# Release and reduction: two origins of schwa 



- The label "schwa" has been applied to a phonological value that is especially variable in its phonetic properties. (for example, Browman and Goldstein 1992 for English schwa)
- Flanking consonants and vowels may have a significant coarticulatory influence on schwa's phonetic starting and ending postures.
- Origins of schwa:
(1) Consonantal release (e.g. Hall 2006)
(2) Vowel reduction (e.g Browman and Goldstein 1992)
(3) Epenthesis (e.g. Van Oostendorp 1995)

Also:
(4) Schwa-zero alternations (e.g. Kenstowicz 1994).

## 1. Release into schwa

- In $\ldots \mathbf{C}_{\mathbf{1}}(+) \mathbf{C}_{2} \ldots$ contexts, the identity of $\mathbf{C}_{\mathbf{1}}$ may, on occasion, fail to be successfully communicated to a listener (e.g. Lombardi 1991, Steriade 1997 for laryngeal contrasts).
- Alternatively, $\mathbf{C}_{\mathbf{1}}$ may released into a "little vowel" before the $\mathbf{C}_{\mathbf{2}}$ constriction is fully achieved. $\mathbf{C}_{1}$ will be more resistant to neutralization or merger.
- This release may become exaggerated over time: $\mathbf{C}_{1} \partial \mathbf{C}_{2}$.
- $\mathbf{C}_{\mathbf{1}} \mathbf{C}_{\mathbf{2}}$ heterorganicity increases the likelihood of $\mathbf{C}_{\mathbf{1}}$ release, since the articulators necessarily change their posture as $\mathbf{C}_{1}$ is followed by $\mathbf{C}_{2}$ (e.g. Chitoran, Goldstein, and Byrd 2002).
- Trans-sonorant harmony is sometimes found as well (Hall 2006), perhaps due to formant "bleeding"
- Such "intrusive" vowels-be they schwa or vowel copies-are often ignored by prosodic phonology, in that they are "skipped over" for stress (Hall 2006)
(1) Hall (2006):
(a) Release into schwa:

| Bulgarian | garəbav | hunchbacked |
| :--- | :--- | :--- |
| Dutch | kaəٍm | quiet |
| English (dialects) | arəm | arm |
| German (S. Hamburg) | bəbatən | to fry |
| Irish Gaelic | 'agələ | fear |
|  | 'gorəm | blue |
| Saami | skuoləfi: | owl |
| Sanskrit | darə |  |

(b) Release into a vowel copy

Arbore
Chamicuro
Finnish
Hausa
Hocank (Winnebago)
Hua
Kekchi
Lakhota
Late Latin
Mamainde
Mono
Negev Bedouin Arabic
Oscan

Popoluca
Scots Gaelic
Spanish (Chilean)
Tiberian Hebrew
lefiedt+atto
tupulu
kalavo
$\mathrm{k}^{\mathrm{w}} \mathrm{uruk}^{\mathrm{w}} \mathrm{utu}$
sinní
hortfăgə + rə
okuruma?
pa?at
gala
skiriptum
mih+i+takPu
gàfūrū
ga'hawa
múlúkis
paterei
itaPa
$\int \mathrm{al}^{\mathrm{Y}} \underline{a}^{\mathrm{a}}$
koronika
falah+a+t
that ewe
chest
transparency
small drum
cold
the Hocank
sky
twins
no gloss
a writing
it is cloudy
mortar
coffee
name
father
your father
hunting
chronicle
you (fs) sent
(2) Theoretically plausible diachronic routes of $\mathbf{C}_{\mathbf{1}}(+) \mathbf{C}_{\mathbf{2}}$


- Proposal: If neutralization of $\mathbf{C}_{\mathbf{1}}$ does not induce excessive homophony, a language might be more able to tolerate this neutralization due to $\mathbf{C}_{\mathbf{1}}$ "unrelease". However, if a language
were to suffer excessive homophony as a consequence of $\mathbf{C}_{\mathbf{1}}$ neutralization, then it might more likely possess $\mathbf{C}_{\mathbf{1}}$ "release" (Martinet 1953, Silverman 2006)


## Indonesian

- Monomorphemic Indonesian words: right-to-left syllabic trochees, end-rule right, with initial dactyls in words with an odd number of syllables, excluding three- and (by necessity) one-syllable words.
- Schwas are completely invisible to stress (Cohn 1989).

