New Variants and Functional Bases on Sonority Conversion*

ABSTRACT

Although sonority conversion has been assumed to hold true sorely for the ranking less sonorous /w/ than rhotic, lateral, it is applied extensively to vowels and other sonorant consonants. This article posits, as well as the less sonorous tap in AmE, the case in the standards/varieties of ModE and PDE where the mid central vowel /ʌ/ has the larger value than high peripheral vowels. The three pieces of evidence (stress distribution, sonorant syllabification, sound change) turn out to support my observation. The reversed ordering does not occur on a pair of voiceless/voiced obstruents and vowels in conditioned stress system. Functionally, all of the possible hierarchies stem from physically rare features according to which the segments of this sort are articulated differently in part from the invariant. The features are classified as (a) the segment-specificity where languages have a similar disposition or as (b) the phenomenon-specificity that affects a ranking within the range of possible articulation.

1. Introduction

The issues this article addresses make a two-way contribution to sonority conversion: facts of English sounds and novel account based on contemporary phonology. Introducing first sonority, when pronouncing, say, /ʃ/, /n/ and /s/ in your language, you would understand the relative loudness ranked as /ʃ/ > /n/ > /s/. Without certain nonlinguistic factors such as speaking in a loud voice, the leftside one indicates the higher sonority. For the sake of convenience, I intended to take the three consonants for which the different ranking is not assumed to take place in the phonologies of the world’s languages. Move on to the theme in this paper, sonority conversion:

(1) A > B > C > D
(2) A > C > B > D

The schemata in (1) and (2) represent the fixed ranking and the sonority conversion, respectively. The former may hold true for all of the languages. Otherwise, the ranking of sonority is inconsistent with the fixed one; as in (2), C has the more loudness than B at the level of an individual language. The ‘sonority conversion’ explicated herein refers to the different ranking of sonority in a certain language, relative to the fixed ranking with the universal applicability.

The research on sonority began to be done prior to the advent of generative grammar. Since the classical works made by Whitney and Sievers in the late 19th century and by Sweet, Jespersen and Trubetzkoy during the first quarter of the 20th century, the effect sonority has had on phonological issues ranges increasingly over theory, law, entity, phenomena, etc. The widely discussed topics in or related with English phonology are two-fold: (a) Preferences Laws (the diachronic shift of syllable structures), originated in Murray – Vennemann (1983) and updated by themselves and reexamined by Picard (1990), Ham (1998) and Hall (2004), (b) syllable-edge coronals (Clements 1990, Hall 2002), discussed both in
a wide variety of the languages and across theoretical frameworks (cf. Green 2003). See Ohala – Kawasaki (1997) on the work reexamining the status of sonority in terms of syllable structures and phonotactic constraints.

The earliest supposition of sonority conversion dates back to 1970s. Hankamer and Aissen (1976) observed that in contrast to the apparently universal ranking, /w/ might have the smaller value than Rhotic (R) and Lateral (L). This idea has been applied correctly to Sanskrit (Steriade 1982: 329) and to Early West Germanic (Suzuki 1989, 1996: 297-307), in the sense that the less sonorous /w/ is solely focused on without recourse to any other orderings. In the examples hereafter, the universal rankings and the individual ones are contrastively shown:

(3) universal  /j/ > /w/ > R > L
(4) Sanskrit    R, /j/ > /w/ > L
(5) Early West Germanic  R > L > /w/

Contrary to the belief in the less sonorous /w/, the sonority conversion is not so totally restricted. The other individual ranking comes from the rhotic, as in Oda (2009). In American English (AmE), the tap is shown to be less sonorous than the lateral (L) and nasals (N), but more sonorous than voiced fricatives (VF):

(6) universal  R > L > N > VF
(7) AmE      L > N > [ɾ] > VF

The other case this author posits is the larger value on the /ʌ/ vowel (henceforth otherwise TURNED V, stressed central vowel, STRUT vowel, etc.) in standards/varieties of ModE and PDE. The ranking of the sonority is posited that it has the higher hierarchy than high peripheral vowels and that this presents the formerly unattested case on the language-internal ranking (MPV = mid peripheral vowels, HPV = high peripheral vowels, MCV = mid central vowels):

(8) universal  MPV > HPV > MCV
(9) English-internal  MPV > TURNED V (MCV for the articulation) > HPV > MCV (for the others)

Although the previous researchers noted above have observed crosslinguistically the limited cases, that is, those between /w/ and liquids, this article views the less sonorous tap and the more sonorous mid central vowel as the two pieces of new evidence.

It is also suggested that certain individual rankings do not occur in the phonologies of any languages: voiceless obstruents relative to the voiced counterparts, some vowels with certain conditions. The reason for this observation comes from the intrinsic nature on speech organs in the generalized view.
Taking into account the previous, the new, and some of the impossible ones, it should be asked why such specific rankings hold true for the rather limited cases. Building on the contemporarily active discussion on functional phonology, this article explores the new application of the phonetic conditioning to the theoretical construct in the phonological phenomena. In this sense, the present argument on the sonority conversion is parallel to those on syllabification (Steriade 1999, Gordon 2002, Blevins 2003). The two themes have in common the feature that the phonetic conditionings behind the theoretical constructs motivate the language-particular phenomena.

More specifically, physically rare features, I assert, functionally render emergent the variants that have an effect on the sonority hierarchies of each language. Provided that, for example, a sonorant consonant has the articulatory feature that the posture of the tongue for it readily causes the turbulent airflow to be vented outside, it functions as the conditioning. The features are classified as segment-specific or phenomenon-specific ones. The two categories make a difference from each other by way of the distribution of the languages, phonetic causations and other factors.

The present paper is organized in the following way. Section 2 reviews briefly the less sonorous tap in AmE. Section 3 discusses the more sonorous TURNED V with the three sorts of the evidence. Section 4 investigates the individual orderings that languages do not take. Section 5 argues in favor of the phonetic groundings in all of the individual cases and section 6 subclassifies them as the crosslinguistic and the language-internal ones. Section 7 concludes this paper.

2. The AmE tap
2.1. Overviewing the way of the analyses

Let us now observe how to adduce pieces of evidence on the sonority conversion. To put it in three ways, they are obliged to be based on the following phenomena:

(10) a. accounted for by sonority
   b. discussed in the frameworks of, for the most part, crosslinguistically examined issues
   c. observed in the level of the individual languages with minor differences of surface and non-derived forms.

The condition in (a) is a matter of fact. The sonority conversion can be accounted for by sonority-based phenomena, but not by features, perception, articulation, etc. The one in (b) consists of a wide variety: the Syllable Contact Law (distance of sonority across syllable boundary), lip-opening on vowels (wide or narrow in a single hierarchy on vowels), historical direction (shift to more or less sonorous one on a phonological process), etc. All of these issues operate crosslinguistically and can present the language-particular features illustrating the differences from those of other languages. The aspect stated in (c) plays an integral role in the language-internal ranking. To be addressed on this is that a certain allophone surfaces in some cases, but not in others, or that vowels with or without stress lead to the different direction on contemporary shifts, etc. Whereas the current paper addresses the
issues of ModE and PDE, some of the phenomena internal to the contemporary variants of English are shown to possibly affect the sonority conversion: intrusive ‘l’ (Gick 1999, 2002b), ‘l’-vocalization (e.g. Britain – Johnson 2007), /l/ as the nucleus and /w/ as the onset (Davis – Hammond 1995), pretonic schwa elision (e.g. Davidson 2006), dialect contact (Kerswill 1995 and others), /hw/ vs. /w/ (see Wells 1999 for the data), the articulatory similarity between schwa and the central approximant of /l/ (Gick 2002a), the allophonic accounts making use of the prosodic hierarchies higher than syllable (Jensen 2000, Harrison 2007, Davis 2009, see also Hammond 1997), mergers of /w/ and /v/ (Trudgill et al. 2005, and others), nasalization (Cohn 1993), happy-tensing (Windsor Lewis 1990, Beal 2000), the syllabic consonant formation as a result of the deletion of a stressed vowel (e.g. Hammond 1999 for the illustrations), language-particular shift (Chambers 1998 for Canadian English), variability of ambisyllabicity (Trousdale 2002, Gick 2003), and others. This list makes a coverage of the controversial phenomena in the Englishes.

