

## NON-FINITE CONSTRUCTIONS IN IMPAIRED BILINGUAL BRAIN: EVIDENCE FROM APHASIA AND AUTISM

By

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### Abstract

Victims of neurological disorders such as aphasia and autism manifest difficulties in language functioning at different levels including construction of syntactic structures. Existing studies have shown that verb production and the tense node are severely impaired in monolingual aphasic and autistic speeches. It is unknown whether the claims are applicable to the nonfinite tense node especially in relation to bilingual brain. Therefore, this study examines English non-finite structures in sentence production among Nigerian bilingual aphasic (NBAP) and Nigerian bilingual autistic (NBAuP) people. X-bar and control modules of Noam Chomsky's Principles and Parameters Theory provided the framework. The qualitative approach was adopted for this descriptive and cross-sectional study. Using Kirkwood's formula for medical statistics with the epidemiology aphasia and autism in Nigeria, 11 (6 aphasic and 5 autistic) clinically diagnosed (NBAP) and (NBAuP) participants were purposively selected from 2 federal medical centres in South Western Nigeria, 1 state hospital in Ibadan Oyo State and 2 privately owned autistic support centres in Ibadan. Passage Reading Test (PRT), In-depth Interviews (IDIs) and Participant Observation (PO) were used to elicit speeches from the participants. The data were subjected to structural analysis. The study revealed that the syntax of English infinitival clauses is preserved in Nigerian bilingual aphasic brain, but selectively impaired in Nigerian bilingual aphasic brain. NBAP generated such structures in instances where they were required. They substituted the PRO-inf with PRO-ing irrespective of whether such syntactic constituents occur in A-position as well as AI-position. Such substitution occurred without affecting the grammaticality of the sentence. NBAuP participants freely produced infinitival structures in the passage reading test (PRT) and their self-generated sentences. However, none of them produced PRO-ing structures. For PRO-ing structures in the PRT, the participants resorted to structural reprocessing and they eventually produced finite structures. This suggests that Nigerian bilingual autistic brains are sensitive to infinitival PRO but they are not sensitive to PRO-ing. It is concluded in the study that Nigerian bilingual aphasic brain is characterised by preservation of the syntax of infinitives while Nigerian bilingual autistic brain is characterised by selective impairment of the syntax of infinitives.

**Keywords:** Syntax of infinitives, Structural reprocessing, Nigerian bilingual aphasic brain, Nigerian bilingual autistic brain, Selective impairment

### Introduction

Neurolinguistics, a branch of linguistics that deals mainly with the biological (neural) basis of the relationship of the human language and brain, aims at explaining how language structures are prompted in the brain. It explores how the patterns and rules of human languages are represented and grounded in the brain. The central topic in the history of neurolinguistics is the localisation of the cerebral structures responsible for the different linguistic processes and the effects of brain damage on language structures and language processes (Bambini, 2012). In recent times, attempts have been directed towards describing language problems that may result from damage to specific locations in the brain.

Impairment of certain parts of the brain (such as the temporal lobe, the Wernicke's and/or Broca's areas) where language is processed (whether at the production or comprehension levels) results in what is known as language disorders, which are broadly classified into acquired and developmental disorders. Examples

of acquired language disorders are Alzheimer, Parkinson, schizophrenia, aphasia, while examples of developmental disorders are autism, cerebral palsy, Down syndrome and spinal bifida. In Nigeria, aphasia and autism are the most prevalent language disorders (Bakare et al. 2012).

Depending on the part of the brain that is impaired, victims of language disorders can manifest difficulty in language functioning at different levels. In most of the existing studies, difficulty to use language is often most evident at the morphological, syntactic and phonological levels. For instance, Roo (2011) shows that Dutch monolingual aphasics have difficulty with verbs, and thus submits that verb production in aphasic speeches is severely impaired. Also, Friedmann and Grodzinsky (1997) as well as Walenski, Mostofsky and Ullman (2014) report that aphasics and autistics, respectively, manifest difficulty with the TP node. Clauses, including non-finite clauses, which are as well control structures are projected at the TP, which is conceived within the Principles and Parameters Theory as inflectional phrase (IP). Kolk et al. (2012) claim that non-finite constructions are just produced and maximally projected as substitutes for finite clauses. Nonfinite clauses differ from other TP structures by their zero inflection feature. In English, structure of nonfinite clauses is accounted for traditionally as IP maximal projection rather than TP, with the head being the inflectional node (I0). Such structure is distinguished by the fact that its verb does not mark tense or agreement. Hence, the I0 node is structurally marked as the –TNS, –AGR.

