# Vowel reduction and suffixation in Nigeria

ADENIKE AKINJOBI

An analysis of the educated usage of speakers of Yoruba English

THIS STUDY investigates how speakers of Educated Yoruba English (EYE) produce the vowels in typically unstressed syllables of English words whose suffixes require a shift of stress and a consequent reduction of vowels, as in *atómic* from *átom* and *dramátic* from *dráma*. Twenty suffixed English words were read by one hundred Yoruba subjects, with a Briton who studied at the University of London serving as the control. The focus is on Yoruba English because of both its many speakers and the need for a 'geo-tribal' approach to defining the concept *Nigerian English*. The data was analysed by converting tokens of occurrence to percentages, the higher percentages being taken as the norm. The acoustic analysis was done in a computerized speech laboratory. The study establishes that vowels occurring in typically unstressed syllables in traditional Standard English remain strong and full in educated Yoruba English.

## Introduction

It is a characteristic of English at large that the addition of certain suffixes may result in the syllable that is stressed in the root word losing its stress to another syllable, a feature commonly known as *stress shift*, which often results in the vowel of the stressed syllable being reduced to schwa (or any other vowel found in unstressed positions) or totally elided. However, this has been observed not to occur in Nigerian English, in which a shift in stress does not initiate a reduction of the vowel in the syllable away from which stress has shifted.

According to Horn (2001:3): 'The term *vowel reduction* is often applied to a number of different linguistic phenomena. On one extreme, it can be used to refer to the wholesale deletion of unstressed vowels, while on the other extreme it is used to refer to non neutralizing changes in the pronunciation of both stressed and unstressed vowels.' Comparably, Carr (1999:116) views 'vowel reduction' as 'reduction in the length of a vowel, usually accompanied by a change in its quality'.

The term *vowel reduction* as used in the present study refers to instances of vowel weakening, duration reduction, or total deletion as a result of 'unstressing'. Four different kinds of sounds that often function as the syllabic peaks of unstressed syllables in Standard English are /ə, ɪ, ʊ/ and any of the syllabic consonants /ŋ, n, m/ (cf. Gimson 1975, O'Connor 1975, Roach 1991, Onuigbo 1996). The most remarkable of these sounds is /ə/ (the 'schwa' vowel), since it occurs only in unstressed syllables, while /ɪ/ and /ʊ/ function in both stressed and unstressed positions. Phonologically, in Standard English, the presence of /ə/ in a syllable automatically signals that the syllable as unstressed.

The mid-central and lax vowel /ə/ (produced with the lips in neutral position, the tongue almost inert in the floor of the mouth, with only a slight arch in the centre) has been routinely described as the vowel with the highest rate of occurrence in Standard English (cf. Roca & Johnson 1999, Akinjobi 2004). This is because vowels realized in their strong forms

*ADENIKE AKINJOBI works in the English Department of the University of Ibadan, Ibadan, Nigeria. He has a B.A. in education from the University of Ilorin and an M.A. and Ph.D. from the University of Ibadan.*

DOI: 10.1017/S0266078406001039

 © 2006 Cambridge University Press

https://doi.org/10.1017/S0266078406001039 Published online by Cambridge University Press

in stressed positions often get reduced to /ə/ in unstressed positions, as when the /æ/ in *drama* /ˈdræmə/ is reduced to /ə/ when the stress shifts in the derived form *dramatic* /drəˈmætɪk/.

The vowel sound /ɪ/ is commonly found in unstressed positions in English and is a close front unrounded vowel in the general area of /iː/ and /i/ which are strong vowels. Roach (1991) claims that it does not possess the exact quality of the /ɪ/ that is found in stressed positions. He proposes the /i/ symbol since '[t]he /i/ vowel is neither the /iː/ of "beat" nor the /ɪ/ of "bit" and is not in contrast with them'. The same applies for /ʊ/, which he claims 'is neither the /uː/ of "shoe" nor the /ʊ/ of "book" but a weak vowel that shares the characteristics of both'.