The reason why these phenomena may possibly operate as the conditioning relevant to the sonority conversion is three-fold. First, as stated in Hankamer and Aissen, it takes place commonly between /w/ and rhotics, laterals. The phenomena in the last paragraphs contain commonly those with the three sonorants. Second, some segments are categorized into a group of sounds: /w/ and labial obstruents, /l/ and schwa, high back vowels, etc. Third, the phenomena are intrinsic to a certain language: intrusive ‘l’, the syllabic consonant formations as a result of the deletion of stressed vowels, etc. The language-particular phenomena make a close relationship with the language-particular ranking of the sonority scale.

In the remainder of this article, the sonority conversion will be fully discussed in terms of the formerly unattested cases and the contemporary functional motivations.

2.2. The less sonorous tap

Taps and flaps are articulatorily different from each other; the former lack the movement in the latter where the front of the tongue is curled up before it moves toward alveolar ridge (Ladefoged 2006). In AmE, the underlying stops /t, d/ undergo tapping (cf. better, city, daddy). The allophonic tap is syllabified to the coda-finals, which may or may not be preceded by one of the liquids or the alveolar nasal (Kahn 1980). For the contemporary correct definition, the prosodic approach (Jensen 2000) employs the higher level in it. It develops the hierarchies from mora to utterance into the allophonic variants and makes the explicit account for the controversial aspects that the ambisyllabicity could not. The evidence is adduced that the tap affiliates not to the coda-final, but to the onsets of the unstressed and the stressed syllables each in (11a, b). The employment of a higher hierarchy in such examples (for the tap, non-utterance-final) should be necessary:

(11) a. go [r]o Europe    b. po[ˈr]ato

Research on the rhotics has been widespread in English phonology and phonetics. The contemporary

Making the assumption on the ordering of this rhotic variant, this paper takes a contrary view to the previous research and posits an unattested case. Lowly valued is the rhotic, instead of the semivowel:

(12) R > /w/ > L or R > L > /w/
(13) L > N > [r]

In AmE, the central approximant of /t/ occupies the status of syllabic nuclei as a result of the elision of schwa. Phonologically, the tap derived from the underlying /t/ or /d/ makes an enough contrast with the rhotic derived from the (/t, d/ → R, /s/ → R): the consonant lenition or the vocalic weakening, the derivational directions, the status of the underlying segments, etc. All else being equal, the candidate on the less sonorous rhotic is the stop-based one.

Compare, next, the tap with alveolar stops in phonetic terms. The difference between them is attributed to the time to make a contact of the tip of the tongue with alveolar ridge: in general, short contact for the tap and long one for the stops. Among the English allophones, clear vs. dark ‘l’ has a gradient articulation, i.e., postured in a certain position between the two extremes. The postures of the tongue body vary in several degrees (Sproat – Fujimura 1993). Whether or not such an articulation is accessible is relevant to the human apparatus on speech organs. The AmE tap conforms to the gradient articulation in the sense that the tip of the tongue moves toward alveolar ridge quickly or slowly. In view of general phonetics, taps are made with a quick contact with alveolar ridge and alveolar stops with a firm contact with it. Wells and de Jong observe the similarity between the tap and the /d/. This would equally lead to the similarity on the time to make a contact. Expectedly enough, the AmE tap has the time of the contact between the quick and the firm ones.

The following paragraphs adduce the pieces of evidence on the less sonorous tap. The arguments in this line have to be made on sonority-based principles and phenomena. In terms of the syllabicity of consonants, high values are equivalent to the status of nuclei. Whereas the phonetic implementation of English syllabic consonants may depend not only on dialects but on speaking tempo,
preceding consonant, final or medial in words, etc., the theme addressed at this point is the possibility on the syllabic nuclei, in other words, the possibility on the more sonorous status for sonorants. It is not affected by other factors on the phonetic implementation. Assuming the sonority contour in syllables (see Clements 1990, 2009, Vaux 2009), nuclei are more sonorous than onsets and codas, but not vice versa. When the underlying schwa in the unstressed syllables is shared in terms of the phonotactic constraints, the central approximant of /r/ occupies the nuclei of a syllable, but the tap does not. Due to the hyperrhoticity that is correlated with the stressed syllabic consonant and the second elements of the diphthong, the rhotics that affiliate to the syllabic nuclei should be common, but it is not the case for the tap in the stressed and unstressed syllables:

(14)  a. your  b. center  c. better  d. creativity

\[ [jr] \quad [r] \quad *[bf.r] \quad *[vr.i] \]

The lack of the syllabic status has also a clear-cut distribution when related with the lateral and nasals (e.g. lit[li], eat[n], at[m], thick[n]). In sum, the central approximant of /r/, the lateral and the three nasals affiliate to the nuclei. Among the sonorant consonants, the central approximant of /r/ occupies the nuclei in both the stressed and unstressed syllables, or, to put it differently, in the higher frequency than the rhotics in other languages and the others only in the unstressed syllables. Given that the sonority and the syllabicity correspond with each other, the central approximant of /r/ has the larger value than the lateral and nasals and the tap has the smaller value than both of them. The fact that the motion of the tongue on the AmE tap is similar to that of the /d/ yields its nonsyllabic status as the natural outcome.

The tap occurs frequently as a singleton (city, water). When occurring as a coda cluster, it is preceded by a rhotic, the lateral and the alveolar nasal:

(15)  a. party  b. guilty  c. Kentish

Assuming that the tap is less sonorous than nasals, the sonority contours on SonC + tap turn out to be reasonable, partly because this ranking demonstrates the satisfaction of the contours, which plays an effective role in the tautosyllabicity. The following two similar cases underpin the present argument. First, according to Treiman – Zukowski (1990), for example, the /dr/ in the word Madrid serves as the onset cluster ([ms'dr1d]), but the /st/ in estate is heterosyllabified ([rs'let]). This is attributed to the preference of the onset clusters in terms of the sonority profiles. Second, in the similar vein, the coda phonemes are tautosyllabified more commonly in those with the sonority contour satisfied: the /lp/ (helper) better than the /ŋkθ/ (strength).

In words with a vowel and a syllabic sonorant, the intervening consonant must be, in accordance with the generalized principle, less sonorous than both of the nuclei:
Based on the forms that in (16a, b), the consonants (v, n) have the smaller value than the following nuclei (n, l) by the degree of one, respectively. By contrast, in the word-finals of (17a, b) where the sonorant syllabification is blocked from occurring (cf. Wells 2000), the preceding consonants (l, r) are higher than, if undergoing the nucleus formation, the syllabic sonorants (n, l) by the sonority ranking of the minimal distance. It is not the case, however, and the form with schwa surfaces. This sort of the minimal sonority distance is widely applicable with regard to the sonorant syllabification. The issue addressed at present is the ranking L > N > r, and the three categories are dealt with:

(18)  a. little  b. bottle  c. atom  d. bottom

The ranking I posit (L > N > r) implies the less sonorous [r] than [l] and [m] with the distance of two or one. This means that each of the sonority profiles conforms to the generalization on the nuclei and the margins and that the internal ordering makes sense.