All full vowels: Schwas and full vowels:

| a. | 'бб | $\begin{equation*} \text { ə' } \sigma \tag{3} \end{equation*}$ | bə'ri | give |
| :---: | :---: | :---: | :---: | :---: |
|  |  |  | kərja | work |
| b. | $\sigma \sigma \sigma$ | $\boldsymbol{\varnothing}^{\prime} \sigma$ | seto'lah | after |
| c. |  | $\sigma^{\boldsymbol{\sigma}} \boldsymbol{\prime} \boldsymbol{\sigma}$ | 'gamelan | Indo. orchestra |
| d. | , $\sigma$ ' $\sigma \sigma$ | $\sigma$ б'бə | a'partəmen | apartment |
| e. |  | ə'бәб | tfə'ritəra | story |
| f. |  | $\varnothing^{\prime} \sigma \sigma$ | perəm'puan | woman |
| g . |  | бә'бб | koper'rasi | cooperation |
| h. | , $\sigma \sigma, \sigma \sigma \sigma \sigma$ | ,бәбб'бの | ,difərensi'asi | differentiation |
|  |  |  | diversifi'kasi | diversification |

- Cohn (1989): the distribution of schwa is largely predictable, and may thus be viewed as a consequence of epenthesis.


## 2 Reduction to schwa

- Due to its short duration and its tendency to coarticulate, schwa is a likely outcome of vowel reduction in stressless domains.


## Reduction to schwa in English

- Three categories just as in Dutch (e.g. Van Oostendorp 1995):

Non-alternating (lexical), e.g. 'soufə sofa, ə'bæut about



- Chomsky and Halle (1968:110) "lax vowels reduce to a central, high, or mid unrounded 'neutral' vowel in English when they are sufficiently weakly stressed: [-stress, -tense, $\mathbf{V}] \rightarrow[ə]$; "The exact phonetic realization of [ə] does not concern [Chomsky and Halle]" (p.110)
- Browman and Goldstein (1992) report on the articulatory characteristics of schwa in the context $\mathbf{p} \mathbf{V}_{\mathbf{1}} \mathbf{p} \mathbf{\prime} \mathbf{p} \mathbf{V}_{\mathbf{2}} \mathbf{p} \boldsymbol{p}$ for a single American English speaker, where $\mathbf{V}_{\mathbf{1}}$ and $\mathbf{V}_{\mathbf{2}}$ were all possible combinations of $\mathbf{I}, \boldsymbol{\varepsilon}, \mathbf{a}, \mathbf{\Lambda}, \mathbf{u}$.
- If schwa is actually a "targetless" vowel, then tongue activity during schwa should be fully predictable from the articulatory posture of these preceding and following contexts, provided these flanking postures are exhaustively quantified.
- The range of variation in the production of schwa is greater than the range of any other vowel, though indicates "a warping of the trajectory toward an overall average or neutral tongue position" (pp.41, 42).
- Flemming (2007): F2 varies more than F1, probably due to the fact that flanking consonants necessarily involve a mouth closing/jaw-raising gesture, thus lowering F1.
- Stresslessness feeds shortening, shortening feeds contrast loss, and contrast loss feeds coarticulation. Schwa results.
- Flemming and Johnson (2007) word-final schwa in word-final position (as in 'tf ${ }^{\text {hamn }}$ e china or ' $\mathrm{k}^{\mathrm{h}}$ amə comma) displays a relatively consistent mid-central quality, though a certain amount of between-speaker height variation is observed.
- Flemming (2007): American English possesses two schwas, word-medial schwa that is more variable, and word-final schwa that is more stable.
- Another possibility: one schwa in English, the variability of which is largely a consequence of its lexical context.
- Within-word motor routines are more frequently produced than are between-word motor routines. As such, they may be more susceptible to fixed coarticulatory effects than are between-word motor routines (Bybee 2001).
- Since the context that follows word-final schwa varies in unconstrained ways (depending only on the phonological shape of the following word), its coarticulatory tendencies may be less entrenched, less routinized, than its word-medial counterpart.
- The result is that word-final schwa may display more stability than its word-medial counterpart.


