllabic /r/. I also argued that this structure may be linked to the tap’s ability to behave like a sonorant, and even a vowel. The sound’s vocalic parts could be the ones enabling the tap to bear length and pitch distinctions in languages like Serbo-Croatian and Slovak.

Acknowledgements

This work is based on my M.A. dissertation. I would like to thank my supervisor, Prof. Andrei A. Avram, for valuable advice and ongoing support. As well, I thank the audiences of ‘R-atics 3 and ConSOLE XX for insightful discussions and an anonymous reviewer for valuable suggestions. All errors in the paper are, of course, my own. A debt of gratitude goes to the five participants, for volunteering their time to help me with the experiment and enduring the long hours of recordings.

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