## Vowel reduction in Nigerian English

English as used in Nigeria has its peculiar features at both the segmental and supra-segmental levels (cf. Dunstan 1969, Adegbite & Akindele 1992, Odumuh 1993, Banjo 1995, Bamgbose 1995). The most frequently occurring vowel in Standard English, /ə/, is the rarest in Nigerian usage (cf. also Akinjobi 2004). Ufomata (1990) identifies /ə/ as a reduced vowel that is not used in Nigerian English, 'thus giving an appearance of many accented syllables in an utterance and a preponderance of strong forms'. She notes that the typical rhythm of Standard English is lacking in Nigerian English because of the absence of /ə/ in traditionally unstressed syllables, in which strong vowels are often used.

However, Jibril (1982) notes that a sound similar to Standard English /ə/ is present in Hausa, in which it is the phonetic exponent of certain short vowels. He observes that Hausa English /ə/ lives up to the reputation of RP /ə/ as a 'convenient resting-ground for off-duty vowels', since the RP /ə/ tested in his study surfaced as the Hausa /ə/ 53.6% of the time in Hausa English, regardless of what its orthographic representation might be. He however claims that its distribution does not correspond to that of RP.

Jowitt (1991) attests that /ə/ occurs only in unstressed syllables in RP and can be regarded as an end-product of stress-timing and that this kind of weakening does not occur in either Nigerian mother tongues (MTs) or Popular Nigerian English (PNE). He also claims that the sound /ə/, although present in Hausa English, does not manifest in the position it occupies in RP, and that the RP /ə/ is often realized as /a/ in Hausa English and that Hausa English /ə/ may feature even in stressed syllables as opposed to the phonological distribution of RP /ə/.

## Research methodology

Twenty suffixed English words were read by one hundred subjects of different Yoruba dialectal backgrounds, all with two to three years of post-secondary education. A Briton who studied at the University of London served as the control to illustrate the established phenomenon of vowel weakening in Standard English.

The data was analysed perceptually by counting tokens of occurrences of the various sounds substituted for the schwa and converting them to percentages. The higher percentage in each instance was taken as the norm. To corroborate the findings from the perceptual analysis, an acoustic analysis of two words produced by ten of the EYE subjects and the control was also carried out using a computerized speech laboratory. The software consists of a suite of sound-processing packages including COOL Edit Pro, Sound Forge and speech acoustic software: Speech Filing System (SFS) developed at University College, London. The duration of the stressed and unstressed syllables and vowels were measured and plotted into column bars while the differences in duration were plotted into scatter charts.

Table 1 contains the result of the investigation of vowel weakening in words where the addition of suffixes was expected to lead to the reassignment of stress in the spoken English of educated Yoruba English speakers. Because the subjects displayed a tendency to produce strong vowels where they were expected to produce weak vowels, a shift in stress due to the addition of a suffix did not result in weakening the vowel in the syllable from which stress shifted. These vowels, which in Standard English are supposed to be consequently unstressed, are still produced in their strong forms.

The two cases where there were exceptions are negligible. For example, with *grammar/grammarian*, 92% of the subjects produced a strong *-a-* in the syllable *-mar* which is expected to be unstressed in *grammar* while just a negligible 8% produced the Standard English schwa /ə/. With *German/Germanic*,



https://doi.org/10.1017/S0266078406001039 Published online by Cambridge University Press