The opposite view is to suggest that the tap has the higher hierarchy than any of the obstruents. First, on account of the Syllable Contact Law, higher sonority scale on the left side of the boundary and lower one on the right side form the better syllable contacts (Ham 1998, Murray 2000 and others). The coda tap is adjacent to the four sorts of the segments across the syllable boundary:

(19)  a. daddy   b. beater   c. little   d. atom
      ['daeri]   ['biz.r]   ['lir.l]   ['aer.m]

In the ranking posited in this article (i.e. R > L > N > r > VF), the example in (19a) makes the maximum distance of seven and the one in (19d) the minimal distance of one. The coda taps illustrated above demonstrate the sonority contours where the syllable contacts are violated in the different degrees. Turn to examine the other cases on the higher sonority scale for the right side of the syllable boundary:

(20)  a. erudite   b. topmost   c. footlight   d. aqua
      [rj]       [p.m]       [l]       [k.w]

Each of the right sides has the larger value by the degrees of one, four, five and seven. The seven degrees are considered to be the biggest difference in the phonology. The syllable boundaries with the eight degrees are represented as voiceless fricative – mid central vowel and as nasal – low vowel, but such cases do not occur. It occurs, if any, when the coda maximization takes precedence on the
ambisyllabicity with regard to the voiceless stop and when the following syllable begins with a high peripheral vowel (thinking). In the example in (19a-d), unless the tap has the lower value than voiced fricative, which leads to the illicit eight degrees, the syllable contact conforms to that of AmE owing to the violation of the licit seven degrees.

In the discussion made in this section, the AmE tap has been shown to present one of the new cases on the sonority conversion. The individual ranking on this variant is suggested as in the following:

(21) universal \( R > L > N > VF \)
(22) AmE \( L > N > [r] > VF \quad = (6) \& (7) \)

3. The vocalic conversion

Many, though not all, of the phonotactic constraints in ModE and PDE have in common the vowel \( /\alpha/ \), which is generalized to consist of the two sorts: (1) occurring as the basic form, highly common, invariant for the majority, derived from the \( /u:/ \), the \( /\alpha:/ \) and the \( /\alpha:/ \) in Middle English, and (2) dialectal, allophonic, lacking historical antecedent (cf. Wells 1982, 1997, 2003, Beal 2004, 2005, Tillery – Bailey 2005, Wolfram 2008 on each accent and the features):

(23) sun, tun, funny, sunny, enough, struck, flood

(24) a. NorthernBrE  sugar  cushion
    \( [\alpha\sigma] \quad [\alpha\sigma\eta] \quad (\text{the stressed } [\alpha] \text{ alternatively}) \)

b. ScotlandE  comma  manner
    \( [k\eta\lambda\eta] \quad [m\alpha\lambda] \quad (\text{schwa as the predominant form}) \)

c. Southern AmE  strut
    \( [\sigma\varepsilon\lambda] \quad [\sigma\varepsilon\lambda] \quad (\text{copronounced}) \)

It differs from other vowels both in and outside the English language in some respects. The separated status rests on articulation, perception, stress, derivation and cardinal vowels. The reason for this observation comes from the intrinsic idea that sonority conversion implies the relative loudness divergent from the universal one and that due to the uncommon status of some features, the sense of the individual ranking becomes explicit. By way of comparison, the \( /\alpha/ \) vowel shares with schwa the articulation as mid central, with \( /\alpha/ \) the one as stressed and central. The sound is more audible than schwa, and less audible than low vowels. When allophonized to the articulatorily lower position, it is described as the low vowels. TURNED \( V \) varies in the points of articulations both crosslinguistically and language-internally. Taking cardinal vowels into consideration, it is represented as the unrounded counterpart of \( /\alpha/ \). This is why the one in the dialects of PDE has a specific articulation. The pronunciations in them are centralized, or slightly more backward, or slightly opener. In the phonetic descriptions (e.g. Dretzke 1998, Roach 2000, Crystal 2003), the third one has the highly common
This paper makes a unified analysis on the three articulations since the sonority scale on them is assumably stable. To my thinking, the rare features on it seem to have been known as one of the peculiarities on English vowels (cf. Crosswhite 2001 on the relevant descriptions).

Given the assumably controversial status on STRUT vowel, the literature on it should be highly common like the other rare sounds of English. Despite the contrary view that the previous one apparently seems to be sparse, the two papers are involved in the recent one on it. See Beal (2012) on the variations in the 18th century of BrE and Fabricius (2007) on the acoustic data.

It is the working hypothesis that the /ʌ/ vowel is, though classified as a mid central on the articulation, more sonorous than high peripheral vowels and that this constitutes the formerly unattested case on the sonority conversion. To sum up the basic feature on the sound, the ideas phonologists may possibly share on TURNED V in uncontroversial sense consist of (a) difference from schwa in terms of the articulatory energy and (b) difference from low vowels in terms of perceptual ambiguity or clearness. The following evidence the more sonorous TURNED V on account of stress (§3.1.), syllabic consonant formation (§3.2.) and sound change (§3.3.).

3.1. Distribution of Stress

The majority of the dialects in ModE and PDE have a consistent stability on the sonority-based distribution of stressed and unstressed vowels. For short vowels other than /ʌ/, low and mid peripheral vowels are stressed, high peripheral vowels are both stressed and unstressed, and mid and high central vowels are unstressed. The exception to this is represented as, say, the dialect in Northern England where the stressed schwa occurs (cf. Wells 1982, Ex. 2a in section 1.).

Theoretically, contrary to the Prince’s (1997, based on the de Lacy’s 2004 citation) fixed theory of markedness, de Lacy (2004) posits the conflation of the rankings. The former has the one where the hierarchy remains consistent; in the five scales on vowels, for instance, high peripheral vowels are always higher than mid peripheral vowels. This has some exceptions, however. In the latter, adjacent hierarchies behave like a single category and some languages have the same behavior of both of the vowels with regard to the placement of stress. Compare at this point the vocalic ranking I posit on this issue with the one on the basis of the invariant:

(25) a. LV > MPV > TURNED V > HPV > MCV > HCV

b. * LV > MPV > HPV > TURNED V, MCV > HCV

The assumably correct ranking in (14a) has the distribution of the stress for the upper three, of no stress for the lower two, and of both of them for HPV. Making the illicit ranking that TURNED V is set equally to MCV, the sonority-based stress placement gives rise to the category that MCV is tantamount not to HCV, but to HPV in the sense that both TURNED V plus MCV and HPV are both stressed and unstressed. Given this, it might be questioned whether the two categories the two vowels with or without stress and the one stressed and the one unstressed vowels are classified as same or different.
On the condition of the single sonority hierarchy, to my thinking, the unitary affiliation makes sense. In a language where the vowel /u/ is always stressed, but the tense counterpart /i/ is always unstressed, unless the sonority ranking varies, it is not the case in point that both of the high front vowels are differentiated in the hierarchy. By way of comparison, both of the hierarchies (25a, b) conform to the conflated theory on markedness made by de Lacy. The validity in (25a) is, however, not accounted for by the theory on sonority, but by the distribution of the stress placement in the polysyllabic words, as shown below. The argument made by the de Lacy's article is obtainable in a different fashion; on the occurrences in the stressed syllables, TURNED V takes precedence on high peripheral vowels. The relationship between the sonority and the stress is reflected in the distribution with the /ʌ/ and the unstressed /i/ in the disyllabic words:

(26) Enough, funny, sunny, monkey, country

The issue addressed at this point is attributed to the ranking of the sonority on the basis of /ʌ/, /i/, and /u/ in the stressed syllables relative to the unstressed high front /i/ vowel in the same words. The minor differences lead to a piece of evidence in this line of research. Observe the cases in which the stressed vowels are occupied by the high back and front vowels, each in (16) and (17):

(27) woman, cushion, bullet
(28) city, busy, pity

In the case of the stressed /u/, the unstressed vocoids vary: from the lefthand, schwa, syllabic [n], and [i]. The last one surfaces also as schwa (Wells 2000). The syllabic [n] preceded by the /ʃ/ might be very possibly an obligatory phonetic implementation. On the next example, the final vowel shifted from the /i/ to the /i/ during Early Modern periods (Windsor Lewis 1990, Beal 2000). After the tensing process took place, the sonority-based distinction between the two syllables was shaped since the derived unstressed vowel is less sonorous than the other.

