Evidence for indeterminate representations: schwa-insertion/intrusion in Dutch.
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1. The larger issue: the phonetics-phonology interface.

Scobbie (2007) sketches the problems with the standard modular conception of phonetics and phonology, and a linear interface between the two.

Standard view of the modules and interface:

(1.1) Phonology
    cognitive, discrete

Phonetics
    physical, gradient

Debate in phonology and phonetics centres around questions of what phenomena should be handled by which module, and how ‘big’ either module is.

(1.2) Phonology: basically about lexical contrast only (phonemic)

Phonetics: this is where all the interesting stuff happens, from coarticulation to reduction etc.

(“1990 linguistic phonetics”)

vs.

(1.3) Phonology: this is where all the interesting stuff happens, from assimilation to lenition etc

Phonetics: merely interprets phonological surface structure

(spe-influenced phonology)

These views are all problematic in some way:
1) phonetics is not universal, but language–specific, learnt and there is fine-grained control by speakers; on the other hand, phonology is about more than just lexical contrasts – there are more categorical/discrete phenomena.
2) there are phenomena which are not clearly assignable to one or the other module.
3) the nature of the interface itself is not always clear.

Alternative: non-modular views of phonetics/phonology (no interface?)

(1.4) Phonology and phonetics interact in single framework
    Functional pressures directly encoded in phonology; no principled distinction between phonetic and phonological processes (e.g. coarticulation vs. assimilation). \( \rightarrow \) discretises phonetics

(functional phonology)

(1.5) Phonology and phonetics interact in single framework
    Articulatory gestures are primitives, any categorical phenomena are artefacts of strongly divergent gradient patterns \( \rightarrow \) continualises phonology

(articulatory phonology)
A “Third Way”: Scobbie (2007) argues, following Ohala (1990), that a model without strict modularity is possible while retaining the notion that there are phenomena which are clearly phonetic (gradient, non-contrastive) as opposed to those which are clearly phonological (categorical, discrete). In such a model, phonology and phonetics overlap, rather than interface. He terms these models “quasi-modular” (despite the title of Ohala’s own paper). This entails that there are phenomena that belong to both realms at the same time – for the linguist, but also for the speaker/hearer. Language users need not be deterministic in treating certain phenomena as phonological or phonetic, any more than researchers need to be if they forgo the strict modular view.

Functional pressures: not part of grammar, belong to diachronic realm → ultimately shape phonologies, but not through constantly present cognitive principles (constraints) (see also Blevins 2004, Johnstone 2006, Silverman 2006).

Exemplar models (Johnson 1997, Pierrehumbert 2000, Pierrehumbert 2001, Bybee 2001) seem to represent this third way: abstractions emerge from lower-level phonetics (all variation is encoded, which forces category formation).

Crucially, ‘phon’ phenomena can occupy the overlap region. Motivation comes from detailed, quantitative data of precisely those processes which were previously subject to “boundary disputes”. One such case is schwa-insertion in liquid-obstruent and liquid-nasal clusters in Dutch.

2. Schwa-insertion in Dutch rC and lC clusters

2.1 Traditional phonological accounts: categorical rule

The traditional description of the process is that of a schwa vowel appearing in a coda cluster of /r/ or /l/ and a following nasal or non-coronal obstruent (Trommelen 1984, 1993, Booij 1995).

(2.1) Schwa-insertion after /r/ and /l/

a. harp /harp/ [harp] ‘harp’
korf /kɔrf/ [kɔrəf] ‘basket’
kerk /kɛrk/ [kɛrɔk] ‘church’
berg /berɣ/ [berax] ‘mountain’
arm /arm/ [aɾm] ‘arm’
toorn /tɔrn/ [torɔn] ‘wrath’
b. alp /alp/ [alp] ‘alp’
twaalf /twɑlf/ [twɑlbf] ‘eleven’
melk /melk/ [melɔk] ‘milk’
lalg /˘al / [˘a˘l] ‘alga’
helm /helm/ [heltm] ‘helmet’

- Schwa-insertion is said not to be possible between liquid and a following coronal obstruent (/t,s/).