## 3 Schwa-zero alternations

- As a consequence of schwa's auditory indistinctness, its presence in a given phonetic context may be susceptible to confusion with its absence in an otherwise identical phonetic context, perhaps leading to a $\boldsymbol{\rho}^{\sim} \varnothing$ alternation


## Schwa-zero alternation in Hindi

- Schwa alternates with zero in would-be $\mathbf{V C ə C V}$ contexts, provided that it is not the first vowel of the morpheme

| (4)a. | pit5ka | squeezed |
| :---: | :---: | :---: |
|  | pıg ${ }^{\text {b }}$ a | melted |
|  | dewrani | brother-in-law's wife |
|  | nəmkin | salty |
|  | siski | a sob |
|  | hirni | doe |
|  | trepa | cause to be restless |
|  | wapsi | on return |
|  | upri | pertaining to the top |
|  | ubton | an unguent |
|  | gərdzila | thunderous |


| pit ${ }^{\text {ek }}$ | squeeze |
| :---: | :---: |
| prg ${ }^{\text {b }}$ l | melt |
| dewor | brother-in-law |
| nəmək | salt |
| sisək | sob |
| hrron | deer |
| torop | restlessness |
| wapes | return |
| upar | top |
| ubetna | to anoint |
| gəredzna | to thunder |


| a+səməj | asəməj | inopportune |
| :---: | :---: | :---: |
|  | ə $\boldsymbol{\text { ərir }}$ | without body |
| ə+kələŋk | əkələŋk | spotless |
| ko+ $\int$ kon | kujəkun | bad omen |

- Hindi schwa derives from Sanskrit **ə and short **a. In Old Hindi, this vowel, and also, some instances of other short vowels ( ${ }^{\prime} \mathbf{I}$ and ${ }^{*} \mathbf{v}$ ), alternated with zero in ${ }^{*} \mathbf{V C V C V} \mathbf{I}$ contexts (Misra 1967).
- As a consequence of their attendant jaw lowering, it takes longer to implement low vowels than non-low vowels, and so contrastively short low vowels are thus especially susceptible to rising.
- Provided that phonetic confusion between VC $\varnothing \mathbf{C V}$ and pre-existing VCCV sequences does not induce undue semantic confusion (by inducing a significant amount of homophony), it is quite possible that the sound pattern may ultimately change from $\mathrm{VCəCV}$ to VCCV.
- Why not schwa deletion in VCCəCV and VCəCCV contexts?
- The resulting sequence might be confused with VCCV.
- At this point, the chances of inducing homophony-hence confusion on the part of listeners-increase considerably.
- Since speech signals that confuse listeners (as opposed to those that do not confuse listeners) are less likely to be reproduced as these listeners become speakers, the presence of confusing signals as part of the conventionalized speech repertoire may be passively curtailed (Labov 1994, Silverman 2006). This may have influenced the present-day Hindi pattern: VCCəCV and $\mathbf{V C ə C C V}$ do not alternate with VCCV.
- Exceptions:
(5)

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kadəmbri ~ kadəmbəri a novel, name for a girl
ustra ~ ustəra razor
pundrik ~ pundərik white lotus
məjdzri ~ məjd3əri tiny cluster of flowers, name for a girl
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- Schwa deletion here results in tri-consonantal sequences that are also found elsewhere, and are usually of the form nasal-homorganic stop - sonorant.
- The phonetic properties of these particular tri-consonantal sequences are readily recoverable from the speech signal, since the medial consonant here does not possess place features that are distinct from the preceding nasal, and thus it does not contribute place cues of its own.