**Table 1 Perceptual analysis**

| Root/stem + suffixes | Anticipated RP vowel change | Vowel quality | Realized EYE variants | Vowel quality | |
|---|---|---|---|---|---|
| phoˈnetics→phoneˈtician | ɛ→ɪ | strong–weak | ɛ→ɛ | strong–strong | |
| ˈpolitics→poliˈtician | ɒ→ɒ | **strong–strong | ɔ→ɔ | strong–strong | |
| ˈcomedy→coˈmedian | ɒ→ə | strong–weak | ɔ→ɔ | strong–strong | __ |
| ˈgrammar→graˈmmarian | Æ→ə | strong–weak | a→e, a→ə | 276 str–str | 24 *str–wk |
| ˈCanada→CaˈnadianCanada | Æ→ə | strong–weak | a→a | strong–strong | |
| ˈColony→CoˈlonianColony | ɒ→ə | strong–weak | o, ɔ→o ɔ | strong–strong | |
| ˈfinal→fiˈnality | Ø→æ | weak–strong | a→a | strong–strong | |
| ˈatom→aˈtomic | Æ→ə | strong–weak | a→a | strong–strong | |
| ˈtutor→tuˈtorial | ə→ɔː | weak–strong | ɔ→o | strong–strong | |
| ˈdrama→draˈmatic | Æ→ə | strong–weak | a→a | strong–strong | |
| ˈstrategy→straˈtegic | æ→ə | strong–weak | a→a | strong–strong | |
| eˈradicate→eradiˈcation | æ→æ | **strong–strong | a→a | strong–strong | |
| exˈhort→exhorˈtation | ɪ→ɛ | weak–strong | ɛ→ɛ | strong–strong | |
| eˈconomy→ecoˈnomic | ɒ→ə | strong–weak | ɔ→ɔ | strong–strong | |
| ˈexecute→exeˈcution | ɛ→ɛ | **strong–strong | ɛ→ɛ | strong–strong | |
| inˈferior→inferiˈority | ə→ɒ | weak-strong | iɔ→ɔ | strong–strong | |
| ˈcurious→curiˈosity | ə→ɒ | weak-strong | iɔ→ɔ | strong–strong | |
| ˈphotograph→phoˈtographer | əʊ→ə | strong–weak | ɔ,o→ɔ | strong–strong | |
| geˈography→geoˈgraphic | ɒ→ə | strong–weak | ɔ→ɔ | strong–strong | |
| ˈGerman→GerˈmanicGerman | ɜː→ə | strong–weak | a→a,e,a→ə | 287 str–str | *13 str–wk |

* Appropriate use of weakening

** Appropriate use of a strong vowel due to the presence of secondary stress.

95.7% of the subjects produced the strong *-a-* in the syllable *-man* which in Standard English is expected to be the weak vowel /ə/, while a negligible 4.3% produced the weak vowel /ə/.

In Standard English, with words such as *ˈpolitics/poliˈtician*, *eˈradicate/ eradiˈcation*, *ˈexecute/exeˈcution* where two syllables are stressed, one bearing the primary stress and one the secondary, the vowel is retained as strong in the two forms (i.e., in those without and with a suffix). This is because vowels in both primarily and secondarily stressed syllables are rendered strong and not weakened. The EYE subjects appropriately use strong vowels in these words therefore confirming the assumption that EYE speakers do not encounter problems in the use of strong vowels but weak ones.

In the word *phonetics* the primary stress is assigned to *-ne-* while the addition of *-ian* shifts the stress to *-ti-*, unstressing the *-ne-* in *phonetician*. Most EYE subjects do not make any significant distinction between stressed *-ne-* and unstressed *-ne-*, as can be deciphered from the table and the clustered column. The mean for the EYE subjects for the stressed syllable *-ne-* is 141.9ms while that of the unstressed syllable is 144.4ms. It is observed here that on average, the syllable whose duration should be reduced was made longer while the one that should be made longer was reduced (Figure 1).