¹ Trommelen (1993) generalises the context to “a cluster of a liquid and a non-coronal consonant”, but this is too restrictive, as the example of toorn makes clear. Booij (1995) formulates the rule as not applying to “appendix” consonants, which /s/ and /t/ are stipulated to be (on independent grounds).
Booij (1995:127) hints at optionality of the rule, saying that “a schwa may be inserted”. However, Trommelen (1993:175) claims that “this is only so in the sense that individual speakers either always apply the rule or don’t apply it. Vacillation seems impossible for a single speaker[...]

Likewise, Booij notes that, while the description is one of categorical insertion, it “may be of a more gradual nature than these descriptions suggest.” (1995:126) This is the only reference in the formal phonological literature to this possibility.

There is no doubt that the insertion concerns a schwa vowel.

So, for phonologists, the process is characterised as a categorical rule of schwa-insertion in liquid+nasal and liquid+non-coronal obstruent context, applying in an either/or fashion (no optionality for individual speakers).

### 2.2 ‘Phonetic’ view: intrusive vowel

Hall (2003) treats Dutch schwa-insertion in an Articulatory Phonology framework. This non-modular theory stays close to the phonetic surface (employing articulatory gestures as both abstract units of representation and physical instantiations thereof). It characterises all processes, from assimilation to deletion and insertion (the latter two not allowed by the theory in their common conceptions) as instances of partial or total overlap.

Schwa-insertion in Dutch, too, then, is a case of overlap of vocalic and consonant gestures. The apparent insertion is really vowel intrusion, arising from the canonical stressed vowel’s articulation overlapping with the transition between the liquid and the closing consonant:

![Diagram of vowel intrusion](image)

So, in such an account of an integrated phonetics-phonology, the work is done by phonetics (the timing relationships of gestures – timing being a typical case of what is usually considered phonetic rather than phonological), and there is no need for an abstract rule of insertion (or a constraint set that forces it). Hall presents a wealth of evidence for why Dutch schwa-insertion is in fact not insertion but intrusion (most of it hinging on the idea that the intrusive schwa does not form the nucleus of a second syllable), though not all of it is equally convincing.

Note that schwa-insertion becomes schwa-intrusion under this view; in fact, it becomes ‘vowel intrusion’, since although the vowel gesture is on its way back to a neutral position (or anticipating a following vocalic gesture) and consequently of a rather central quality, the intrusive vowel will be coloured to an extent by the quality of the canonical stressed vowel which it arises out of.

These very different treatments of Dutch schwa-insertion/intrusion show an instance of a “boundary dispute” between phonetics and phonology. Both sides make clear, sometimes contradictory, predictions – so the boundary dispute may be resolved by examining more

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2 Namely that 1) total syllable duration is constant, whether there is vowel intrusion or not; 2) the metalinguistic experiments of Van Donselaar et al. (1999) in which subjects were asked to “reverse” words segmentally show that vowel-intrusive *tulp* [tvlp] is turned into [plvl] rather than [plvl]; 3) the inapplicability of post-schwa [n]-deletion for intrusive schwa vis-à-vis lexical schwa; 4) further phonological arguments from allomorph selection, interaction with tones in a Limburg dialect, and 5) some not entirely convincing ones about long vowels and markedness of rC clusters in general.
detailed data (the formal phonologists in 2.1 worked with introspective data, Hall with a single informant).

Predictions made by ‘pure phonology’ view:
- Categorical for speakers (Trommelen, though Labov-style variable rule for Booij)
- Insertion of ‘full segment’
- Segment = schwa
- No insertion in other contexts

Predictions made by ‘pure phonetics’ view:
- Quantitative variation
- Gradient implementation (half-segment, transition sound)
- Intrusive element strongly coloured by stressed canonical vowel
- Possibility of intrusive vowels in other contexts (?)

I will now consider each of these predictions, using a larger corpus of spoken Dutch.