Between the two high lax vowels, the less sonorous one corresponds to the back vowel, which does not cooccur with the /i/ in many of the cases, but with the schwa and the syllabic consonants. The established sonority contours are reflected in the cooccurrences. The /u/ vowel more commonly co-occur with the /i/ vowel. The higher frequency is manifested in the words such as city, busy. For the /ʌ/ vowel, it is true that the cooccurrence of the /i/ is most common. (See the lists of the words exemplified in Wells 1982:132, Gimson – Cruttenden 1994:104.) The supposition derived from this sonority-based vowel distributions is the generalization that if a stressed vowel more frequently co-occur with the /i/ vowel, it has more possibility to have the larger sonority value. The stressed central vowel is therefore higher than high peripheral vowels.
3.2. Syllabic consonant formation

Both the dialects of ModE and PDE have the phonological process of the sonorant syllabification by way of the deletion of schwa, in particular, in the words where the syllabic consonant and the form with schwa co-occur (cf. tunnel and happen). Syllabic consonants may or may not occur on the basis of certain conditionings. On the basis of speaking tempo, fast speech makes the syllabic formation more, but slow speech by contrast makes the form with schwa more; the possible ones consist of the words where the two forms co-occur, as in final, thicken. The syllabic positions (pretonic, posttonic or stressed) are included in the criteria in the sense that posttonic syllables more readily undergo the process and that AmE syllabic [r] is typically stressed among all of the accents. (See Roach – Sergeant – Miller 1992, Wells 1995, Toft 2002, Oda 2007 on some of the conditionings.)

The conditionings of derivation, under which the deletion of a vowel and the compensatory syllabic formation proceed, make the two periods differ radically from each other. The former period has solely the underlying schwa with the exception extremely limited. In the latter, the variability on the underlying vowels sharply increases. Stressed vowels as the underlying status are concerned with the argument made at this point since we must examine the issue of the underlying /ʌ/ of stressed syllabic consonants. The status of syllabic nuclei is sonority-related. Needless to say, nuclei must be more sonorous than onsets and cldas. In stressed syllables, the smaller values of the vowel facilitate the syllabic consonant formation. The following exemplify the syllabic consonant formation when the underlying forms are represented as the ones with the vowels mid central, high peripheral, and TURNED V (29a, b, c, each in the order). Due to the examples that evidence the stressed syllabic consonant formation, I adopt those in AmE, which contain more stressed syllabic consonants. Many, though not all, of the following examples are cited from Kahn (1980) and Hammond (1999):

(29) a. heard, bird, purse, surf, curt, firm, curl
    b. your, poor, bull
    c. mull

The underlying vowels are represented most commonly as /ə/, and partially as the other two. I assume that the ones in (29b) take precedence on the one in (29c) with respect to the frequency of the occurrences. First, the /ə/ is closer to the central approximant of /r/ on the shapes of the tongue. The reason for it comes from the raising of the back. When the syllabic consonants are implemented, listeners can perceive each of the words without any difficulty. In this sense, the back vowel makes a contrast with /u/ and /ʌ/. Second, the words your and poor are used in daily lives. Third, as far as I can see in the literature, there is no example other than mull on the one as a result of the deletion of TURNED V. Even if there are more, the less common status seems to be inevitably true.

The issue of whether or not the underlying vowels are deleted, in either the syllabic consonant formation or vowel loss in a certain way, is explicitly accounted for by the ranking of the sonority. Vowel loss and sonorant syllabification in general share the phonological process of the deletion of
schwa, which is the least sonorous among the vowels in many languages. In enough contrast, low and mid peripheral vowels are not deleted in any case.

As demonstrated above, the sonorant syllabification takes place by way of the deleted /ʊ/ more commonly than the deleted /ʌ/. The deletion of the vowels features low sonority on them. AmE is not included in the exception. The syllabic consonant formations occur more commonly as the deletion of the less sonorous vowels. The other process vowel loss is usually that of schwa. This leads me to argue for the more sonorous TURNED V relative to high peripheral vowels.

3.3. Sound Change
3.3.1. Sonority promotion

The /ʌ/ vowel began to occur around the end of ME and was derived from Early ME /ʊ/. Since Early ModE, it became the standard pronunciation in the words such as enough, sunny, come. In the general view, the shift of the vowels from ME to early ModE clearly reflects in the phonology the sonority promotion in stressed syllables and the sonority demotion in unstressed syllables. The clear-cut distribution on the basis of sonority was established throughout the periods. Preference Laws (Vennemann 1988, see also Vennemann 1983, Murray – Vennemann 1983, Murray 2000) state that in historical linguistics, syllable structures shift from worse to better. This maxim is applicable to the vocalic contrast in the periods. The preference to the vocalic formation of TURNED V is referred to as the Nucleus Law (Vennemann 1988:27), but it does not make use of sonority scale. It is definitely clear, though, that the shifts like those in the periods conform to the basic ideas on the preference to the sonority. The dialectal differences and the inconsistent shifts notwithstanding, it became predominant that the low and mid peripheral vowels occupy the stressed ones, while the mid central vowels the unstressed ones.

Since the focus at this point is the sonority scale of TURNED V, short stressed vowels should be dealt with. The sound changes for them were not so thorough as those for the Great Vowel Shift (cf. Stockwell 2002 as one of the models). Overall, it is the case in point that the three periods early and late ME and early ModE each partially improved on the stress-related sonority. In late ME or early ModE, the three vowels shifted to TURNED V, as illustrated in the following:

(30) Come, judge, supper, onion, love
(31) enough, other, rough, month
(32) flood, blood

Prior to the formation of the ModE /ʌ/, the ME equivalents to (30)-(32) were the /ʊ/, the /ʊ/ and the /oʊ/, respectively. The earlier counterparts are always occupied by the stressed vowels. The unstressed high back vowels themselves were much less common in ME. This paper assumes that the /ʌ/ vowel formation can be accounted for by the sonority promotion:
TURNED V is ranked as higher than high peripherals and as lower than mid peripheral vowels. This is motivated by the other vocalic shifts in the same period:

(35)  
\begin{align*}
&\text{a. } /\alpha/ \rightarrow [\alpha] \quad \text{dog, body, college} \\
&\text{b. } /\alpha/ \rightarrow /\ae/ \quad \text{cat, fact, black}
\end{align*}

(36)  
\begin{align*}
/\omega/ \rightarrow /\uw/ \quad \text{cool, move, fool}
\end{align*}

Taking a look at the direction of the sonority, each of the sound changes in (35a, b) has the promotion, and the stability in the slightly rough view. The short vowels do not undergo the demotion in any respect. In contrast, the long vowels take the demotion, as in (36). By way of the system on the sonority, the formation of the /\alpha/ vowel therefore results from the promotion or stability of the sonority in comparison with a high peripheral vowel, /u/.

Compare next the newly formed TURNED V with the unstressed vowel in the disyllabic words. A certain feature emerges from them:

(37)  
\begin{align*}
&\text{a. money} \\
&\text{b. worry}
\end{align*}

(38)  
\begin{align*}
\text{enough},
\end{align*}

The earlier forms in ME were described as the /\alpha/ in (37a, b) and the /\uw/ in (38). In all of them, the unstressed syllables have the /\i/. In the words such as money, worry, the /\u/ still remained to occur in the period at issue. According to Windsor Lewis (1990), this tensing originates in the Modern period. In the similar vein, Beal (2000) takes a closer examination on that in Northern England. The high back vowels in (37, 38) are, prior to the newly formed /\alpha/, equal to each of the other high front vowels. In the level of the individual vowels, the high back is less sonorous than the high front. I claim that this sound change is grounded in the sonority contour where the stressed vowels should be highly valued than the unstressed vowels. In the examples such as (37, 38), the classical forms have the stressed high back vowel and the unstressed high front vowel. The stressed vowel has therefore the same hierarchy as, and, in the level of each segment, lower than, the other (Front Vowel > Back Vowel, in the same height).

