

MOTOR-PROSODIC PLANNING AND INTONATION IN DISORDERED NIGERIAN ENGLISH SPEECH

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Abstract

Intonation performs a central role in spoken communication by indicating sentence type, the intention of the speaker, and discourse meaning. In Nigerian English, intonation is shaped by interaction with native tonal languages, resulting in patterns that are markedly different from those of native-speaker varieties of English. While numerous studies have examined Nigerian English intonation in non-clinical populations, relatively little attention has been paid to how it is realised in disordered Nigerian English speech. This study examines sentence-level intonation in disordered Nigerian English speech within the framework of Motor-Prosodic Planning Theory with a view to determining the extent of preservation of or damage to motor-prosodic routines. Using regulated sentence-reading tasks containing declarative statements, wh-questions and yes-no questions, speech data were purposively elicited from thirty-five Nigerians with acquired and developmental language disorders from clinical and educational locations. Frequency counts, percentage distributions complemented with bar chart substantiated the motor-theoretical analysis. The findings reveal that falling intonation is the most frequently realised overall pattern, with a strong concentration in declarative statements, indicating partial preservation of default, low-complexity motor-prosodic routines. In contrast, wh-questions exhibit a high incidence of obscure intonation patterns, indicating substantial disruption in the motor planning of interrogative prosody. Yes-no questions have a more varied distribution, with rising intonation occurring frequently, with the use of level and falling intonation being significant, indicating unstable performance of pitch-raising gestures. Across all sentence types, obscure and level intonation patterns are used frequently, signalling diminished pitch modulation and poor control of tone. The results indicate that although some intonation patterns are preserved in disordered Nigerian English speech, there is a challenge in mapping prosodic representations to motor plans, especially in the motorically complex interrogative contexts. The research draws attention to the importance of motor-prosodic planning deficits in accounting for intonation deficits in disordered Nigerian English speech and the diagnostic potential of intonation. It provides empirical evidence to the emerging body of research on prosodic impairment in disordered speech in multilingual settings.

Keywords: Sentence-level intonation; Language disorders; Nigerian English Prosody; Disordered phonology; Clinical phonology

Introduction

Intonation is a crucial component of speech that speakers use to convey sentence type, discourse meaning and pragmatic meaning. Through pitch variation across a sentence, speakers can signal different sentences types from statements to questions, information structure, and pragmatic meanings relating to certainty, doubt, emphasis (Roach, 2000; Dash, 2022). In English, intonation is primarily used at the sentence level to supplement segmental and grammatical structure. When intonation is not used appropriately, or is impaired, spoken messages can be unclear or confusing to listeners, even if the words and grammatical structure are relatively unaffected.

Nigerian English has emerged in a multilingual setting in which indigenous tonal languages like Yoruba, Igbo and Hausa predominate. In these languages, pitch is used lexically, while in English it is largely used for sentence-level distinctions (Gimson, 1989; Cruttenden, 1997; Ladd, 2008; Udofot, 2022). This contact has led to the description of Nigerian English intonation with features like frequent use of falling tunes, limited pitch range, and less use of rising or complex tunes, particularly in questions (Jowitt, 1991; Gut, 2001; Ufomata, 2004). These are mostly explained as consistent results of language contact rather than being atypical. Although the intonation of Nigerian English has been described in non-clinical speech (Jowitt, 1991; Udofot, 1997; Gut, 2001; Melefa, 2019; Asadu et al., 2019; Babarinde and Ahamefula, 2020; Fasunon, 2022; Akindele and Oladipupo, 2022; Essien, 2024; Atoye, 2005), there is little documentation of how these prosodic patterns are realised in speakers with language disorders.