## Schwa-zero alternation in Chukchee

- Kenstowicz (1994) discusses schwa insertion.
a. $\quad \mathbf{C C}+\mathrm{C}$
tumyə+ret
meml ${ }^{2}+$ joc $\gamma+$ +
qejŋə+Уiniw
group of comrades pail
lots of brown bears
b. $\quad \mathrm{C}+ə \mathrm{CC}$
watap+ənlay
place without moss
rPew+ət?ul whale meat
nəm+ətku+n group of villages
- When a morpheme boundary is present in a string of three adjacent consonants ( $\mathbf{C}+\mathbf{C C}$ or $\mathbf{C C}+\mathbf{C}$ ), schwa is found at the morpheme boundary itself ( $\mathbf{C} \boldsymbol{\mathbf { C C }}$ or $\mathbf{C C ə C ) , ~ a n d ~ t h u s ~}$ "morpheme integrity" is preserved.
- Schwa is serving a demarcative function here, in that it provides information about morphological structure: the presence of schwa cues morpheme boundaries.
- Schwa in Chukchee may thus be characterized as a "prosody" in the sense of Firth (1948).
- Instead, when a morpheme boundary is coextensive with a word boundary, schwa is found away from that boundary.
(7) a. \#CəC

| pəne+k | to grind | ye+mne+lin | past tense |
| :--- | :--- | :--- | :--- |
| təm+ək | to kill <br> to | 子e+nmə+len |  |
| tənut+ək | to swell |  |  |
|  |  |  |  |
| CəC\# |  | qepl+e | erg. |
| qepəl | ball | meml+aratyayən | waterfall |

- The absence of schwas at word edges may also be viewed in terms of Firthian prosodies: word boundaries might be cued in part by low-probability consonantal sequences that-due in great part to the prevalence of word-medial schwas - are less often encountered wordmedially.
- That is, preserving consonants at word edges, as opposed to inserting schwa here, might render word boundaries more prominent due to the potentially low probability of such boundary-straddling (hence boundary-cueing) sound sequences.


## 4. Concluding remarks, and ideas for future research

- Schwa is short in duration, is subject to significant coarticulatory variation, and seems to have a mid- centralizing-tendency.
- Phonologically, it has been classified as a "featureless" vowel.
- Its featureless status makes it a likely candidate for epenthesis.
- Some schwas may have their origins in the audible release of a consonant when this consonant is immediately followed by another consonant: cues to the phonetic content of consonants are more reliably communicated upon audible release, ideally into a vowel.
- These schwas may or may not be visible to the prosodic structure of the language.
- Schwa may also be the result of vowel reduction. Its short duration and its consequent tendency to coarticulate make schwa a likely candidate for the vocalism of stressless domains.
- Perhaps as a consequence of its tendency to camouflage itself, schwa is especially susceptible to deletion, and thus may alternate with zero under varying conditions.
- Proposals that might be investigated in future studies:
(1) Release into schwa is more likely to be present in a language when the absence of release might lead to a significant increase in the amount of homophony.
(2) Trans-sonorant harmony deriving from schwa-insertion is more likely to be present in a language if it does not produce a significant amount of homophony.
(3) Reduction of full vowels to schwa is more likely to be present in a language when it does not induce a significant amount of homophony.
(4) Word-medial schwa is likely to possess a greater amount of fixed coarticulation than is word-peripheral schwa; word-peripheral schwa is likely to possess more a stable realization (confirmed by Flemming for English).
(5) Schwa deletion is more likely to be present in a language when cues to neighboring consonants are not jeopardized to the point of their deleting as well.
(6) Schwa deletion is more likely to be present in a language if the resulting strings of consonants are already present in the language (confirmed by Ohala for Hindi).
(7) Schwa deletion is more likely to be present in a language when it does not induce a significant amount of homophony.
(8) Schwa insertion may display a word-medial versus word-edge asymmetry in terms of its insertion site such that its presence or absence plays a demarcative role (confirmed by Kenstowicz for Chukchee).


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