2.3 Data: urban accents of Dutch

The HEMA corpus (Sebregts et al. 2003, Tops 2005) describes the speech of 400 speakers of urban accented Standard Dutch from 10 cities in the Netherlands and Flanders. The socially stratified corpus (for sex and age) contains, for each speaker, two repetitions of 26 one-word items, distributed over two tasks (picture naming and word list reading). There are 4 potential schwa-insertion/intrusion items in the corpus, all of them rC:

\[
\begin{align*}
\text{harp} & \quad /\text{harp}/ & \quad [\text{harp}] \\
\text{kerk} & \quad /\text{kerk}/ & \quad [\text{kerk}] \\
\text{arm} & \quad /\text{arm}/ & \quad [\text{arm}] \\
\text{berg} & \quad /\text{berg}/ & \quad [\text{berg}] \\
\end{align*}
\]

4 items x 400 speakers x 2 repetitions = 3200 tokens of potential schwa-insertion/intrusion. 9 damaged or otherwise unusable files \( \rightarrow 3190 \) tokens

All 3190 tokens were transcribed with regard to the phonetic realisation of /r/ and the presence or absence of schwa-insertion/intrusion. The results are presented below.

2.3.1. categoriality

\[
\begin{array}{llllll}
\text{Percentages of schwa-insertion in urban accent data} & \text{(n=total no. of schwa-insertion context tokens)} \\
\text{city} & n & \text{total %} & \text{harp} & \text{kerk} & \text{arm} & \text{berg} \\
\hline
\text{Antwerp} & 318 & 95.0 & 92.6 & 97.5 & 92.5 & 97.5 \\
\text{Hasselt} & 318 & 87.4 & 79.7 & 83.8 & 94.9 & 91.3 \\
\text{Bruges} & 332 & 83.7 & 78.3 & 84.1 & 91.7 & 80.7 \\
\text{Ghent} & 335 & 20.6 & 10.8 & 11.9 & 42.9 & 16.7 \\
\text{FL} & 1303 & 71.7 & 65.4 & 69.3 & 80.5 & 71.5 \\
\text{The Hague} & 287 & 43.6 & 43.7 & 50.0 & 41.7 & 38.9 \\
\text{Leiden} & 313 & 48.6 & 43.8 & 53.8 & 49.4 & 47.4 \\
\text{Rotterdam} & 343 & 66.8 & 68.6 & 68.6 & 61.6 & 68.2 \\
\text{Amsterdam} & 316 & 79.4 & 80.0 & 78.8 & 78.9 & 80.0 \\
\text{Utrecht} & 315 & 84.4 & 82.1 & 87.3 & 86.1 & 82.3 \\
\text{Nijmegen} & 314 & 92.7 & 92.4 & 97.5 & 89.6 & 91.1 \\
\text{NL} & 1888 & 69.2 & 68.4 & 72.7 & 67.9 & 68.0 \\
\hline
\text{total} & 3191 & 70.2 & 67.2 & 71.3 & 72.9 & 69.4 \\
\end{array}
\]
The table shows that a vocalic element was present in 70.2% of the potential schwa-insertion/intrusion items. It also shows that a wider, bird’s eye view obscures a lot of variability. At first sight, the rates of schwa-insertion/intrusion seem fairly even comparing the Netherlands and Flanders (69.2 vs 71.7). A closer look at the individual urban accents reveals a great deal of variation (95% in Antwerp, 20% in Ghent – cities at 65km from each other; 92% in Nijmegen, 43 in The Hague, etc).

Similarly, there does not seem to be a great deal of variation between the 4 items, judging by the bottom line (range of 67.2-72.9%). Again, however, a closer look reveals that, for instance, the low score in Ghent would have been a lot lower without the item arm, which has significantly more +schwa realisations. In general, arm is the item with most +schwa realisations in Belgium, whereas in the Netherlands it has the lowest relative number.

Apart from showing dialectal differences in the application, a simple look at the inequal numbers of schwa-insertions/intrusions in the 4 items reveals that the process cannot be as categorical for speakers as Trommelen (1993) asserts. These are the figures:

- 15% of the speakers never realise schwa in these items (19% NL, 9% FL)
- 47% of the speakers always realise schwa in these items (46% NL, 48% FL)
- 38% of the speakers vary – most of them cluster close to the two categorical groups, though almost 20% of the variable speakers have insertion rates around the 50/50 mark.