Early ModE established the phonological system that in polysyllabic words, the sonority on stressed vowels is higher than that on unstressed vowels. During the ME periods, the equality of the sonority has a minor, but, in the two opposing ways, neither common nor no, distribution. The following cases are involved in the equal ranking of the two vowels:
The /u/ vowels in both of the syllables shift to the better one in Early (or Late) ModE due to the tensing in the word-final positions. In the level of each segment, the tense /i/ has the smaller value than the other. That is why the better sonority contours are formed on the basis of the sonority. By observing the slightly different one unseparatable two elements, the two diphthongs exemplified above each consist of the two elements as the high peripheral vocoids. Both of them disappeared in Early ModE with the dates and the later forms inconsistent among dialects.

The shifts in the words such as those in (39, 40a, b) serve to make a difference between the vowels with or without stress. Looking back on the cases in (37a, b, 38), the emergent /ʌ/ plays a role in making the similar effect to them. This means that the shift becomes reasonable on the assumably true ranking.

3.3.2. Contemporary case

Given the surface [ʌ] derived from /u/ in Northern BrE (see 2a, sugar, cushion), this allophonicization implicitly demonstrates that the same shift as the ME sound change that created the new phoneme /ʌ/ takes place recursively in the contemporary dialect. Alongside this line of research, see McMahon (1990) in view of the phonological theory, Beal (2007) with regard to the language-internal analysis. It has been argued that speakers in a Present-Day language have the phonological knowledge on the corresponding Modern periods (cf. Chomsky – Halle 1968 on the earlier discussion). The allophonic [ʌ] in Northern England is like this in the sense of the history of BrE, but unlike this in the sense of the one in the specific dialect.

Wells (1982:353) observes that this northern shift owes to hypercorrection, which results from employing the person’s own accent in those with the underlying /u/. In the words sugar, butcher and cushion, all of the /u/ vowels are stressed and TURNED V replaces them. The sonority-based argument is applied to this contemporary shift. In the dialects of ModE and PDE, the rankings on the sonority of the vowels are in general correlated with the stress placement. The stressed vowels shift to the more sonorous one. This leads me to claim that the relationship of the stressed vowels with it bases the allophonicization in the northern dialect on the sonority promotion. The direction of the more sonorous stressed vowels remains to be consistent with the antecedent and the /ʌ/ vowel has the higher sonority scale than high peripheral vowels.

The second illustration on the newly suggested rankings is the vocalic case, which is represented as in the following:

(39) city, pity
(40) a. /tu/ tiwesdai ‘Tuesday’
    b. /ʊ/ juinen ‘join’
universal MPV > HPV > MCV
English-internal MPV > TURNED V (MCV for the articulation) > HPV > MCV (for the others)

=(8) & (9)

4. Prohibited conversion

4.1. Voiceless and voiced obstruents

There is no case in which voiceless stops and voiceless fricatives have the higher sonority scale than each of the voiced counterparts. The difference between the pair of the sounds is attributed to the articulation made by voice and breath each on voiced and voiceless consonants. The former accompanies the vibration of vocal folds when air flow passes through glottis and the latter does not. With the state of the activity on the voicing, I assume, a certain voiced obstruent has the higher sonority scale than the voiceless one, but not vice versa.

Final neutralization, as one of the fields in laryngeal phonology, (cf. Avery – Idsardi 2001, Hock 1999, Honeybone 2005, Iverson – Salmons 1995, 2003, 2007, Jensen – Jensen 2005, van Oostendorp 2007) refers to the term that the underlying form with either of [+voice] surfaces as both of them: [+voice] → [-voice], [+voice] or, in contrast, [-voice] → [-voice], [+voice]. In the first one of these schemata, the underlying voiced form may or may not surface as the voiceless one; given the underlying form with final –nd, for example, the stop devoices and the surface form –nt co-occurs with the faithful form. The second one is implied to be the emergent voiced obstruent; in the one with final –nt, the stop voices and the two forms are coexistent alike. That is why the feature [voice] is made use of as the binary at the same time. This is referred to as final neutralization.

Hock (1999) assumes that the final devoicing occurs by way of the assimilation to ‘silence’. It has the positional conditioning of either the end of utterance or pause between the two sentences. Let us consider now the effect of the following form as the alternative; the underlying voiced obstruent is followed by vowel-initial word or speakers make a quick speech; likewise, it is followed by the word with initial consonant or speakers make a slight pause. I observe that this might depend on languages, but quick speech or pause has more possibility on the final devoicing. Word-medially, the effect made by the following segments is more important. Taken from a crosslinguistically common one, the sequence nasal + stop is homogeneous on the points of articulation. The devoicing is, if any, grounded in the assimilation. Due to the strings of the medial segments, there is no effect where the so-called silence leads to the lack of the voice. Oppositely, the word-final obstruents are assumed to undergo the effect of the pause. The longer the time for the silence, the more the occurrence on the final devoicing. In this sense, the silence with the effect on it makes sense, though specific observations might be necessary in some languages. Assuming the assimilation to the silence, it is definitely clear that the shift to the voiceless sound is implied to be the one to the less sonorous sound.

The final voicing must be examined on what functionally motivates the shift. The two possibilities arise on it: consonant lenition or assimilation to vowel. The former is meant to be the
process whereby certain consonants become phonetically weaker in terms of either reduction of effort (Kirchner 2004) or reduction to obstruct air flow (Kingston 2007). The crosslinguistic tendencies are taken into account that consonants become weaker intervocically and that the strength on each of the vocalic sounds more readily causes the lenition to occur (Kirchner 2004). The process to weaken consonants, however, depends on each example in each language; whether or not the process of a lenition occurs has the gradient aspect (i.e. obligatory, near obligatory, slightly conditioned, and largely conditioned). Overall, consonant lenition is constrained in several respects.

By contrast, the assimilation might be possibly binary. It is a reasonable outcome that the assimilatory process takes place on a phonological environment in every case. The final voicing accords with it. Given the case in which the attachment of the derivational –y to the stem –nt gives rise to –ndy, this voicing is possibly binary; if the derivational vowel is attached to the stem, the voicing always occurs; without any vowel, no voicing occurs in any case. Making a comparison with the consonant lenition, the assimilation can better account for the voicing.

The argument I would like to make in this section is attributed to the issue of the phonological directions. The devoicing is grounded in the assimilation to the silence and the voicing in the one to the vowel. Both of the processes lead to the clear-cut distribution that while the devoicing incurs the less sonorous effect, the voicing the more sonorous one. This means the sonority scale that a voiced obstruent is always higher than the corresponding voiceless one. The obstruents therefore have the fixed ranking in the sense that the voiced/voiceless pairs do not become opposite (VF for voiced fricatives, VLF for voiceless fricatives, VS for voiced stops, VLS for voiceless stops):

\[(43) \quad \begin{align*}
  & \text{a. } V\vphantom{L}F > V\vphantom{L}F \\
  & \quad \ast V\vphantom{L}F > VF \\
  & \text{b. } VS > V\vphantom{L}S \\
  & \quad \ast V\vphantom{L}S > VS
\end{align*}\]

4.2. Vowels with/without stress

Sonority scale on vowels is in part affected by stress. Languages differ in terms of the distribution of stress. The invariant on the ranking of the sonority is shown in the case in which certain adjacent two hierarchies are consistent with each other with respect to stress. Possible candidates contain high and mid central vowels definitely in unstressed syllables and the counterpart with stress on mid peripheral and low vowels. Let us take as the example /i/ and /e/ both of which occur only in stressed syllables. Each of them belongs to high and mid peripheral vowels. The difference of the articulations owes to that of lip-opening. Other aspects might lead to minor differences, but the lip-opening contributes to the largest effect.

