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Syntactic accounts of agrammatism in English and Scots Gaelic

Diane Nelson, Louise Kelly, Richard Shillcock & Ronnie Cann
diane@ling.ed.ac.uk

Abstract

This paper is based on a recent research grant proposal submitted to ESRC entitled 'A cross-linguistic investigation into the impairment of functional categories in agrammatism in English and Scots Gaelic'. We outline a theoretically-motivated approach for characterising agrammatism, an acquired language deficit associated with Broca's aphasia. Based on previous experimental results presented in the psycholinguistic and syntactic literature, we suggest following Ouhalla and Tait & Shillcock that agrammatism is the result of impaired access to functional (closed-class) categories when generating syntactic representations. We predict that Broca's aphasic subjects will show a statistically significant number of errors in production, comprehension, *and* grammaticality judgements crosslinguistically in experimental tasks designed to test the presence of functional categories in syntactic representations. We present a series of experiments designed to test the hypothesis for both English and Scots Gaelic-speaking subjects.

1 Characterising agrammatism

In recent years language deficits, particularly agrammatism, have been increasingly recognised as a rich source of neuropsychological evidence for theories of grammar. One of the key empirical questions that remains to be answered, however, is to what extent agrammatism is a unified language impairment that disrupts production, comprehension, and judgement of grammaticality cross-linguistically. Current developments in linguistic theory provide a testable hypothesis within a well-developed theoretical framework in which to direct research. By testing agrammatic subjects in all three areas of linguistic competence, we hope to gauge to what extent agrammatic performance arises as a result of impaired access to functional categories for generating syntactic representations cross-linguistically, while at the same time contributing to the small body of extant knowledge relating to agrammatism in Scots Gaelic.

Characterisations of agrammatism, a condition associated with Broca's aphasia and damage to Broca's area in the left hemisphere of right-handed patients, traditionally focus on features of agrammatics' 'telegraphic' spontaneous production. These features include a preponderance of substantives, a lack of inflectional affixes, and the omission or misselection of 'closed-class' or function words including complementisers, relative pronouns, personal pronouns, determiners and auxiliaries. Cross-linguistic data from production bears out this generalisation (Tait & Shillcock 1994; Menn & Obler 1990). Relatively recently, experimental evidence (Caramazza & Zurif 1976; Schwartz *et al.* 1980; and Saffran *et al.* 1980) has demonstrated that the deficit characterised by agrammatic output extends to comprehension, where interpretation of a given sentence is dependent upon sensitivity to grammatical features. For instance, in picture-matching tasks, patients perform at chance when presented with semantically reversible passives (e.g. 'Cecil was seen by Imelda'), object relative clauses ('I bought the picture Catriona painted') and object clefts ('It was Homer that Miriam saw'). Agrammatics also appear to encounter difficulties in processing determiners in pairs such as 'I showed her the baby pictures' vs. 'I showed her baby the pictures' (Heilman & Scholes 1976). Interpretation of corresponding active and subject-extracted constructions (e.g. 'It was Homer that saw Miriam'), however, appears to be relatively intact within the scope of these studies. Interestingly, research conducted by Linebarger and colleagues (e.g. Linebarger *et al.* 1983) suggests that patients with both production and comprehension deficits in certain constructions may successfully judge (un)grammaticality of some of the same sentences they are unable to interpret, but still fail to judge grammaticality in other sentence types. These results highlight the importance of a multi-methodological approach when conducting linguistic and psycholinguistic research on agrammatism.

From a theoretical linguistic point of view, the data summarised above raises tantalising questions. Despite a history of failure in communication between clinical aphasiologists and theoretical linguists, the last two decades have witnessed a dramatic increase in interdisciplinary approaches to cognitive neuropsychology, with theories of both processing and syntactic representation being introduced in an effort to account for the attested performance of agrammatics. Important earlier accounts of agrammatism viewed various production and comprehension difficulties as parallel impairments, resulting in a unified underlying breakdown in a particular component of the language faculty or processor (e.g. Kean 1977; Bradley *et al.* 1980). In recent years, however, the focus of research has shifted away from more global accounts assuming parallelism towards those which implicate specific impairments of either production or comprehension mechanisms.

For research within the innatist tradition, e.g. the Principles and Parameters framework (first proposed by Chomsky 1981), this divergence of focus is problematic because no distinction is made within the model between mechanisms of production and mechanisms of comprehension. Instead, integral to the framework is the notion that representations are generated and constrained by identical linguistic principles of Universal Grammar for production, comprehension *and* grammaticality judgements; characterisations of normal grammar assume that these three aspects of language use are reflexes of the same underlying linguistic knowledge. Previous accounts of agrammatism within Principles and Parameters, however, have tended to fail to make the same assumption of parallelism implicit in the framework.