Acquired and developmental language disorders are known to have effects on several speech processes including articulation, fluency and prosody (Paul and Cohen, 1982; Reed, 2005; Frith, 2008; Hategekimana and Tuyizere, 2024). Existing research on language disorders in Nigeria has mainly centred on segmental phonology and syllable structure, documenting phenomena such as consonant cluster deletion, vowel alteration and syllable reduction (Salami, 2005; Sunday, 2013; Esan, 2017; Sunday and Esan, 2018; Esan, 2019; Abe, 2023). There has been relatively little research on suprasegmental features, especially sentence-level intonation, which involves sustained control of pitch and is crucial for intelligibility and pragmatic function. The lack of focus on prosody in the literature limits our knowledge of the role of Nigerian English intonation in clinical populations, and the contextually relevant data available for assessment and intervention. Neurolinguistic studies indicate that prosody is underpinned by distributed neural networks that include motor planning, laryngeal control and right-hemisphere dominance (Mitchell, et al., 2003; Gandour et al., 2004; Ditcher, et al., 2018). This means that intonation

breakdowns may occur despite speakers' awareness of sentence structure and communicative intention. This has prompted growing awareness that prosodic errors should be considered not only as phonological errors but also as speech motor planning errors.

The current study uses Motor-Prosodic Planning Theory based on speech motor control theories (van der Merwe, 1997) as its theoretical framework. It provides a unified account of how prosody is produced as a result of speech motor planning and execution rather than as a phonological construct (Krivokapic, 2010). It provides testable predictions of increased motor demands of complex pitch contours and is predictive in clinical and experimental settings. In this view, default intonation patterns such as falling contours in declarative statements are considered as motor routines which are less vulnerable to disruption while interrogative and complex pitch contours which require more complex motor sequencing and timing are therefore more vulnerable. The theory therefore predicts selective preservation of simple contours and instability, flattening or obscurity of complex contours.

Drawing on this framework, the current study examines sentence-level intonation patterns in disordered Nigerian English speech, specifically declarative statements, wh-questions and yes-no questions. Through examining the occurrence and distribution of intonation contours in different types of sentences, the study aims to ascertain the degree to which prosodic abnormalities can be explained by motor-prosodic planning deficits. In so doing, it adds to the emerging body of neurolinguistic and clinical research that puts intonation at the forefront of diagnostic and explanatory functions in disordered speech, and extends this focus to the Nigerian speech community.

Nigerian English Intonation and Language Disorders Studies

Intonation is acknowledged as an integral part of spoken language, playing a role in the organisation of meaning, the distinction between sentence types and pragmatic meanings (Cruttenden, 1997; Ladd, 2008). In English, sentence intonation consists of regular pitch movements that indicate the type of a sentence (statement, question, command, exclamation), which aids in the expression of speaker's attitude and discourse organisation. Intonation research has received much attention in phonetics and phonology, especially in varieties of English where prosodic systems are involved with language and sociocultural factors.

In the case of Nigerian English, prosodic studies have demonstrated that intonation has distinctive features. Nigerian English is spoken in a multilingual context where the indigenous languages are tonal and where pitch is used to convey lexical as well as phrasal meaning (Sunday and Oyemade, 2021; Ngor, 2024; Sylvanus and Ogunlaye, 2025). The contact situation impacts the learning and production of English intonation by Nigerian speakers. Descriptive studies have reported falling pitch contours in declarative sentences, a limited pitch range and less frequent use of

rising contours in interrogatives than in British and American English (Jowitt, 1991; Gut, 2001). These are viewed as systematic elements of Nigerian English prosody, rather than impairments, as a result of the interaction between the first language (which is tonal) and English intonation.

While there is a growing body of work on intonation in non-clinical Nigerian English speech, research on prosody in clinical populations remains limited. A number of studies on language disorders in Nigeria have focused primarily on segmental phonological characteristics, documenting patterns such as consonant cluster reduction, vowel modification, syllable simplification, and epenthesis in the speech of individuals with acquired and developmental disorders (Sunday, 2010; Esan, 2017, 2019; Sunday & Esan, 2018, Abe, 2023, 2024). These investigations provide valuable insight into structural phonological deviations, but there remains the need to provide evidence on suprasegmental features, particularly intonation.