The clustered column in the figure shows the control as making a distinction between the duration of the stressed and unstressed syllable, rendering the stressed syllable *-ne-* of phonetics longer than the unstressed *-ne-* of phonetician.



https://doi.org/10.1017/S0266078406001039 Published online by Cambridge University Press

**Table 2 Acoustic analysis: The *-ne-* in *phonetics* and *phonetician***

| Subjects | Duration of *-ne-* when stressed in the stem form before suffix is added | Duration of *-ne-* after the suffix is added and the stress shifts to *-ti-* |
|---|---|---|
| Control | 146 | 105.5 |
| EYE 1 | 158.2 | 131.6 |
| 2 | 151.5 | 153.4 |
| 3 | 140.8 | 143.2 |
| 4 | 139.3 | 141.4 |
| 5 | 150.7 | 125.6 |
| 6 | 120.5 | 128.2 |
| 7 | 122.6 | 204.5 |
| 8 | 164.2 | 128.8 |
| 9 | 140.9 | 159 |
| 10 | 130.2 | 128.9 |

**The clustered columns for the stressed *-ne-* of *phonetics* and the unstressed *-ne-* of *phonetician***

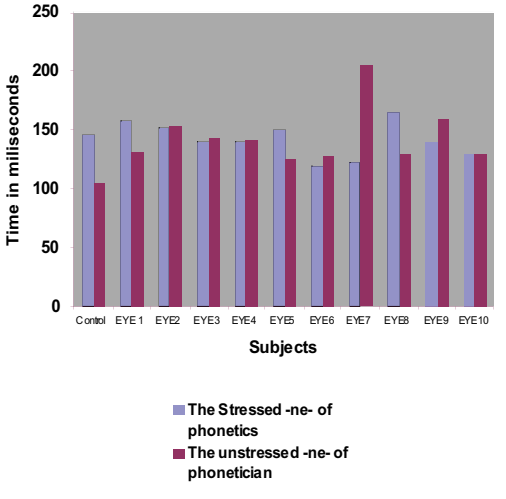



Figure 1

It is observed here that majority of the EYE subjects, except Subjects 1, 5 and 8 did not make remarkable distinctions between these forms. Some of the bars which represent the unstressed syllable *-ne-* of phonetician which are supposed to be shorter are even longer than the stressed *-ne-* of phonetics.

**Table 3 The differences in the duration of the stressed *-ne-* of *phonetics* and the unstressed *-ne-* of *phonetician***

| Subjects | Differences in duration |
|---|---|
| Control | 40.5 |
| 1 | 26.6 |
| 2 | 19.0 |
| 3 | 2.4 |
| 4 | 2.1 |
| 5 | 25.0 |
| 6 | 7.7 |
| 7 | 81.9 |
| 8 | 35.4 |
| 9 | 18.1 |
| 10 | 1.3 |

**XY scatter for the difference in duration of the stressed *-ne-* of *phonetics* and the unstressed *-ne-* of *phonetician***

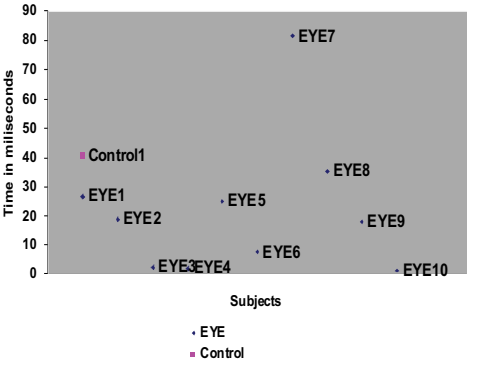



Figure 2

Observing the differences in the duration of the stressed and unstressed syllable *-ne-* for the EYE subjects, it is glaring that many of the differences are not applied in the direction of Standard English usage. The longest duration difference was rendered by Subject 7 but contrary to what obtains in Standard English, the syllable that was expected to be stressed was rendered shorter than the one that was expected to be reduced.