For example, Grodzinsky (1990 and other work) argues that agrammatics have access to verbal argument structure and to normal structure-building mechanisms, i.e. share grammatical competence with normals, but at a particular level of representation (S-structure) a series of impairments results in attested failures in performance. Separate deficits are posited for production and comprehension, despite the fact that the framework he adopts assumes identical mechanisms to underlie both types of linguistic phenomenon. Although the proposed deficits appear to capture a wide range of data, Grodzinsky's approach has been criticised by other theoreticians mainly because it combines formal linguistic characterisation with a nonlinguistic, heuristic device: the Default Principle.

Other accounts within the same syntactic framework have recently tended to focus on data from agrammatic comprehension only. Mauner *et al.* (1993) pinpoint agrammatic comprehension deficits in the syntax-semantics interface. Drawing on a hypothesis known as the Double Dependency Model, they distinguish between referential indices related to movement, which share a single theta-role, and those related to anaphoric binding, which do not. Mauner *et al.* argue that agrammatics may lose the ability to establish referential dependencies when two such indices are present in a given representation, while retaining the ability to successfully detect un/grammaticality in the same sentences. Hickok & Avrutin (1995) also focus on data from comprehension, and argue that the interpretation of binding chains is disrupted while the interpretation of government chains is intact. While both of these proposals suggest theoretically-motivated, non-heuristic devices for the interpretation of moved elements, both account for a relatively limited amount of data, and specifically exclude evidence from, and analysis of, agrammatic production.

The current study aims to apply a model of agrammatic impairment that does assume parallelism, specifically that agrammatic performance is the result of a single underlying deficit affecting the generation of syntactic representations over and above the VP-level. This approach assumes that agrammatics have access to syntactic structure and verbal semantics, but may lack consistent access to the elements that determine more complex syntactic structures and inflectional morphology, and allow certain types of movement. This underlying impairment is expected to yield particular types of errors in production, comprehension and grammaticality judgements. We believe that by testing a range of phenomena in speakers of both Scots Gaelic and English, evidence for a parallel deficit across subjects and languages may emerge.[1]

2 Agrammatism: an impairment to functional categories?

In recent years there has been a marked shift of focus in syntactic theory towards morphosyntax and the status of functional categories in the grammar. A growing amount of evidence has accumulated to suggest that both function words (elements of negation, complementisers, determiners, auxiliaries, and prepositions) and inflectional affixes (agreement, tense/aspect, and passive morphemes) may be represented in the syntax according to the principles of X-Bar Theory along with content words, such as nouns and verbs

[1]Criticisms of parallelistic approaches cite evidence from cases where subjects showing agrammatic output appear to lack comprehension disorder (e.g. Miceli et al. 1983). Kean (1995) argues that such infrequent cases may not actually be Broca's aphasics, and suggests that the dismissal of parallelism is unwarranted on these grounds.

(Abney 1987; Pollock 1989). According to this model, content words, function words and inflectional affixes are taken from the lexicon separately and inserted into tree structures. The process of attaching affixes to stems is thus a syntactic one, with either the content word raising to attach itself to inflectional morphemes or the inflectional morphemes lowering to attach to the content word. Importantly, however, both inflectional affixes and function words may be realised in the syntax as functional categories, which in turn enter into structural relations with contentive elements.

There is an increasing consensus in the literature that functional categories play a central role in syntactic and morphosyntactic operations including abstract case assignment, passivisation, word order, and question formation. The most recent variant on the Principles and Parameters framework, the Minimalist Program (Chomsky 1993 and subsequent work) assumes the projection of functional categories to be a basic component of Universal Grammar. To what extent particular functional categories vary across languages and the way in which they are represented in the lexicon is a matter of some debate. Within the model proposed by Cann & Tait (1989), functional categories and major category elements are stored in two separate lexica, the f-(functional) lexicon and the c-(contentive) lexicon. Structure is built not according to a universal cross-linguistic template, but is dependent on language-specific properties of functional categories as specified in the lexicon.

Based on the attested performance of agrammatic subjects, who encounter difficulty in producing and interpreting function words and inflectional affixes, the following generalised deficit has been proposed (Ouhalla 1993; Tait & Shillcock 1994; Hagiwara 1995; Reznick 1995)[2]

> Functional categories may fail to project in agrammatic representations.

This hypothesis successfully predicts a large portion of the existing evidence from agrammatic comprehension, since syntactic representations without projections of functional categories lack positions for moved objects in reversible passives, object-clefts and object-relative clauses. Since the VP remains intact according to this model, no sensitivity to argument structure or verbal semantics is expected to be lost; this is borne out extensively in previous experiments (Grodzinsky 1990). In addition, it accounts for observed problems using and interpreting words and affixes linked with functional categories such as case, personal pronouns, determiners, and relative pronouns (Hagiwara 1995; Goodenough *et al.* 1977). Conceptually, this approach is advantageous for several reasons:

- Characterising the agrammatic language deficit in terms of *syntactic representation* captures attested data from both production and comprehension in a unified way.