→ For a majority the process is categorical (or categorically absent), but a large minority varies.

2.3.2 social factors

Neither of the two approaches in 2.1 and 2.2 mention the possibility of social variation, though neither excludes the possibility of schwa-insertion being or becoming socially relevant. Some figures:

- Male speakers realise schwa in 73% of these items, female speakers 68.9%. This distinction is mainly relevant in the Netherlands (M:73.8-F:67.3), whereas in Flanders there is no significant effect (M:71.8-F:71.4).
- Younger speakers realise schwa in 63.4% of the items, older speakers 77.8%. This is a large difference, and clearly associates schwa-insertion with older speech, but it is entirely due to the speakers from the Netherlands (Y:57.4-O:82.2); there is no such effect in Flanders at all (Y:72.0-O:71.2). In some of the cities in the Netherlands, this effect is very strong, such as in Leiden (Y:21.9-O:72.0), in others it is absent (Nijmegen).

→ There is quantitative variation in schwa-insertion/intrusion, which is exploited socially.³

It is now time to examine the phonetics of schwa-insertion/intrusion, starting with the duration of the inserted/intrusive element.

To this end, a subcorpus was selected from the larger corpus: only speakers that realise schwa consistently were included, from 4 cities with very specific patterns: Bruges, Nijmegen, and Utrecht and Rotterdam.

³The figures for schwa-insertion in some of the cities of the Netherlands correlate with those for a specific coda variant of /r/: a retroflex or bunched approximant, not unlike American English [ɹ]. Speakers that realise coda-r as this approximant almost never exhibit schwa-insertion, and vice versa. It is likely that it is the presence of this coda-r variant, rather than the absence of schwa-insertion itself, that is socially marked for age (Van Bezooijen 2005, Sebregts & Scobbie 2005, Sebregts 2008).
2.3.3. Bruges

/r/ is realised as an alveolar trill or tap by all Bruges speakers (26) in the subcorpus in the relevant items. Duration measurements of the epenthetic/intrusive vocalic element are presented below:

(2.5)  Duration in msec of [ə] in schwa-insertion items: Bruges

<table>
<thead>
<tr>
<th>item</th>
<th>n</th>
<th>average</th>
<th>min</th>
<th>max</th>
<th>stdev</th>
</tr>
</thead>
<tbody>
<tr>
<td>harp</td>
<td>25</td>
<td>34</td>
<td>16</td>
<td>58</td>
<td>12</td>
</tr>
<tr>
<td>kerk</td>
<td>24</td>
<td>39</td>
<td>16</td>
<td>66</td>
<td>13</td>
</tr>
<tr>
<td>arm</td>
<td>24</td>
<td>34</td>
<td>17</td>
<td>50</td>
<td>10</td>
</tr>
<tr>
<td>berg</td>
<td>26</td>
<td>42</td>
<td>22</td>
<td>70</td>
<td>13</td>
</tr>
</tbody>
</table>

The duration of epenthetic/intrusive schwa in the relevant contexts is relatively stable across the four items (38msec on average). There is a rather large range for the vowel's duration. To gauge the significance of the average durations of epenthetic/intrusive schwa, we need to compare them to the average durations of canonical vowels as uttered by the same speakers.

(2.6)  Duration in msec of short vowels and schwa: Bruges

<table>
<thead>
<tr>
<th>vowel</th>
<th>n</th>
<th>average</th>
<th>min</th>
<th>max</th>
<th>stdev</th>
</tr>
</thead>
<tbody>
<tr>
<td>full short vowel</td>
<td>49</td>
<td>97</td>
<td>61</td>
<td>148</td>
<td>22</td>
</tr>
<tr>
<td>canonical schwa</td>
<td>50</td>
<td>83</td>
<td>48</td>
<td>112</td>
<td>16</td>
</tr>
<tr>
<td>epenthetic schwa</td>
<td>99</td>
<td>38</td>
<td>16</td>
<td>70</td>
<td>13</td>
</tr>
</tbody>
</table>

Table (2.6) shows the average duration of full short vowels, canonical schwa and epenthetic schwa. The full short vowel values were calculated over the vowels in the items rgk and kryk as uttered by the Bruges speakers, while the values for canonical schwa were calculated over these same speakers' productions of beraad and sturen.