The XY scatter shows the control as having the difference of above 40ms while there is only one EYE subject with a higher duration



https://doi.org/10.1017/S0266078406001039 Published online by Cambridge University Press

**Table 4 The vowel *-e-* in the *-ne-* of *phonetics/phonetician***

| Subjects | Duration of *-e-* when stressed in the stem form before suffix is added | Duration of *-e-* after the suffix is added and the stress shifts from it to *-ti-* |
|---|---|---|
| Control | 71.5 | 40.9 |
| EYE 1 | 101.8 | 93.4 |
| 2 | 86.9 | 91.7 |
| 3 | 82.3 | 65.2 |
| 4 | 99.3 | 91.4 |
| 5 | 92.1 | 81.6 |
| 6 | 93.2 | 82.9 |
| 7 | 74.4 | 93.5 |
| 8 | 91.4 | 77.3 |
| 9 | 105.8 | 95.9 |
| 10 | 78.9 | 96.6 |

**The clustered columns for the stressed *-e-* of the *-ne-* of *phonetics* and the unstressed *-e-* of the *-ne-* of *phonetician***

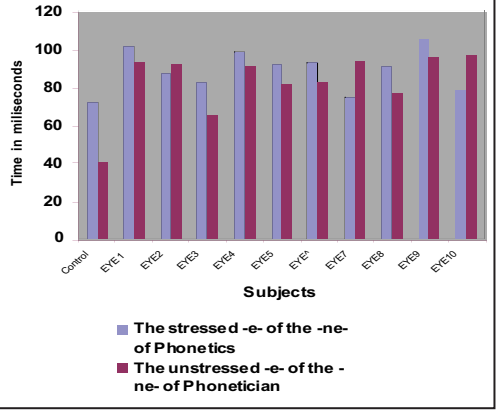



Figure 3

difference. (Note that it has been observed earlier that the application of the duration difference for this subject is not in accordance with Standard English usage but rather in the opposite direction.)

What is observed here are some differences in duration which conform to Standard English usage when compared to the information obtained from earlier analyses. Though not so significant, a majority of the subjects reduced the duration of the *-e-* vowel of *phonetics* when

**Table 5 The differences in the durations of the *-e-* of *phonetics* and the *-e-* of *phonetician***

| Subjects | Differences in duration |
|---|---|
| Control | 30.6 |
| 1 | 8.4 |
| 2 | 4.8 |
| 3 | 17.1 |
| 4 | 7.9 |
| 5 | 10.5 |
| 6 | 10.3 |
| 7 | 19.1 |
| 8 | 14.1 |
| 9 | 9.9 |
| 10 | 17.7 |

the suffix *-ian* is added to it in *phonetician*. Despite this, it is still realized that the difference in the means of the durations of the stressed *-e-* and the unstressed *-e-* as produced by these EYE subjects is not so remarkable. The stressed *-e-* has a mean of 90.6 while the unstressed *-e-* has a mean of 87 with only an insignificant difference of 3.6ms (figure 3).

It is observed from the clustered columns above that there is a remarkable reduction in the control's rendition of the unstressed *-e-* vowel in *phonetician*. The EYE subjects are observed not to make such remarkable distinctions as the control, although their performance with this particular sound conformed more to Standard English usage than those analysed earlier. However, EYE subjects 2, 7 and 10 are still observed to have differences that do not conform to Standard English.

It is observed from the XY scatter (figure 4), although there is a relative differentiation in duration of the rendition of the *-e-* vowel by EYE subjects, the control is still observed to have a higher duration difference than the EYE subjects.

In the word *comedy* the stress is on *co-* and the other syllables are unstressed. However, when *-ian* is added, the stress shifts to *-me-*, and *co-* is unstressed in *comedian*. In Table 6, the EYE subjects do not have a marked increase in duration in their rendition of the *-me-* of *comedian*, which is expected to be longer in duration than the *-me-* of *comedy*. Some subjects even reduced rather than increased the duration. The mean for the EYE subjects is



https://doi.org/10.1017/S0266078406001039 Published online by Cambridge University Press

**Table 6 The *-me-* of *comedy/comedian***

| Subjects | Duration of *-me-* when unstressed in the stem form before suffix is added | Duration of *-me-* when stressed after the suffix is added and the stress shifts to it |
|---|---|---|
| Control | 117.4 | 195.7 |
| EYE 1 | 160.6 | 181.3 |
| 2 | 187.3 | 213.3 |
| 3 | 178.3 | 190.2 |
| 4 | 200.5 | 205.2 |
| 5 | 151.8 | 153.6 |
| 6 | 150.3 | 152.4 |
| 7 | 199.3 | 167.4 |
| 8 | 148.5 | 205.9 |
| 9 | 201.5 | 202.6 |
| 10 | 198.4 | 167.0 |