The opening for the /e/ vowel is implied to venting more air flow from oral cavity to the outside. Lips are opener when speakers articulate it. The sonority, or to put it differently, the loudness is an abstract entity in phonological theory, but not the issue of phonetic details involving sequential effect,
and posture of the tongue in the analyses. In this context, sequential effect means, for instance, that the AmE tap is followed by [m] (atom) and by [l] (little). After speakers produced it, lips are closed on the former and almost stable on the latter. If the two syllabic consonants make the difference on the loudness of the preceding rhotic, the account makes sense. This sort of analytical way is interesting for phonologists and creative for theorists, but not regarded as the decisive criteria to set the ranking of the specific sonority. The wide aspects of the segment in the language should be inclusive, when the ranking is made. One of the core ideas in phonological analysis comes from the fixed view that, all else being consistent, a vocoid has a higher ranking than the other, when both of them are consistent with each other with respect to stress. With other conditions equivalent to each other, more loudness is conveyed on the vowel with the more lip-opening. The following is the ranking of the vowels based on the discussion in this section (LV for low vowels, MPV for mid peripheral vowels):

(44)  

<table>
<thead>
<tr>
<th>a. with the vowels stressed</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>/a/ (LV)</td>
<td>&gt;</td>
<td>/o/ (MPV)</td>
</tr>
<tr>
<td>*/o/ &gt; /a/</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b. with the vowels unstressed</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>/i/ (HPV)</td>
<td>&gt;</td>
<td>/a/ (MCV)</td>
</tr>
<tr>
<td>*/a/ &gt; /i/</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. The functional basis
5.1. Overview

Looking back on the research history on functional phonology, the advent of Optimality Theory shifted the trend from phonological to phonetic bases. It seems that the latter have thereafter been continuously discussed in several respects. The arguments vary in each work, but the core of the discussions is that some of the phonological conditionings are replaced by the phonetic ones or that unknown theory and unsettled issue are better exploited by the contemporary physical basis. It is specified that phonological entities, markedness constraints, language-internal phenomena or other, are accounted for by either of them (cf. Hayes 1999 for the overview and the references).

Phonetic bases on constraints and phenomena have continuously been widely discussed in the literature. In 1995 onwards, phonetic accounts have been applied widely to the discussions other than constraints and phenomena: syllabification (Steriade 1999, Gordon 2002, Blevins 2003), speaker and listener (Ohala to appear for the most recent one), Dispersion Theory (Flemming 2004), Evolutionary Phonology (Blevins 2004 and the subsequent works), faithfulness constraints (Steriade 2008, McCarthy 2011), bidirectional grammar (Boersma 2007), accidental and systematic gaps (Oda 2011), Licensing by Cue (Steriade 1997), sound change from the view of perception (Hamann 2009, Beddor to appear), Lexical Diffusion (Bybee to appear) and sonority scale (Clements 2009, see also Vaux 2009). Building on this central theme, the present article posits the physically rare features with regard to the sonority conversion.
Although sonority scale and sonority conversion share the theme on the rankings of the loudness, the functional motivation differs intrinsically from each other. The former implies the arguments on the universal features regarding consonants and vowels; given the fixed ranking, say, R > L > N, we should discuss, in highly general terms, the issues of why the lefthand ones are more sonorous and of how each of the sonorants is organized. (See Clements and Vaux along this theme). The sonority conversion refers to the fact that certain segments become more or less sonorous differently from the invariant. This is implied to be the issue of the rather limited examples in the individual languages.

5.2. Physically rare features

As has been demonstrated up to this point, the sonority conversion consists of the following three cases. Even if other unknown rankings come to light, they assumably conform to the functional analyses made in this article:

(45) a. the less sonorous /w/ in Sanskrit, Early West Germanic and others
b. the less sonorous tap in AmE
c. the more sonorous central vowel in the standards/varieties of ModE and PDE.

The issue to be asked at this point is the one of whether or not other cases on the sonority conversion take place both in and outside the English language. I assume that the one in (a) is not totally restricted within the two languages, but should occur slightly more, though not everywhere, in the phonologies of the world’s languages. The reason for this observation comes from syllabic phonology. As the general tendency, onsets are likely to undergo fortition, while codas lenition. The smaller value of the /w/ is thus intrinsic to onsets, rather than to codas. In languages where /w/ occurs in onsets, but not in codas and where onsets tend to undergo fortition processes, the less sonorous /w/ might possibly occur. Note that while the account on the basis of the phonotactic constraint is phonological, it differs from the phonetic motivation on the sonority conversion this paper addresses. The former implies the issue of the prosodic conditioning under which the less sonorous /w/ takes place. It deals with the one of where it occurs, but not of how it occurs, as in functional phonology. The phonetic basis on the less sonorous /w/ will be given in this section.

In contrast to the less sonorous /w/, the other two are cited from the English language. The AmE tap and TURNED V represent the individual cases. I expect other language-particular cases to possibly occur. In the examples like these, there are three conceivable reasons for the occurrences. First, the phenomena should be language-particular. In AmE the tap resembles the [d] for the motion on the front of the tongue. Second, rare derivations play a role. In Late ME, /u:/ and /u/ shifted to the /ʌ/ vowel, which, as a whole, has the different articulation from that of cardinal vowels. Third, syllabic phonology addresses the segmental slots and the direction of the shifts. If onsets undergo fortition or codas lenition just or almost obligatorily, and if a consonant occurs in either of them, the language may have the case of the sonority conversion.
The present paper posits the conditioning physically rare features under which the sonority conversion operates in the phonologies. The term ‘physically rare features’ has not been made use of in functional phonology as far as I know, but seems to be conceived as one of the shared ideas in the research on phonetic descriptions and sound patterns. The idea of ‘physically rare’ is obtainable by way of, say, the obstruent-like turbulent air flow for a sonorant consonant, which motivates the lower sonority scale than the corresponding invariant. The sonority conversion implies the issue of production, not of perception, and it is assumed to stem from the phonetic conditionings. I employ the term ‘physical’ for the purpose of clarifying the usages. The other two ‘phonetic’ and ‘articulatory’ are used frequently in the arguments of the functional bases, like the present paper of my own and, therefore, avoided in the use of the term.

Let us now fully illustrate what the physically rare features refer to. Consider first the two cases of section 4 in which the sonority conversion does not take place. Both of them are based on the general assumption that speech organs do not create such variants:

(46) a. VF > VLF
    *VLF > VF
b. VS > VLS
    *VLS > VS

(47) a. with the vowels stressed
    /a/ (LV) > /o/ (MPV)
    */o/ > /a/
b. with the vowels unstressed
    /u/ (HPV) > /a/ (MCV)
    */a/ > /u/ = (43) & (44)

The reason why the voiceless obstruents are in any case less sonorous than the corresponding voiced ones rests on the distinction between the sounds with breath and with voice. As reviewed in section 4.1., voicing and devoicing stem from the assimilations to the vowel and to silence, respectively (Hock 1999). Each of them turns out to put more sonorous and less sonorous effects. Moreover, the two ways of the air stream are, beyond question, considered to be a universal feature. The sonority on the pair of the obstruents is therefore consistent with each other. Very similarly, when the stress placement is consistent with each other, the sonority scale on the vowels is invariant. In the similar vein, this fixed ranking is relevant to the universal feature on the stress system. If it is consistent with each other, the two vowels like the ones shown above have the sonority in accordance with the fixed ranking. The case in which the vocalic sonority conversion takes place should be the different one from these. The /l/, a mid central vowel, is definitely stressed, but high peripheral vowels are both stressed and unstressed.