The average length of epenthetic schwa is only half of that of canonical schwa. The ranges for canonical and epenthetic schwa do overlap somewhat, but their distributions are overall quite distinct. Full vowels are even longer, as would be predicted (Koopmans-van Beinum 1994), even though the closing consonant in the items for which this was measured, /k/, conditions the shortest phonetic vowel length in Dutch (Waals 1999:56).

The shortest schwas in Bruges invite an ‘intrusive’ vowel analysis with an even more local source: the trilled or tapped [r]/[ɾ] itself. The vocoids phases in between two contacts are schwa-like, and about 17msec on average, and that following a tap is roughly 20msec (Recasens 1991, Ladefoged and Maddieson 1996, Tops 2005).

(2.7)

→ Epenthetic/intrusive schwa in the Bruges data can to be ‘half a segment’, which might mean that, phonologically speaking, it is not a segment at all. Note, however, that the longest epenthetic/intrusive schwas fall well within the range of canonical schwa (and even just inside that of full short vowels)

→ The shortest epenthetic/intrusive schwas in Bruges are below 20msec, which is roughly the length of the vocoid portion (between two contacts) of a voiced trill.
2.3.4 Nijmegen

Comparing the Bruges data to those from Nijmegen reveals that the situation in these two dialects is very different indeed. The durations of short vowels, canonical schwa, and epenthetic schwa in Nijmegen are in tables (2.8) and (2.9). Note that in Nijmegen, /r/ is realised as a uvular approximant, weak fricative or trill and never alveolar.

(2.8) **Duration of [ə] in msec in schwa-insertion items: Nijmegen**

<table>
<thead>
<tr>
<th>item</th>
<th>n</th>
<th>average</th>
<th>min</th>
<th>max</th>
<th>stdev</th>
</tr>
</thead>
<tbody>
<tr>
<td>harp</td>
<td>14</td>
<td>67</td>
<td>39</td>
<td>117</td>
<td>21</td>
</tr>
<tr>
<td>kerk</td>
<td>15</td>
<td>80</td>
<td>45</td>
<td>129</td>
<td>24</td>
</tr>
<tr>
<td>arm</td>
<td>15</td>
<td>68</td>
<td>37</td>
<td>112</td>
<td>20</td>
</tr>
<tr>
<td>berg</td>
<td>14</td>
<td>99</td>
<td>30</td>
<td>197</td>
<td>41</td>
</tr>
</tbody>
</table>

(2.9) **Duration in msec of short vowels and schwa: Nijmegen**

<table>
<thead>
<tr>
<th>vowel</th>
<th>n</th>
<th>average</th>
<th>min</th>
<th>max</th>
<th>stdev</th>
</tr>
</thead>
<tbody>
<tr>
<td>full short vowel</td>
<td>28</td>
<td>115</td>
<td>70</td>
<td>174</td>
<td>27</td>
</tr>
<tr>
<td>canonical schwa</td>
<td>30</td>
<td>85</td>
<td>21</td>
<td>163</td>
<td>26</td>
</tr>
<tr>
<td>epenthetic schwa</td>
<td>58</td>
<td>78</td>
<td>30</td>
<td>197</td>
<td>31</td>
</tr>
</tbody>
</table>

Epenthetic/intrusive schwa in Nijmegen turns out to be twice as long as that in Bruges (78 vs 38 msec); in addition, the differences between the individual items are larger for the Nijmegen speakers, and so are the ranges – with the higher values falling well within the range for stressed short vowels.

(2.10)

Æ Nijmegen more amenable to phonological view of schwa-insertion: inserted schwa has length of other – canonical – schwas. Extremely short schwas do not occur.
Æ the Nijmegen /r/ in the pre-schwa context is uvular, whereas that of Brugge is alveolar. This may partly explain the difference – the very short schwas of Bruges may well be part of the trilled/tapped alveolar r.