It is noteworthy that Nigeria is a multilingual setting with a large proportion of its citizens being bilingual in a Nigerian indigenous language and English. Hence, English is used in a second language context. Studies in English as second language (ESL) contexts such as Lamidi (2007) among others have shown that the grammar of a second language can be influenced by that of the indigenous language. This underscores some problems with the use of English among bilingual Nigerians. While Roo's study was conducted among Dutch monolingual speakers, it is not known whether the reports of his study are applicable to bilingual groups. Also, apart from the fact that none of the above extant studies examines aphasics and autistic performance in ESL situation, they fail to consider aphasics' and autistics' performance in the production structures with zero inflection. To investigate these, the current study examines English non-finite structures in the sentence production among Nigerian bilingual aphasic and autistic people.

### **Theoretical framework**

X-bar and control modules of Noam Chomsky's Principles and Parameters Theory (PPT) provided the theoretical and analytical pivot for the study. PPT (Chomsky, 1993) is a constraint-based theory of grammar; it is a modular grammar theory. It is composed of seven interrelated modules, with each addressing diverse components of language and language processing.

### **X-bar theory**

X-bar is the module of the grammar regulating the structure of phrases. In the PPT model, X-bar forms the basis of syntactic structure. X-bar theory brings out what is common in the structure of phrases. The theoretical module seeks to capture the similarities between different categories of phrases by assigning the same structure to them, as shown in Figure 1 below.

In X-bar theory, all phrases are headed by one head. In the terminology of traditional linguistics, all phrases are endocentric. In other words, XI theory forms the basis of syntactic structure in the transformational tradition. The head of the projection is a zero projection (X0). Heads are terminal nodes: they dominate words. XI theory distinguishes two further levels of projection. Complements (and adjuncts) combine with X to form XI projections. It should be noted that X is a variable, representing any lexical or functional class. Depending on the structure under analysis, X could be the head noun in a noun phrase (NP), the prepositional head in a prepositional phrase (PP), the complementiser in a complementiser phrase (CP), the inflection in an inflectional phrase (IP), the negator in a negative construction (NegP) and so on. The maximal projection of focus in this paper is the IP, with the I0 as the head. Hence, the value of X in this study is the inflection.

### Control theory

This is the module of the grammar that explicates how the null subject in a non-finite clause (PRO) gets its meaning. In PPT, we talk of the controller which must c-command the controllee. This is identical to the notion of co-referentiality and very similar to the notion of ‘bind’. Verbs which allow an infinitive complement with a PRO subject are said to function (in the relevant use) as control verbs, and the clause containing the PRO subject is said to be a control clause. There are two major kinds of control. The first kind is called arbitrary control. The meaning of this PRO is essentially “someone”, usually who is not performing the action in the verb of an embedded clause; as illustrated in the example below:

a. [PRO riding on the pedestal] is prohibited.]]

b. [The next thing is [PRO to read the text.]]

PRO in the above sentences is not controlled by anything. It gets its meaning from outside the sentence. Thus, PRO has arbitrary control. Another type of control is obligatory control. In this case, the ‘performer’ of the action stated in the embedded clause is found in the construction. It also comes in two different varieties. In the sentence below, PRO refers to Ìbùkún and Ìyanu, respectively; it cannot refer to anyone else:

c. [Ìbùkúni tried [PRO<sub>i</sub> to leave.]]

d. [Ìyanui is reluctant [PRO<sub>i</sub> to leave.]]

Ìbùkún and Ìyanu in the above sentences are in the subject position of the matrix clause, hence PRO in the two sentences have subject control. Featherston (2001: 45) also calls this ‘Equi’ and he describes it further as “a sentence in which the PRO in the embedded non-finite clause is controlled by the subject argument of the main clause” (p. 45). There is also object control— a sentence where there is a PRO in the embedded non-finite clause and it is controlled by the object argument of the main clause. For example:

e. [The union president instigated the students<sub>i</sub> [PRO<sub>i</sub> to protest.]]

The interpretation of PRO in sentence (e) is dependent on the agent of the action ‘protest’. Semantically, ‘the students’, which is the object of the matrix clause, is the agent of the action ‘protest’ in the embedded clause. It implies that ‘the students’ controls the PRO in the sentence. Therefore, PRO (in e) is object controlled.

There are other circumstances where PRO does not have to be (but can be) controlled; he calls this ‘optional control’. An example is shown below:

f. [Túndéi says it is a good thing [PRO<sub>i/j</sub> to praise the Lord.]]