The semivowel /w/ has the double points of articulations as labio-velar. The majority of the
Consonants are articulated with a single point of articulation: interdental for /f, v/, labial for /p, b/, velar for /ɣ/, etc.; speakers employ the one articulator in each of them. The consonants like these show a predominant distribution. The difference between the single and the double articulations is attributed to the rare status on the latter. The sound of /w/ may or may not be pronounced like a semivowel in languages. All else being equal, however, the rare articulation is likely to produce the sounds where the ranking of the sonority differs from the invariant.

The fixed ranking of the sonority is shown as /j/ > /w/ > /t/ > /l/ > nasals. Among the sonorant consonants, the /w/ has the physically rare feature of the turbulent air flow. (See Ohala – Solé 2010 on the related articles.) The coarticulated labio-velar readily renders possible the sound that makes the constriction to produce a fricative-like sound through the passage inside oral cavity. When the back of the tongue is raised more, it is accessible. The air flow is obstructed at the point of velar and the fricative sound is produced. Given the less sonorous /w/, the relevant issue to the lower sonority of the sonorant consonants is devoicing. Rhotics and laterals devoice when a voiceless obstruent precedes them in the onset, but this is true for the other sonorants. The semivowels /j/ and /w/ also devoice in the same context. In the sense of the devoicing, the four consonants are set in the same category:

(48) Devoicing onset /pj, tw, pr, kl/

By way of comparison, the effect of the devoicing yields the different outcomes. The articulations on the the /j/, the /t/ and the /l/ turn out to be the sounds unlike obstruents. All of the three sonorants are not articulated with friction or stop/release, unless the point or manner of articulation becomes similar to that of other sound like that of the AmE tap as explicated in the next paragraphs. It is possible in certain languages that the devoiced /w/ is solely classified as the nonsonorants owing to the friction. The less sonorous /w/ stems from the rare status on the articulatory feature. This paper assumes that the less sonorous /w/ is ascribed to the physically rare feature in the sense that the articulation of /w/ readily gives rise to the sound of the fricative.

Moving on to the AmE tap, the physically rare feature is manifested in the contact of the tongue. The tap and the stops /t, d/ share the point of articulation and make a contact of the tip with alveolar ridge. The two sounds are distinctive with regard to the duration. Taking the view of the crosslinguistically common articulation, instead of the specific one in AmE, taps make a quick contact with the articulator and, then, the tongue body returns to the neutral position of oral cavity. The short duration is considered to be the crosslinguistic feature on articulating them. Likewise, in the general view, the contact for the stops is firm and takes the long duration. The front moves to alveolar ridge, and is set in the stable state, and released at the final stage.

In AmE, the duration of the tap is in the mid level between those of the two extremes. It is uncertain whether or not work on English phonetics has shown the articulatory durations of the tap and the related sounds in detail. However, it is generalized to be close to that of the [d]. The rhoticized allophone is derived from the underlying /t, d/ (better, duddy). The shift like this occurs sporadically.
some languages. When the same allophone (i.e. /t/ to [r]) occurs, the articulation is not consistent with each other. Inside the dialects of English, the one in the mid and north of England has the allophone derivationally equivalent to the one in AmE:

(49)  a. shut up  b. What’s the matter?

[[u]p] [ma.ə]  (Wells 1982:370)

The derived rhotic surfaces as the central approximant. The articulation on the central approximant of /r/ is made at palato-alveolar with the front of the tongue curled up. Between the underlying alveolar stop and the surface rhotic, there is no mid status of the duration, unlike the pair of the similar sounds in AmE. Taking a look at the phonologies of the world’s languages, the case on the shift from /t/ to tap is manifested in Malayalam (Mohanann 1986) and Taupua (MacDonald 1990). (See Kirchner 2001 on the list of the languages with this shift.) It seems that in both of the languages, the tapping is regarded as one of the phonological processes. That is to say, the frequency of the allophone is not so high as that of the AmE tap. The blocking of the tapping contains the examples like those illustrated below:

(50)  a. ..., wouldn’t it?  b. eaten beaten

[[ʔ] [tn] [ʔn]]

In any case, the tapping takes place predominantly. Malayalam and Taupua have the phonological process of the tapping each in the ordinary way. The reason why AmE has the tap as the articulatorily mid status comes in part from hyperhotticity, because of which the rhotics range from schwa-like to voiced stop-like ones.

Finally, addressing on TURNED V, the vowels in ModE and PDE are articulated differently relative to the one of cardinal vowels. In the latter, it corresponds with the unrounded counterpart of /ɔ/. In other words, among the unrounded vowels, the articulation on it inside oral cavity is made at the point lower than /o/ and higher than /u/. The identical vowel to the one in cardinal vowels, in view of International Phonetic Alphabet (IPA), is central, or, more backward, opener.

This articulation makes a difference from the other mid central vowels. Upper and lower jaws are more separated. Highly relevantly, the lips are opener. Speakers produce the more energetic sound. The sound conveyed by air stream is clearer and louder. To sum up, the different use of the cardinal vowel leads to the fact that each of the speech organs is articulated differently.

The phonological conditioning is disused on this issue. Stress is one conceivable idea. The /ɔ/ vowel is definitely stressed except for the sole dialectal case. This is conspicuous enough to differentiate with the schwa. However, given /æ/, despite the occurrence in stressed syllables, there is no case in which the mid central vowel and the high peripheral vowels are oppositely ranked. This account therefore does not make sense.
6. The two subclasses

6.1. Segment or phenomenon

In the arguments on functional phonology, the physically rare feature serves as the conditioning behind the sonority conversion. It causes the sonority of the sound to be differently ranked. The physically rare features are further divided into the two subclasses: segment-specifity and phenomenon-specifity.

It is prerequisite to clarify what these two are meant to be. In the former, the phonetic feature on one or more of movement, posture, duration, air flow, etc., is peculiar to a certain consonant or vowel. It is differently ranked owing to the uncommon feature specific to the articulation of the segment itself. Crosslinguistically, the pronunciation of the sonorant consonant A, for example, becomes in nature like an obstruent. This features intrinsically A, but not the other sonorant consonants. This theory does not mean to be applied to one sound. The rare features motivate the rather limited examples on the sonority conversion. For the segment-specific cases, the highly similar orderings of the segment occur in some languages. The important issue on this is the rare articulation of the sound itself.

As will be shown below, the segment-specific case of the sonority conversion is solely the less sonorous /w/. Looking back on the research history, the ranking less sonorous /w/ was posited and, after that, illustrated in the individual languages. It should be asked at this point whether or not this restriction makes a correct analysis on it. It might seem to be probably true that the sounds other than /w/ are not involved in the segment-specific one. I predict, however, that, if any, more sonorous rhotics are one possibility on it:

(51) HPV > MCV > HCV > /j/ > /w/ > R

In the general ranking shown above, rhotics as a whole have the lower sonority scale than high peripheral vowels by the degree of five. The posture of the articulators on them is rather close to the vowels like /u/, /u/ in the senses that the back of the tongue is raised and that the lips are rounded. According to Hall (2000) and the subsequent works (Hall 2003, 2004, Hall – Hamann 2010), the sequence /r/ + /j/ has a marked status due to the opposite postures. For the articulators, the rhotic is produced with the tip, while the palatal glide with the blade. For the shape of the tongue, the concave on the /r/ and the convex on the /j/ make an enough contrast with each other. The phonetic aspect that the back of the tongue is raised for the rhotic is shown in the advocators. In terms of the sequential conditionings (e.g. Ohala – Kawasaki 1984, 1997 in the opposing views, see also Solé 1998), rhotics and high back vowels are commonly adjacent to each other. The reason for making this argument stems from the idea that the segment-specific sonority conversion rests on the feature of the consonant (or the vowel) itself. Among the sonorant consonants, /w/ solely causes the friction to occur without an assimilation. It results in the ranking less sonorous /w/ than rhotic, lateral. Rhotics are generalized to be closer to high back vowels than to /j/ and nasals on the basis of the posture and the point of articulation. Consequently, I predict that the rhotic may have the larger value than semivowels in some
languages. If so, this represents the second case of the segment-specificity.