**XY scatter for the difference in duration of the stressed *-e-* of *phonetics* and the unstressed *-e-* of *phonetician***

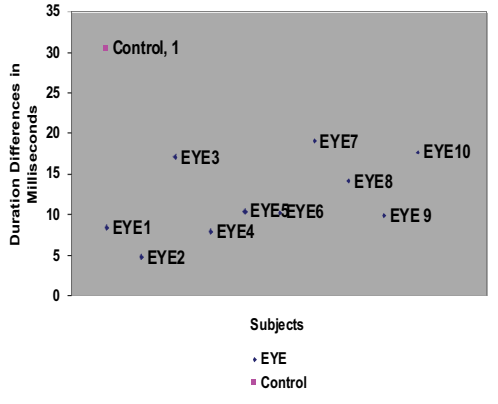



Figure 4

177.7ms for unstressed *-me-* and 183.9ms for stressed *-me-*, the difference between the two being an insignificant 6.2ms. The control however has a difference of 78.3ms.

In the production of the unstressed *-me-* of *comedy* and the stressed *-me-* of *comedian*, the control has a shorter duration for the *-me-* of *comedy* and a longer duration for the *-me-* of *comedian*. The EYE subjects, except for No. 9, are observed not to make such a marked distinction in the duration of these syllables and in the few instances where there is such a distinction it does not conform to Standard English usage.

**Table 7 The differences in the duration of the unstressed *-me-* of comedy and the stressed *-me-* of *comedian***

| Subjects | Differences in duration |
|---|---|
| Control | 78.3 |
| 1 | 20.7 |
| 2 | 26.0 |
| 3 | 11.9 |
| 4 | 4.7 |
| 5 | 1.8 |
| 6 | 2.1 |
| 7 | 31.9 |
| 8 | 57.4 |
| 9 | 1.1 |
| 10 | 31.4 |

**The clustered columns for the stressed *-me-* of *comedian* and the unstressed *-me-* of *comedy***

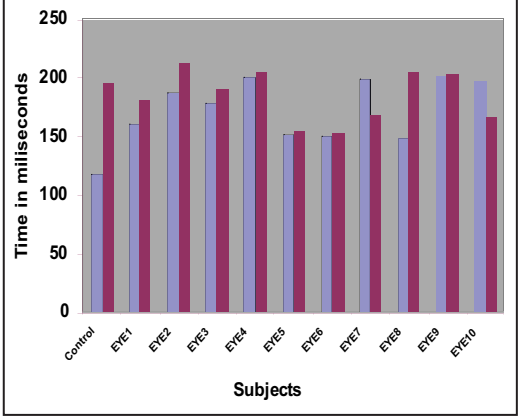



Figure 5

The EYE subjects are observed to have shorter differences in the durations of the unstressed *-me-* of *comedy* and the stressed *-me-* of *comedian*. The control as observed from this XY scatter chart has a higher difference in duration than the EYE subjects.

The duration of the unstressed *-e-* in *comedy* and the stressed *-e-* of *comedian* for most EYE subjects are not so different. The mean for the unstressed *-e-* is 99.2 while that for the stressed



https://doi.org/10.1017/S0266078406001039 Published online by Cambridge University Press

**Table 8 The vowel *-e-* in the *-me-* of *comedy/comedian***

| Subjects | Duration of *-e-* when unstressed in the stem form before suffix is added | Duration of *-e-* when stressed after the suffix is added and the stress shifts to it |
|---|---|---|
| Control | 48.8 | 84.1 |
| EYE 1 | 105.7 | 106.0 |
| 2 | 117.2 | 124.2 |
| 3 | 112.6 | 128.9 |
| 4 | 104.4 | 109.3 |
| 5 | 85.9 | 94.4 |
| 6 | 84.9 | 92.8 |
| 7 | 99.2 | 55.5 |
| 8 | 82.0 | 129.7 |
| 9 | 101.3 | 94.2 |
| 10 | 98.7 | 54.3 |