Internationally, studies on disordered speech have highlighted that intonation and prosody can be differentially affected depending on the nature of the disorder. For example, research on individuals with all forms of language disorders has reported simplified or flattened intonation patterns, reduced pitch range, and diminished contrastive use of rising versus falling contours (Shriberg et al., 2001; Paul et al., 2005; Peppé, 2006; Rhys et al., 2013) which can contribute to communicative difficulties. These results show that prosody is a critical aspect of speech impairment, and may be relevant in clinical diagnosis and treatment.

While there is this growing awareness of impaired prosody in speech disorders, there is a lack of specific descriptive studies on the intonation of sentences in Nigerian clinical speech. Since prosodic systems in Nigerian English could differ from those of other varieties of English, it is important to describe how these systems work in clinical speech. These descriptions are important for theoretical and practical reasons: theoretically, they add to our understanding of the interaction of language disorders with contact prosody; practically, they offer clinicians and teachers in Nigeria empirically-based information about prosodic patterns in disordered speech.

Motor-Prosodic Planning Theory

The present study is grounded in the Motor-Prosodic Planning Theory, a neurolinguistic theory which views prosodic behaviour, especially intonation, as the by-product of integrated speech motor planning and execution processes, rather than an abstract phonological system. In this theory, intonation is considered a coordinated motor activity involving pitch, rhythm and boundary marking which needs to be planned and executed via intricate neural networks.

This theory is heavily influenced by models of speech motor control which postulate that speech production is a multi-stage process which includes linguistic planning, motor programming and motor execution (van der Merwe, 1997). Prosodic elements like intonation are thought to be particularly vulnerable due to the fine

control of laryngeal muscles, fine timing and sustained pitch movements which are required over extended speech. As a result, damage to the motor planning stage results in a loss of pitch range, monotonic intonation or indeterminate (obscure) intonation.

Neurolinguistic studies have shown that prosodic processing and production are mostly lateralised to the right hemisphere, in regions that are responsible for motor planning and integration of suprasegmental features (Ross, 1981; Cutler et al., 1997). Lesions to or dysfunction in these areas has shown to result in aprosodia, monotonic speech and difficulty in controlling intonational contrasts (Ross & Monnot, 2008). This theory explains these impairments by suggesting that although speakers can have phonological knowledge of intonation categories, they have difficulty turning this knowledge into motor plans.

From a phonological point of view, intonation has been characterised as a system of pitch accents and boundary tones (Ladd, 2008). But the theory extends this view by stressing that the motor coordination mechanisms are required to realise these abstract tonal units. As a result, more complex intonation contours (rise-fall or fall-rise patterns) are expected to be more vulnerable to impairment than default contours (such as final falling intonation) due to the need for more complex pitch movements and thus greater motor sequencing demands.

In clinical speech, motor-prosodic planning deficits are reflected in inconsistent or inappropriate intonation in different types of sentences, especially in interrogative sentences where prosodic marking is used to distinguish between different meanings (van der Merwe, 1997). Thus, the theory offers a strong explanatory framework for the patterns of partial preservation and systematic variation in prosody, particularly in disordered speech varieties.

The theory provides a framework for understanding the intonation patterns in disordered Nigerian English speech in the current study. It predicts that the default falling intonation patterns in declarative statements are relatively stable, while interrogative and contrastive intonation patterns, which are more complex in terms of motor planning and execution, are less stable. As such, the theory provides an appropriate explanatory lens for interpreting the frequency distributions and variability observed in the data.

Methodology

The study adopted a descriptive research design aimed at accounting for the realisation of sentence-level intonation in disordered Nigerian English speech. The focus is on identifying and describing intonation patterns as they occur naturally in regulated sentence production of people with language disorders. The participants were thirty-five (35) Nigerian English speakers drawn from clinical and educational settings aged eleven to seventy-five years. From the record of the clinical diagnosis conducted by neurologists, eighteen were diagnosed with acquired language

disorder induced by stroke and seventeen were diagnosed with various categories of developmental language disorder such as intellectual disability, Down's syndrome, autism spectrum disorder and severe receptive language disorder. These are treated as a group because of their shared motor-prosodic vulnerability. They were bilinguals who acquired English as their L2. They were literate in English. Ethical approval was obtained prior to data collection, and informed consent was secured from all participants or their caregivers. All procedures complied with ethical standards governing research with human participants. Participants were assured of confidentiality and recordings were used solely for research purposes.