2.3.5 Utrecht/Rotterdam

The data from Rotterdam and Utrecht contain both alveolar and uvular /r/ speakers: from Rotterdam, 11 with alveolar /r/, 6 with uvular /r/; from Utrecht, 11 with uvular /r/, 6 with alveolar /r/ (this reflects the relative frequencies of alveolar/uvular /r/ in the dialects).
The results of the duration measurements for Rotterdam and Utrecht turned out to be highly similar (non-significant differences for all items except harp), and are therefore pooled in the table below.

(2.11) **Duration in msec of [ə] in schwa-insertion items: Utrecht/ Rotterdam**

<table>
<thead>
<tr>
<th>item</th>
<th>n</th>
<th>average</th>
<th>min</th>
<th>max</th>
<th>stdev</th>
</tr>
</thead>
<tbody>
<tr>
<td>harp</td>
<td>33</td>
<td>67</td>
<td>17</td>
<td>98</td>
<td>21</td>
</tr>
<tr>
<td>kerk</td>
<td>33</td>
<td>81</td>
<td>42</td>
<td>130</td>
<td>24</td>
</tr>
<tr>
<td>arm</td>
<td>32</td>
<td>72</td>
<td>35</td>
<td>119</td>
<td>20</td>
</tr>
<tr>
<td>berg</td>
<td>34</td>
<td>92</td>
<td>17</td>
<td>155</td>
<td>29</td>
</tr>
</tbody>
</table>

The results from Utrecht and Rotterdam very much echo those from Nijmegen: their average durations are roughly the same, and so are the ranges (although the very short schwas of Bruges are also present in the Utrecht and Rotterdam data, while they were absent in Nijmegen). Comparison of the schwa-insertion items with canonical schwa and short stressed vowels (2.12) reveals a further difference: the average duration of canonical schwa is in-between that of full short vowels and that of epenthetic schwa, whereas in Nijmegen the two schwa vowels had similar durations. In other words, the difference between canonical and epenthetic schwa noted in Bruges is also present in the Rotterdam and Utrecht data, although it is much smaller.

(2.12) **duration in msec of [ə] in schwa-insertion items: Utrecht/Rotterdam**

<table>
<thead>
<tr>
<th>vowel</th>
<th>n</th>
<th>average</th>
<th>min</th>
<th>max</th>
<th>stdev</th>
</tr>
</thead>
<tbody>
<tr>
<td>full short vowel</td>
<td>66</td>
<td>110</td>
<td>56</td>
<td>153</td>
<td>23</td>
</tr>
<tr>
<td>canonical schwa</td>
<td>68</td>
<td>96</td>
<td>44</td>
<td>155</td>
<td>26</td>
</tr>
<tr>
<td>epenthetic schwa</td>
<td>132</td>
<td>78</td>
<td>17</td>
<td>155</td>
<td>25</td>
</tr>
</tbody>
</table>

It is hard to interpret these results within a framework where epenthesis is seen as an either/or situation: either a segment is present or absent. In the case of Bruges, it could perhaps be argued that the (extremely short) schwa vowel there is not phonologically present, but instead, an artefact of gestural alignment – intrusive. In Nijmegen, the segment-length schwa could be inserted subject to a rule. However, the Utrecht/Rotterdam data suggest that there is in fact a more complicated pattern to be observed here. Apart from individual speakers exhibiting gradient variation in the length of their inserted/intrusive schwa, there is also a cross-dialect gradience – in which intrusive ‘phonetic’ schwas becomes gradiently more ‘phonological’ going from Bruges to Utrecht/Rotterdam to Nijmegen.

The Articulatory Phonology framework similarly has problems with the observed facts. As Warner et al. (2001) note for schwa-insertion after /l/ in Dutch, despite the non-phonological status of epenthetic schwa suggested by Van Donselaar et al. (1999), the presence or absence of schwa determines the clear/dark /l/ allophony. This situation is mirrored by that of /r/: the variants of /r/ that appear with schwa in these contexts are the same as those that appear intervocally, whereas those that appear without schwa are the same as those that appear in the other coda contexts. In other words, the allophony of /r/ depends on the presence or absence of schwa, and schwa needs to be a part of the phonological plan at some point. Warner et al. (2001) propose allowing for the insertion of gestures, in order to accommodate the optional schwa and clear/dark /l/ allophony(!)