**XY scatter for the difference in duration of the stressed *-me-* of *comedian* and the unstressed *-me-* of *comedy***

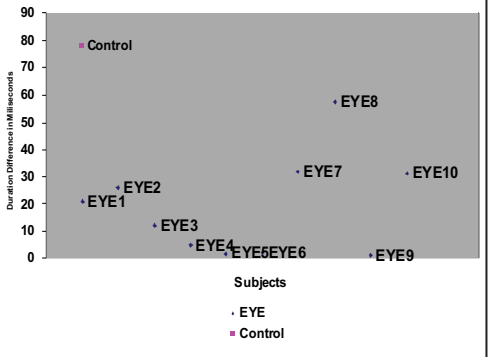



Figure 6

**Table 9 The differences in the duration of the unstressed *-e-* of *comedy* and the stressed *-e-* of *comedian***

| Subjects | Differences in duration |
|---|---|
| Control | 35.6 |
| 1 | 0.3 |
| 2 | 7.0 |
| 3 | 16.3 |
| 4 | 4.9 |
| 5 | 8.5 |
| 6 | 7.9 |
| 7 | 43.7 |
| 8 | 47.7 |
| 9 | 7.1 |
| 10 | 44.4 |

**The clustered columns for the unstressed *-e-* of the *-me-* of *comedy* and the stressed *-e-* of the *-me-* of *comedian***

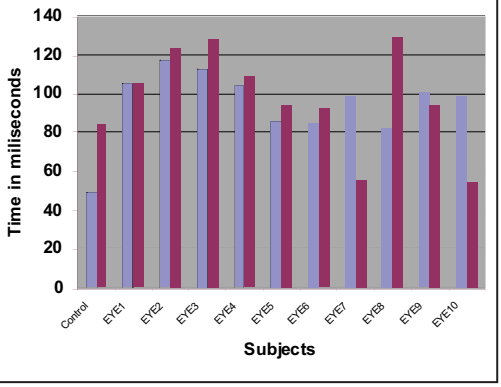



Figure 7

*-e-* is 99. It is important to note here that, on average, the unstressed *-e-* has a longer duration than the stressed *-e-* of the EYE subjects. This, as mentioned earlier, does not conform to what obtains in Standard English usage.

In Figure 7, except for Subject 8, the durations of the unstressed vowel *-e-* for the EYE subjects (as observed in the clustered columns above) are not very different from that of the stressed version, which in Standard English is expected to be longer. The control as observed in the same clustered columns makes a remarkable distinction between the versions of the vowel.

Here, the EYE subjects who differentiated remarkably between the duration of the stressed *-e-* of *comedian* and the unstressed *-e-* of *comedy* have the longer duration assigned to the unstressed syllable while the stressed syllable is rendered shorter. Subjects 7, 8 and 10 have a duration difference of 43.7ms, 44.7ms, and 44.4ms respectively. These differences are even higher than the control's, which is



https://doi.org/10.1017/S0266078406001039 Published online by Cambridge University Press

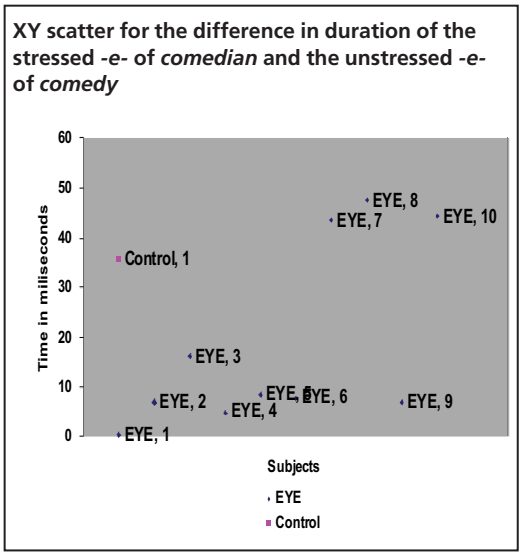



Figure 8

35.6ms. But the higher durations are not assigned to the stressed syllables, as has been established to be the case in Standard English.