The speech materials used for data collection consisted of a set of short, simple English sentences designed to elicit intonation on basic sentence types commonly used in everyday communication, including: declarative statements, wh-questions, and yes-no questions. Sentences with low syntactic and lexical complexity are chosen to ensure that the participants' attention was drawn to the production of the sentences without additional cognitive or linguistic demands.

The task used to gather data was a sentence-reading task. Participants were instructed to speak the sentences aloud in a comfortable speaking rate in a soundproof room. Participants' speech was recorded digitally to enhance the quality of the recording. The recordings for each sentence were played back numerous times to determine the overall intonation pattern realised by the speaker. Intonation tunes were descriptively categorised according to the overall pitch movement, such as fall, rise, level, unclear or mixed (fall-rise or rise-fall). Attention was paid to how these patterns corresponded to sentence type. The analysis focused on the distribution and frequency of intonation patterns. Results were summarised using simple frequency counts and percentages and bar chart to highlight dominant tendencies in the data.

Presentation of Data and Analysis

This section presents the intonation patterns observed in the speech of Nigerian English speakers with language disorders. The analysis focuses on sentence-level intonation across three basic sentence types: declarative statements, wh-questions, and yes-no questions in disordered Nigerian English speech. Intonation patterns are described in terms of overall pitch movement, classified as falling, rising, level, fall-rise, rise-fall and obscure contours. The results are presented descriptively using frequency counts and percentages to highlight dominant tendencies and atypical intonation in the data.

Intonation Patterns in Declarative Statements

Table 1 below presents the distribution of intonation patterns in declarative statements produced by the participants.

Table 1: Distribution of intonation patterns in declarative statements

Intonation pattern	Frequency	Percentage (%)
Falling	22	62.9
Level	7	20
Fall-rise	4	11.4
Obscure	2	5.7
Total	35	100

As shown in Table 1, the most frequent pattern observed in the intonation abilities of the participants in declarative sentence is falling tune, and this accounts for almost two-thirds of the data with 22 occurrences (62.9%). It was followed by level tune with 7 instances (20%) and fall-rise tunes occurred in 4 instances (11.4%). Obscure tunes were the rarest, and were observed just twice (5.7%). The dominance of intonation indicates some retention of canonical declarative intonation, albeit with less variability and some irregularities, as evidenced by the presence of level and obscure tunes.

Intonation patterns in wh-questions

As displayed in Table 2 below, there is high frequency of obscure tunes as against the canonical falling tune exhibited by the participants in wh-questions.

Table 2: Distribution of intonation patterns in wh-questions

Intonation pattern	Frequency	Percentage %
Falling	15	42.9
Level	1	2.9
Obscure	19	54.2
Total	35	100

Patterns of intonation in wh-questions are quite different. The most common intonation pattern was obscure (19 times, 54.2%) followed by falling intonation (15 times, 42.9%). There was only one instance (2.9%) of level intonation. The prevalence of obscure contours suggests that there is a major disruption in the

prosodic marking of interrogability in wh-questions, which usually have a controlled falling contour in Nigerian English varieties.

Intonation Patterns in Yes-No Questions

Yes-no questions showed greater variation in intonation patterns compared to declaratives and wh-questions. The realization is presented in Table 3 below:

Table 3: Distribution of intonation patterns in yes-no questions

Intonation pattern	Frequency	Percentage
Rising	13	37.1
Level	11	31.4
Falling	8	22.9
Rise-fall	1	2.9
Obscure	2	5.7
Total	35	100

Yes-no questions exhibited a more varied distribution of intonation patterns. Although the canonical rising tune was more prominent in wh-questions than in others accounting for 37.1% instances, other tunes such as level, falling, rise-fall and obscure tunes altogether accounted for a sizable part of the data summing up to 62.9%. Rising tune was closely followed by level tune with 11 occurrences (31.4%). Falling tune appeared in 8 cases (22.9%) and non-canonical patterns such as rise-fall and obscure tunes were minimally represented at 2.9% and 5.7% respectively. This dispersion suggests instability in the prosodic encoding of question modality in disordered Nigerian English speech.