PRO here can mean two different things. It can either refer to Túndé or have an arbitrary (PRO<sub>arb</sub>) reading. This can be seen by looking at the binding of the following two extensions of the sentence:

g. [Túndéi says it is a good thing [PRO<sub>i</sub> to praise the Lord on his<sub>i</sub> birthday.]]

h. [Túndéi says it is a good thing [PRO<sub>i/j</sub> to praise the Lord on one’s<sub>j</sub> birthday.]]

The genitive marker his in (g) refers to Túndé (thus, his birthday is interpreted as Túndé’s birthday). The co-indexation of these nominal and genitive entities Túndé and his, respectively with PRO in sentence (g) implies that PRO is interpreted as and thus controlled by Túndé which is the subject of the matrix clause. Thus, PRO (in g) is subject controlled. In (h), PRO is interpreted in the context of the indefinite pronominal entity, one. In this case, the controller of the position occupied by PRO is arbitrary.

There are other categorisations in which control can be considered: they are syntactic or functional control, and anaphoric or semantic control. Syntactic or functional control ensures the similitude of the grammatical features of the controller and the controllee in terms of category, number and gender. An example is given below.

i. [Mr Kolai is advised [to PRO<sub>i</sub> rest.]]

In the example above, the controller of PRO is Kola, which has its grammatical features as +masculine, + singular, + 3rd person. Thus, PRO shares these grammatical features with Kola.

Anaphoric or semantic control requires the identical reference between the anaphor and its antecedent. The sentence below illustrates this.

j. [The ladyi hurt her finger [while [PRO<sub>i</sub> scratching herselfi.]]]

k. \*[The ladyi hurt her finger [while [PRO<sub>i</sub> scratching oneselfi.]]]

In (j) and (k), PRO is the subject of the verb *scratching* in the embedded clauses. Since the internal arguments ‘herself’ (j) and ‘oneself’ (k) are anaphors (reflexives), they should have identical reference in their antecedents. The co-indexation in (j) and (k) shows that the agent of the action expressed by the verb ‘scratching’ (in both sentences) is ‘The lady’. Hence, PRO is controlled by ‘The lady’, and consequently, the antecedents of the anaphors *herself* and *oneself* is ‘The lady.’ Sentence (j) is grammatical since identical reference exists between the controller of PRO and the anaphor ‘herself’. On the contrary, (k) is ungrammatical because the subject of *scratch* is (obligatorily) interpreted as ‘The lady’, with which the anaphor ‘oneself’ does not share identical reference. This illustrates a violation of binder-bindee co-indexation as stipulated by the Principle A of Binding theory, which requires that an anaphor must be bound within its governing category. In relation Binding theory therefore, the reflexives ‘oneself’ and ‘herself’ (in j and k, respectively) are bound by the NP ‘the lady’, which is semantically the agent of ‘hurt’ and ‘scratching’ in both sentences. Given this semantic relationship therefore, the ungrammaticality of sentence k relates to lack of semantic features between the binder (the lady) and the bindee (oneself).

### **Methodology**

The qualitative, descriptive and cross-sectional design was adopted for this study. Speeches elicited from clinically diagnosed 10 adult aphasic patients and 5 autistic children constituted the data for the study. The sample size for the study was calculated based on Kirkword’s (1988) formula for medical statistics in line with the epidemiology of these neurological disorders in Nigeria. Participants were purposively selected from two federal medical centres in Nigeria (University College Hospital, Ibadan; and Federal Medical Centre, Owo), 1 state hospital in Oyo State (Adeoyo Specialist Hospital, Ibadan) and 2 privately owned autistic support centres in Ibadan (Treasure Delight International Centre; and Jesus’ Kids Autistic Centre). The bases for inclusion were that participants must be Nigerian ESL and have attained the age of nine (9) years, a current medical diagnosis of aphasia or autism, and a current placement in the autistic support classroom (for autistic participants). An autistic support classroom is a highly structured classroom that is designed to meet the needs of students with autism spectrum disorders. Prospective participants who did not meet all of these criteria were excluded from the study.

While the study had 15 participants in all, 4 aphasic participants (among the 10 of them selected) had blurred speech and their sentences were not coherent enough for analysis. Therefore, their speeches were exempted from the analysis. Thus, the analysis was based on the speeches of 11 (6 aphasic and 5 autistic) participants. The instruments for data collection were Passage Reading Test (PRT), In-depth Interviews (IDIs) and Participant Observation (PO). The speeches elicited from the participants were tape-recorded and transcribed (orthographically). They were then subjected to structural analysis. Analysis was done within the theoretical frame of X-bar and Control modules of Principles and Parameter Theory.