- Utrecht/Rotterdam data: mixed picture: epenthetic schwa not the same as lexical schwa, but longer than intrusive vowel in Bruges
- realisation of /r/ not a factor (alveolar vs uvular speakers non-significant)4

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4 For the pooled results of Rotterdam and Utrecht, as well as for the Rotterdam speakers separately. Place of articulation was significant within the Utrecht speaker group, but note that this was the case for all vowels, including the full canonical vowels in rok and kruk.
2.3.6 Spectral properties

The schwa-like nature of the epenthetic/intrusive vowel should not be taken for granted. Especially if the gestural realignment analysis is correct in assuming that the perceived vowel is simply the result of the separation between /t/ and the following consonant, the quality of the lexical vowel would be expected to be reflected in that of the intrusive vowel. For the phonological insertion analysis – which may be appropriate for the Nijmegen situation – a specific schwa target might be expected, without too much colouring from the lexical vowel in the word.

The figure below shows pairs of lexical vowels in Bruges ([ɛ] and [a] in *berg, kerk* and *harp, arm*) and their associated epenthetic/intrusive schwas plotted in a vowel space diagram. On one hand, it is clear that the inserted/intrusive vowel is not simply a copy of the lexical one (there is quite some distance involved in the vowel diagram); on the other hand, the quality of the epenthetic vowel in these items is not fixed, and depends to some degree on the quality of the vowel in the preceding syllable: the ‘schwas’ in *kerk* and *berg* are more fronted than those of *arm* and *harp*.

(2.13)

However, a look at the formant structure of lexical schwa in *beraad* and *sturen* reveals that the ‘colouring’ of the intrusive schwas is not any different from that found with lexical schwa, falling within the range of normal coarticulation. Schwa in Dutch is simply very variable (Koopmans-van Beinum 1994)

(2.14)

The results from the spectral analysis complicate the Bruges situation: the epenthetic schwa is not of full vowel or canonical schwa length, but its spectral properties are determined only to a limited degree by the quality of the canonical full vowel in the preceding syllable.
3. Schwa-insertion in unexpected places: coronal obstruents in Bruges

Schwa-insertion between /r/ and following coronal obstruents does in fact occur, although it is far less frequent than in schwa-insertion contexts recognised in the literature. 3.2% of the items bord ‘plate’, paard ‘horse’, worst ‘sausage’, kers ‘cherry’ and kaars ‘candle’ are realised with a schwa-like vowel between /r/ and the following coronal obstruent in the data from all 10 cities. In most of the cities in the corpus, it is in fact a marginal phenomenon; however, in Bruges it is rather common, with around a third of the worst and kers tokens, and 19.7% of all pre-coronal obstruent tokens exhibiting schwa.

3.1 Duration

The duration of the schwa in bord, worst and kers is in the table below. The average duration is strikingly similar to that in the pre-non-coronal context.

<table>
<thead>
<tr>
<th>item</th>
<th>n</th>
<th>average</th>
<th>min</th>
<th>max</th>
<th>stdev</th>
</tr>
</thead>
<tbody>
<tr>
<td>bord</td>
<td>7</td>
<td>34</td>
<td>21</td>
<td>63</td>
<td>15</td>
</tr>
<tr>
<td>worst</td>
<td>14</td>
<td>35</td>
<td>12</td>
<td>84</td>
<td>20</td>
</tr>
<tr>
<td>kers</td>
<td>15</td>
<td>37</td>
<td>19</td>
<td>66</td>
<td>14</td>
</tr>
</tbody>
</table>

The range of the duration of schwa in the coronal obstruent contexts exceeds that of the ‘normal’ schwa-insertion context, and the longest schwas observed in the coronal obstruent context are well within the range of canonical schwa.