Overall Summary of intonation patterns distribution

Table 4 and Fig.1 present the summary of the intonation patterns according to the degree of prominence across all tested sentence types.

Table 4: Overall distribution of intonation patterns across sentence types

Intonation pattern	Frequency	Percentage %
Falling	45	42.9
Obscure	23	21.9
Level	19	18.1
Rising	13	12.4

Fall-rise	4	3.8
Rise-fall	1	0.9
Total	105	100

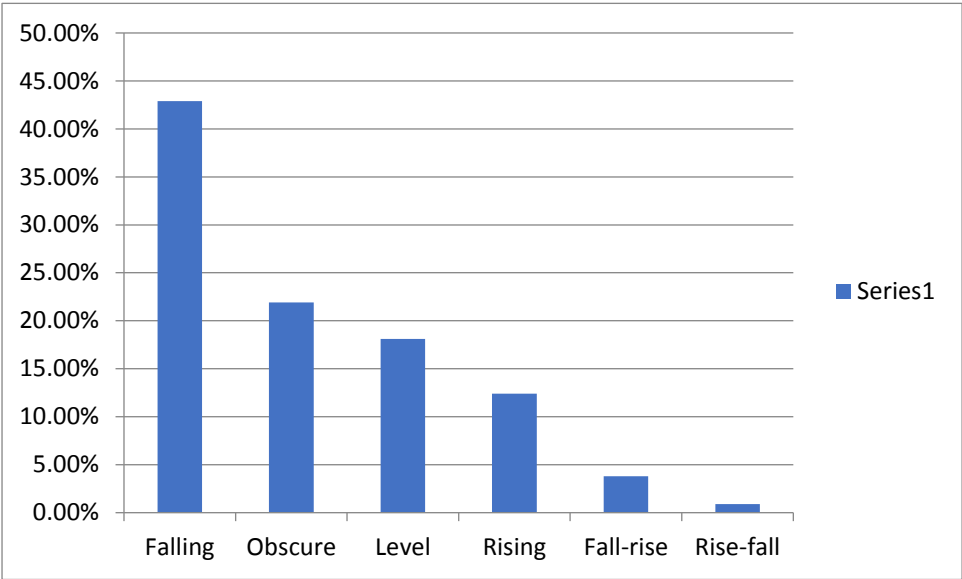


Fig.1: Aggregate Analysis across Sentence Types

As shown in Fig.1, an aggregate analysis across all sentence types shows that falling intonations remains the most frequent overall pattern, with 45 occurrences (42.9%). However, obscure intonation patterns form a substantial proportion of the data, occurring 23 times (21.9%). There is 18.1% level intonation and 12.4% rising intonation. More complex intonations like fall-rise and rise-fall are rare, and account for less than 5% of the corpus. The overall distribution shows both residual abilities and systematic prosodic deficits in Nigerian English speech with disorders.

Interpretation of the data in terms of Motor-Prosodic Planning Theory

Motor-Prosodic Planning Theory proposes that prosody, and specifically intonation, is not just a phonological feature, but rather the result of integrated motor, timing and pitch control processes. These are neutrally implemented, principally in the frontal-subcortical system and the right hemisphere. Deficits in intonation occur when speakers have difficulty in planning, sequencing and/or executing pitch movements, even in the presence of relatively unimpaired segmental articulation. The prevalence of falling intonation in declaratives (62.9%) can be used

as an argument that default motor-prosodic patterns are relatively preserved in disordered Nigerian English. Low pitch excursion in declaratives involve falling intonation, which are associated with routinised speech motor patterns. Such simple and routine patterns are not expected to be affected, hence their high incidence in the data.