### **Analysis**

#### **Non-finite structures in Nigerian Bilingual Aphasic Speeches**

In the data gathered for this study, there is preponderance of non-finite constructions in the sentence production of Nigerian bilingual aphasic patients (NBAS). This is first an indication of their ability to produce English clauses. This suggests that syntax is not completely impaired in Nigerian bilingual aphasic condition. Below are some non-finite constructions in the speeches of the study’s selected participants.

The non-finite structure (in 1) above has the feature PRO-ing. It was deduced from the researcher’s interaction with the participant that the latter intended an infinitival construction, “It is difficult to complain”, where the non-finite structure is in a non-argument position. Despite the syntactic reprocessing, the grammaticality of the construction is not impaired. While the PRO-ing is the subject of the sentence, it is in itself an embedded clause and its temporal interpretation is dependent on the matrix verb ‘is’. Therefore, the embedded clause takes a null subject (PRO) to which no case is assigned, and the PRO is arbitrary control. Like the PRO-ing in (1), the inf- PRO in (2) is also an embedded clause in an argument position. The matrix verb ‘like’ is transitive and thus requires an accusative NP. Rather than an

NP complement, the verb subcategorises for an inf-complement. However, the interpretation of PRO in the structure is in the context of ‘nurses’, which is the subject NP of the matrix clause. While case is not assigned to PRO, the position it occupies has the semantic role of agent (of the verb ‘shout’; as ‘nurses’ is to ‘like’ in the matrix clause). Thus, PRO in the structure is subject control. Structures (3-6) below show that aphasics can also produce infinitival constructions in AI position as well.

3. [IP, Spec, NPDoctorsi VPcome [IP, SpecPROi VPto see NPme]] (APP34)
4. \*[IP, Spec, NP{Children, wife and me}I VPagree [IP, SpecPROi VPto stay AdvPhere AdvPuntil [IP, Spec, Poss-inghealing VPis restore]]] (APP16)
5. [IP, Spec, NPPatientsi VPhave NPrights [IP, SpecPROi to complain::: poor services]] (APP17)
6. [IP, Spec, NPIi VPam using NPit [IP, SpecPROi VPto take NPpicture inside back hnnnnnn your head]]. (APP8)

In (3) and (4), the verbs ‘come’ and ‘agree’, respectively are intransitive. Hence the positions of infinitival complement in each of the structures are non-argument positions. In (3), ‘doctor’, which is the agent of the verb ‘come’ (in the matrix clause) is as well the agent of the verb ‘see’ in the embedded clause. Similarly, in (4), PRO which is the null subject of the embedded clause is interpreted as children, wife and me, which constitute the subject of the matrix clause. Thus, while PRO is not assigned a case (as required by PRO theorem; Featherston, 2001), the position is interpreted as ‘patient’. Thus, since PRO is the bearer of the theta role assigned by the matrix verbs in both sentences to their external arguments, PRO in the structures is subject control. Structure (5) is slightly different from the earlier two in that the matrix verb ‘have’ is transitive and thus its complement NP is projected. Though the infinitival clause projects as NP complement, the interpretation of PRO is outside the NP complement. Semantically, the agent of the verb ‘complain’ in the embedded clause is the same as that of the matrix verb ‘have’. Thus, PRO is controlled by ‘Patients’, which is the external argument in the matrix clause. This is similar to the features of PRO in (6) where, semantically, the infinitival structure states the purpose for which the object NP (it) in the matrix clause is being used. The agent of ‘take’ is the pronoun ‘I’ in the matrix clause, not the accusative NP ‘it’. As the co-indexing shows, PRO (in 6) does not have the theta role of instrument (as in ‘it’); but that of agent. Structures (7) and (8) below further reveal aphasics’ use of infinitival clauses in AI position; while (7) shows arbitrary controlled PRO, (8) reveals object control PRO in such position.

To be honest hnnnnnn you, doctors are clever huma

8b. I thank you doctor for doing your job conscientiously.

Structure (7) above is an adjunct structure in the test item. PRO in the small clause has the -inf feature and it does not share semantic relation with any overt NP. Hence, the control of PRO in the small clause is arbitrary. Structure (8a) as contained in the SP reads “I thank you doctor for doing your job...” The participant (in 8a) was able to reprocess the PRO-ing to generate a to-inf yet without duplicating or conflating these structures in the same utterance. However, the structure is ungrammatical. Its ungrammaticality arises from violation of theta criterion, which requires that “an argument bear a theta role and a theta role is assigned to an argument” (Lamidi, 2011: 57). ‘Doctor’ in the given structure is assigned the role of patient in the matrix while the position occupied by PRO in the embedded clause is assigned semantic role of agent. In (8b), ‘doctor’ is interpreted as the patient in the matrix clause and within the same structure, it is assigned agent theta role in the embedded clause. Also, a semantic problem occurs at the LF as (8b) expresses consequential meaning as against the intended causative meaning. The sequence of action communicated in (8a) shows that the action in the embedded clause actually precedes that expressed by the verb in the matrix clause. On the contrary, the participant’s eventual production expresses the action in the matrix clause as one that precedes that of the embedded clause. Thus while the given structure implies that the appreciation is consequent upon the job which the doctor has done, the actual production presents the appreciation as a condition for the doctor to do the job.