3.2 Spectral properties

Schwa in the coronal obstruent context has very similar characteristics as that in the ‘schwa-insertion’ context of harp, kerk, arm and berg: relative to the position of the canonical vowel, the formants of the epenthetic vowel shift toward the centre of the vowel space.

The formant values of the schwa vowel in kers, bord and worst converge to a great degree: the back vowel /ɔ/ seems to exert little backing effect, as the schwa vowel between /r/ and the [s] or [t] in these words is almost as fronted as the schwa that appears in kers.
In Bruges, then, there is little or no difference between the schwa-insertions in this context and that in the ‘standard’ schwa-insertion context.

→ Falsifies claims about the context for schwa-insertion/intrusion (at least in Bruges Dutch)
→ But does it mean that schwa-intrusion in Bruges is entirely ‘phonetic’?
→ Is it possible to decide on a “phonetic” or “phonological” status of the process at all?
→ There is a clear difference between the two contexts only in terms of frequency of occurrence: many more speakers realise schwa much more consistently in the ‘standard’ context than in the coronal obstruent context.
→ The link between the phonetic origins of schwa-insertion and the current phonological rule in other dialects however, is illustrated by the Bruges data.

4. Schwa-insertion/intrusion in other languages

Dutch is not the only language for which the phenomenon of schwa-insertion after liquids has been noted. Lenz (1892-1893) first described schwa-insertion in Chilean Spanish well over a hundred years ago, and it is a well-known process in Spanish phonetics/phonology (Malmberg 1965, Blecua Falgueras 2001, Bradley 2004)

**Duration:** Malmberg (1965:32) notes that it may in some cases be as long as a full, unstressed vowel.


In Spanish, the context is not usually word-final:

(4.1)  *La fuerza* [la fwer’sa]
*Los árboles verdes* [lo sar’soles ørødes]
*Cargar* [kar ‘yar’]
*La hierba* [la jèr’ba]
Malmberg (1965:33-34) states that the epenthetic vowel (‘elemento parásito’) can take on the role of an actual vowel, as has occurred in a number of Spanish dialects for forms such as *tiguere* (<*tigre*), *corónica* (<*crónica*), *Inglaterra* (<*Inglaterra*).

This phenomenon is commonly known from the history of the Romance languages (Latin *quiritare* → Spanish *gritar*, Lat. *Directum* → French *droit*), as well as from Old French and contemporary dialects of Romance – apart from Spanish, forms such as Portuguese *fevereiro* (<*februario*).

Similarly, schwa-insertion/intrusion in Cr clusters has been noted for a number of languages, such as Spanish, Portuguese, Greek and Swedish.

5. **Diachronic origins of schwa-intrusion**

These facts point toward an explanation for the process in diachronic terms. If tapped and trilled realisations of /r/ and ‘light’ realisations of /l/ indeed induce the appearance of a vocalic element (whether from gestural overlap or because it is inherently part of the sound, as with trilled (and tapped?) r, these may gradually become more perceptible – there may even be a drift toward longer schwas, because of functional pressures.

In Exemplar Theory, forms with and without schwas will be stored for lexical items that have the schwa-insertion context. The mechanisms of gestural reduction or realignment may still be seen to operate on the productional surface level, but the presence or absence of schwa is determined at the level of lexical access (that is, in exemplar selection for production), as is the allophone of /r/ that is part of the representation. This presents a solution to the theoretical problem found with standard Articulatory Phonology.

6. **Conclusion: schwa-insertion/intrusion in Dutch?**

- Variation between dialects, variation between speakers, variation within speakers
- Phonological/phonetic status of schwa-insertion/intrusion hard to determine: conflicting evidence
- ‘Phonetic’ aspects make clear the diachronic origins of the process
- ‘Phonological’ aspects show that it is not an automatic consequence of the production of certain phones, but expressly targeted in speech production.
- Differences between dialects show various stages of ‘phonologisation’, but what does that really mean?
- At the very least in the Rotterdam/Utrecht dialects, but probably in **all** dialects, the process is indeterminate between phonological and phonetic.

**References**