It is observed here too that the mean of the differences for the EYE subjects (17.4 ms) is not remarkable. The control has a difference of 35.6ms (figure 8).

It is observed from the XY scatter above that subjects 7, 8 and 10 have higher duration differences than the Control's but do not conform to Standard English usage, but are in opposition to it. Rather than assign longer duration to the stressed *-e-* of *comedian*, the unstressed *-e-* of *comedy* is rendered longer.

## Results

Analysis of the data gathered from the educated Yoruba English speakers establishes that a greater percentage of the subjects produced full strong vowels in the syllables that should in Standard English lose their stress as a consequence of adding suffixes. The result of the acoustic study corroborates the findings from perceptual analysis:

- The subjects were found not to make the necessary contrasts in the duration of stressed and unstressed syllables. The vowels in the positions where they were stressed and expected to be long and the positions where they were unstressed and expected to be reduced and consequently shorter in duration were observed to have close durations.
- Where contrasts were found, they were irregular and often did not conform to standard usage, since unstressed syllables that are expected to be shorter were made longer and the stressed syllables were made shorter by some of the subjects.

The results confirm that educated Yoruba English speakers do not reduce vowels that are regularly reduced in Standard English. The consistent use of full and strong vowels in positions where reduced vowels should be found confirms the perceived tendency for strong vowels to occur in almost all syllables as opposed to the stress-timed pattern that obtains in the spoken Standard English of native speakers. ■

### *References*


Adegbite, F., & W. Akindele. 1992. *The sociology and politics of English in Nigeria.* Ile-Ife: Debiyi- Iwa Publishers.

Akinjobi, A. 2004. *A phonological investigation of vowel weakening and unstressed syllable obscuration in educated Yoruba English*: an unpublished doctoral dissertation, the University of Ibadan, Nigeria.

Bamgbose, A. 1995. 'English in the Nigerian Environment.' In A. Bamgbose *et al*., eds., *New Englishes*, pp. 9–26. Nigeria: Mosuro.

Banjo, L. A. 1995. 'On codifying Nigerian English: Research so far.' In Bamgbose *et al*., eds., *New Englishes*, pp. 203–231. Nigeria: Mosuro.

Carr, P. 1999. *English phonetics and phonology: An introduction*. USA: Blackwell.

Crosswhite, C. 2001. 'Vowel Reduction in Optimality Theory.' In L. Horn, ed., *Outstanding dissertations in Linguistics*, pp. 1–109. New York: Routledge.

Dunstan, E. (ed.) 1969. *Twelve Nigerian languages: A handbook on their sound systems for teachers of English.* London: Longman.

Gimson, A. C. 1975. *A practical course of English pronunciation: A perceptual Approach,* London: Edward Arnold.

Jowitt, D. 1991. *Nigerian English Usage: An Introduction*. Ibadan: Longman.

O'Connor, J. D. 1984. *Better English Pronunciation*. Cambridge: University Press.

Odumuh, A. E. 1993. *Sociolinguistics and Nigerian English*. Ibadan: Sam Bookman.

Onuigbo, S. 1996. *Oral English for Schools and Colleges*, Onitsha: Africana-Fep.

Roach, P. 1991. *English Phonetics and Phonology*. Cambridge: University Press.

Roca, I., & W. Johnson. 1999. *A Course in Phonology*. UK: Blackwell.

Ufomata, T. 1990. 'Thoughts on Spoken Nigerian English.' In the *Journal of Nigerian English Studies Association,* 10:2, pp. 13–20.




https://doi.org/10.1017/S0266078406001039 Published online by Cambridge University Press