From the discussion so far, it is revealed that the syntax of English infinitival clauses is preserved in aphasia. The discussion also reveals that non-finite constructions are not just produced as substitutes for finite clauses (as Kolket al., 2012 categorically states). The participants generated such structures in instances where they are required. Moreover, the participants were found to substitute the PRO-inf with

PRO-ing without affecting the grammaticality of the sentence. It also reveals that the control of PRO in their constructions does not depend on whether the non-finite construction is in argument position or not, as claimed by Butterworth (2004). This is evident in their ability to produce such structures in A-position as well as AI-position. This study suggests that the reason for the preservation of the syntax of infinitives in aphasia cannot be far from the fact the aphasic participants have problems mainly with past tense verbs such that even in tensed clauses, the participants used non-finite construction.

#### Non-finite structures in Nigerian Bilingual Autistic Speeches

Attention in this section is given to the performance of Nigerian bilingual autistic patients in the production of nonfinite structures.

1. [IP, SpecPRO inf(-TNS; -AGR)To VPbe AdjPhonest with you...] (AUP1)
2. \*[So no reason [to feel insecure or unsafe]] (AUP12)
3. [IP, SpecI VPwant IP, SpecPRO inf(-TNS; -AGR)to VPplay.] (AUP15)

Structures (1-4) above are infinitival structures (PRO-inf). While structures (5) and (6) have finite features, their inclusion in this discussion has implication for the discussion of nonfinite constructions in this study. The participants correctly produced the infinitival constituents in (1), (2), (3) and (4) without any modification to the Inflection node. However, it should be noted that the violation of extension of the Extended Projection Principle in (2) brings about the ungrammaticality of the sentence.

On the other hand, the produced structures in (5) and (6) compared to the actual stimuli presented to the participants reveal that they engaged in some syntactic reprocessing. The actual structure given to the participants, represented in structure (5) is "...while getting medical attention recently..." (which involves PRO-ing structure). The transformational re-processing by the participant substituted the PRO-ing with the finite variant of the verb 'get'. The participant therefore produced a finite (imperative) structure in which the subject position is null (marked as  $\epsilon$ ). Similarly, in (6a), the participant projected an overt subject NP you in the IP structure embedded within the CP. He went further to eliminate -TNS, -AGR features that characterise the INFL node (shown in 6b). The result of this morphosyntactic modification is the production of +TNS, +AGR INFL in (6a). Thus, instead of the expected non-finite clause (in 6b) introduced by the COMP for, the participant adjoined the embedded clauses to the main clause by a conjunction for. Also, instead of the expected null Spec, IP position (contained in the SP), a pronominal element was projected as the (agent)/external argument of the hitherto infinitival verb. However, this syntactic reprocessing does not affect the grammaticality and meaning of the sentence.

As observed above, participants freely produced infinitival structures in the passage reading test (PRT) and their self-generated sentences. On the contrary, none of them produced PRO-ing structures. For structures in the PRT that involve the PRO-ing, the participants resorted to structural reprocessing and they eventually produced finite structures. It is, therefore, posited in this study that autistics are sensitive to infinitival PRO but they are not sensitive to PRO-ing. Considering the patterns in the two structures, the case, therefore, with autism in the production/use of English non-finite constructions is that PRO-inf is preserved while PRO-ing is not. In addition, the participants' structural outputs considered above show that syntax is not completely impaired in autism, especially given the fact that some of the re-processings preserve some conditions necessary for grammaticality.

#### Conclusion

The syntax of non-finite constructions (PRO-inf and PRO-ing) is preserved in aphasia. It is frequently used and well structurally distributed irrespective of its position (whether A or AI) in a sentence. However, the PRO-ing is often reprocessed such that the meaning of structures is modified, though grammaticality is still achieved. In autistic speeches, such (PRO-ing) structure is reprocessed such that it is produced as a finite construction, thereby bringing about shift in meaning. Nigerian bilingual autistics' production of the English non-finite clause is characterised by selective impairment.

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