Turning to the other, phenomenon-specific conversion, the particular cases occur in each of them. To the extent that human apparatus allows the articulation to be made, the rare features have an effect on the internal ranking. The possible cases may contain a mid-levelled articulation for the language-particular segment A between the invariants A and B. The mid status on the articulator A is derived from the factors such as duration, constriction: between long and short on the durations or between strong and weak on the constrictions. The fact that such articulatory features are peculiar to the language leads to the status of the physically rare features. This implies that the one for the particular A is motivated by a physically rare feature and that the ranking of the sonority on the segment in the language diverges from the invariant.

6.2. The classification

The two subclasses made in the last section are correctly applied to each case on the sonority conversion, as shown below:

\[(52) \text{Segment-specificity} \]
\[\text{the less sonorous }/w/ \text{ (feature of the segment itself, friction)} \]

\[(53) \text{Phenomenon-specificity} \]
\[a. \text{the less sonorous tap (feature of the phenom. In AmE)} \]
\[b. \text{the more sonorous TURNED V (feature of the Eng vowels)} \]

The less sonorous /w/ is applied to the case of the segment-specificity. Given that it occurs in some languages, the rare feature on the segment /w/ plays a role in each of them. The feature that readily causes the friction to occur without assimilation is in itself that of the /w/ sound and lacking in the other sonorant consonants. The reason why this conversion commonly occurs stems from the phonetic feature of /w/. The less sonorous /w/ in Sanskrit, Early West Germanic and somewhere results neither from a language-internal phenomenon nor from a feature of the classic languages. It is attributed to the feature of the /w/ where the posture of the tongue is likely to make a constriction of air flow and produce the less sonorous sound. This is the segment-specificity the present article posits as a functional motivation. The languages with the ranking hold the shared feature.

The two cases in (53a, b) are meant to be phenomenon-specific. Crosslinguistically, for stops, the tip of the tongue makes a firm contact with alveolar and for taps, it makes a quick contact. The physically rare features on the AmE tap are based on the articulation that facilitates the middle level between the firm and the quick contacts (see de Jong 1998 on the observation along this line). The time for contacting with an articulator may or may not be binary and the tip with alveolar is involved in the gradient case. As has been shown in this literature, some dialects in BrE take the allophonic rhotic derived from /t/. The rhotic in them is articulated with the central approximant:
I assume that there is no case, in any way, in which physically rare feature leads to the less sonorous /t/-approximant. If this rhotic is phonetically closer to other sound, the highest possibility seems to be schwa, as in the case of AmE in Gick (2002). As argued in section 5.2., the shift from the /t/ to the tap takes place, in the languages other than AmE, in Malayalam and Taula, but the identical phonetic conditionings are lacking in both of them. Regarding the t-to-r as the allophonic occurrence, both AmE and BrE share alveolar ridge as the point of articulation for the stops, but differ from each other on that for the rhotics: the same articulator, alveolar ridge for the AmE tap and palato-alveolar for the BrE approximant. This renders different the possibility that the sonority conversion takes place with reference to the phonetic details. The phonetic feature is true only for the AmE tap and thus implied to be phenomenon-specific.

When taking a look at the diagram of cardinal vowels (e.g. Ladefoged 2006:217), the vowel is equivalent to the unrounded counterpart of /ʌ/. In comparison with back unrounded vowels, it is in positions lower than /o/ and higher than /u/. As mentioned earlier, STRUT vowel is articulated as the mid central or slightly more backward or slightly opener. This is why the corresponding vowel in the standards/varieties of English implies to be the phenomenon of the different articulation. This leads to the difference from the other mid central vowels to the large degree: the opener lips, the jaw opening, much energy, clear and loud voice (see §5.2.). If segment-specific, this sort of the sonority conversion is obliged to occur in some languages. However, it is not the case in point. The less sonorous /w/ is segment-specific since the segment itself is likely to be articulated with friction. The more sonorous /ʌ/ has the different picture. The articulation on it is the phenomenon solely to English pronunciation, though similar cases to it may possibly occur in the different way. Finally, the following summarizes the features of the two subclasses:

\[
\begin{array}{ccc}
\text{Segment-specifity} & \text{Phenomenon-specifity} \\
\text{Phonetics} & \text{external} & \text{internal} \\
\text{Other factor} & \text{none} & \text{language-internal feature} \\
\text{Applied language} & \text{some} & \text{solely} \\
\end{array}
\]

We can see the clear-cut differences between them in the sense of distinguishing between those across the languages and in the individual level. Looking at the above colimn in the descending order, the aspects of ‘external’ and ‘internal’ imply that the former is applied to more than one languages, while the latter solely to the language or the dialect. The friction for the /w/ occurs in more than one languages. The contact and the duration for the AmE tap are the features that are lacking in other languages. For STRUT vowel, the phonetic features such as the lips, the jaw opening, energy, etc. are represented as the language-particular ones. The other factor in the next column holds only to the phenomenon-specific
ones. Due to the hyperhoticity, AmE rhotics consist of the wide variety. In view of the phonetic features, the variants of the rhotics range from the schwa-like approximant to the stop-like tap. Relevantly to the phonetic factors, the last ones show the difference of the applied languages between two or more and one.

7. Conclusion

The previous works have implicitly shown that the sonority conversion holds only to the ranking less sonorous /w/ than rhotic, lateral. On the contrary, this article has demonstrated that it is extensively applied to other sonorant consonants and vowels: in the variants of English, the less sonorous tap than the lateral, nasals and the more sonorous /x/ than high peripheral vowels. Languages delimit the individual rankings since the pair of obstruents and some vowels constitute the cases to which the fixed rankings are definitely applied. In view of the functional phonology, the sonority conversion stems from the physically rare features, according to which the articulation differs in part from that of the invariant. The phonetic conditionings are classified as (a) the segment-specificity where languages have a similar disposition and (b) the phenomenon-specificity that affects a ranking within the range of possible articulation.

*Earlier Versions of this paper were presented at the 1st conference on the International Society for the Linguistics of English, held in Freiburg, Germany on October 9, 2008, and the 3rd Conference on Rhotics, held in Bolzano, Italy on December 2, 2011. Comments by the audiences there made it improve in a few respects. Needless to say, any inadequacies are my own.

Footnote

1 In my assumption, the fact that the less sonorous /w/, as Hankamer and Aissen posit originally, is capable of being developed into several ways. The present paper argues on the other individual rankings and the functional motivations. It may or may not be true that the less sonorous /w/ may receive the difference of the ranking between the dialects (Oda 2012).

2 The summary of section 2 is almost consistent with the argument of the original paper. Though some were omitted due to the lack of the space, the linguistic assertion remains to be kept.

3 The allophonic shift from the [nr] to the [r] occurs commonly in the words such as center, winter. The word Kentish seems to be pronounced as the [nr].

4 It might be assumed that the status of the possible syllabic nuclei is regarded as the issue of sonority and each of the phonetic implementations that of phonetic bases (Oda 2008).

5 One of the basic ideas on pedagogical sound-spelling relationships comes from the one that after the system of the spellings was established around the 16th century, some of the sounds shifted to others and that this created a sound-spelling uncorrespondence. The sound of TURNED V is most commonly spelled with <u> such as sun/sunny, fun, etc. This implicitly illustrates the sound-spelling uncorrespondence after the establishment of the fixed spellings.
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