On the other hand, the high frequency of obscure intonation patterns in wh-questions (54.2%) is attributed to a breakdown in prosodic planning of linguistically marked sentence types. Wh-questions feature controlled pitch alignment, boundary tones and syntax-pitch coordination. This theory explains this by proposing that more complicated planning involves overloaded compromised motor control, flattening, distorting or obscure contours. So, the high use of obscure intonation suggests failed or uncompleted motor plans, rather than prosodic incompetence.

Motor-prosodic instability is also found in yes-no questions. Although rising intonation is still prevailing (37.1%), its low dominance with high use of level tunes (31.4%) and falling (22.9%) tunes suggests motor-prosodic instability of pitch raising. Rising intonation requires difficult sustained pitch-raising and laryngeal adjustments. Motor-prosodic analysis indicates that level or falling intonation might be compensatory strategies in language disorders where pitch raising is not reliably produced.

The distribution of the different sentence types also supports this. While there is still a high proportion of falling intonation (42.9%), the high proportion of obscure (21.9%) and level (18.1%) intonation patterns suggests restricted pitch range and lack of tonal contrast, which are characteristics of motor-prosodic disorders. The literature on Nigerian English reports the rare use of level tune (Udofot, 2022) but the high incidence of level tune in the subjects' speech suggests otherwise, suggesting a significant difference between the intonation of Nigerian English and the subjects. The low incidence of complex contours like fall-rise (3.8%) and rise-fall (0.9%) also suggests that complex pitch movements are most affected in disordered speech because they require complex sequencing and timing in the motor planning system.

In summary, the findings are consistent with Motor-Prosodic Planning Theory in that the intonation deficits in disordered Nigerian English speech are relative. The subjects maintain simple prosodic templates but have problems planning and carrying out motorically complex pitch movements, especially in questions. This suggests that the prosodic deficits in this group are likely to be due to an impairment of the system of motor planning and execution, rather than phonological or pragmatic impairment.

Findings

The findings of this study provide evidence for intonation impairment in disordered Nigerian English speech in line with the theory. The high incidence of default falling intonation in declarative sentences indicates that simple, well-

practised motor-prosodic routines are not severely impaired. However, the prevalence of obscure and level intonation types - particularly in wh-questions and to a lesser extent in yes-no questions - suggests a severe impairment in the planning and execution of motorically complex pitch movements. Low frequencies of rising and complex types also reflect a reduced pitch range, unstable pitch sequences and weakened laryngeal control. In all, these findings indicate that the prosodic impairment in the population studied is not a result of loss of phonological knowledge, but rather of problems in converting intact prosodic representations into motor plans, supporting the main thesis of the theory that intonation breakdowns are mainly a result of dysfunction of speech motor planning and execution.

Conclusion

This study investigated intonation of disordered Nigerian English speech at the sentence level in the context of Motor-Prosodic Planning Theory, advancing the clinical and descriptive studies of Nigerian English prosody. The study emphasises the role of intonation from a motorically constrained perspective of speech production and its relevance in clinical prosodic studies of a multilingual population.

Theoretically, this study contributes to the emerging body of research that views prosodic impairment as more than a phonological aberration, but as a manifestation of speech motor-planning and execution problems. Applying this view to Nigerian English offers evidence that the norms of prosodic behaviour in this variety interact in predictable ways with constraints of the disorder, and so adds to models of prosody that go beyond native speakers and Western clinical populations.

Furthermore, the study emphasises the need to consider sentence-type prosody in the diagnosis and treatment of language disorders in Nigeria. Intonation offers a diagnostic tool for motor-prosodic control, and needs to be evaluated and treated along with segmental and syllabic features. This may lead to better outcomes for patients with speech motor control disorders through the treatment of pitch modulation and sentence-type prosody.

Finally, this study offers possibilities for future research such as acoustic analyses of intonation, comparisons of prosodic disorders and studies of prosodic impairment across language varieties. Such works would further clarify the interaction between language contact, neurolinguistic constraints, and prosodic realisation in disordered speech.

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