[2] Hagiwara and Reznick, though adopting a similar hypothesis to Ouhalla and Tait & Shillcock, differ slightly in their theoretical perspectives, assuming the Minimalist Program (Chomsky 1993) as a syntactic framework. They both argue that only certain functional projections are impaired: in the case of Hagiwara, for Japanese, those lower down in the syntactic structure, while Reznick suggests that only those with no semantic content are disrupted. Both of these proposals provide hypotheses which may or may not find support in the experiments currently outlined.

- The notion that functional categories may be lacking in agrammatism complements current theories of *language acquisition*, which suggest that functional categories are acquired at a later stage of development than major category elements (Radford 1990; Tsimpli 1992).

- This approach does not suggest an impairment to a specific module of the grammar; the adoption of Cann & Tait's (1989) model of *two lexica* instead suggests an impairment of access to the f-lexicon, where functional elements bearing syntactic information are stored. This syntactic account gains support from processing models: data from priming experiments (Bard & Shillcock 1993) indicate that function words engage in a 'strong interaction' with syntactic processing in lexical ambiguity resolution. This is in marked contrast to the 'informational encapsulation' of content words from syntactic processing, in initial ambiguity resolution.

This hypothesis is a strong one that yields a large number of testable predictions, some of which have already been borne out by the available evidence. Although syntactic in focus, it does not rule out processing accounts in which functional elements are processed in a different way from contentive elements or in which additional processing effort is required to construct representations containing functional elements (Hagiwara 1995). To this end we intend to complement our theoretical syntactic research with a statistical parsing approach outlined in a later section.

The main apparent drawback for approaches such as the current one, which implicate syntactic representation deficits in agrammatism, involves data from grammaticality judgements. Experimental evidence from Linebarger *et al.* (1983 and subsequent work) seems to suggest that agrammatics may be sensitive to grammaticality or a lack thereof in the very sentence types (reversible passives, object clefts, etc.) that they cannot interpret. However, the results presented by Linebarger and colleagues show several interesting discrepancies to this generalisation: in particular, as pointed out by Mauner *et al.* (1993), subjects failed to detect ungrammaticality in English sentences where agreement and auxiliaries were incorrectly conjugated. Moreover, Japanese agrammatics have failed to detect case-related ungrammaticality (Hagiwara 1995). Agreement, auxiliaries and case are all strongly linked with functional categories in the syntax, making these findings particularly relevant to the current study.

The inconclusive nature of the evidence related to grammaticality judgements underlines the necessity of implementing multiple methodologies in any study of agrammatism. Furthermore, since the syntactic theory adopted in the current study assumes functional categories to be included in an innate Universal Grammar, any hypothesis related to syntactic representation is made more robust if supported by cross-linguistic evidence. For this reason our experimental design sets out to study related phenomena in two languages, English and Scots Gaelic, by bringing together evidence from three domains relevant to the study of grammar, namely production, comprehension and grammaticality judgements.

3 Testing impairment to functional categories

Specifically, our working hypothesis predicts that some level of disruption will be evident in production, comprehension and/or grammaticality judgement in tasks where functional categories play a crucial role in determining syntactic structure. As mentioned previously, earlier experimental results support the hypothesis that access to complementisers, relative pronouns and passive morphology is impaired for generating syntactic representations, given agrammatic performance on reversible passives, object-clefts and object-relative clauses. In addition, we anticipate a statistically significant number of errors in all or some task types in the following environments for both English and Scots Gaelic. A brief outline of the relevant constructions in Gaelic is included as an Appendix.

- *Word Order*: Scots Gaelic has a basic VSO word order, while English is SVO. Unmarked agrammatic word order in both languages is predicted to be SVO, since VSO in Gaelic is assumed to be derived as the result of movement into functional projections (Adger 1993; Ramchand 1995).

- *Negation*: Negation in Scots Gaelic is signalled by three distinct elements, *cha*, which occurs sentence-initially, *nach*, which occurs in questions and subordinate clauses, and *gun*, which appears in non-finite clauses and nominalisations. All three are expected to be strongly disrupted; if one element of negation is used, it is predicted to be *nach*. In English, the unstressed negation element *n't* is predicted to be absent or impaired.

- *Tense/Aspect*: Tense/aspect in both languages is expected to present difficulties for subjects. In Gaelic, progressive/perfective aspectual distinctions are expressed via different word order and the use of an aspectual particle. If functional categories are disrupted, subjects should fail to produce VSO word order in aspectually unmarked sentences and absence or misselection of aspectual particles is expected. In English, aspectual distinctions may be marked via auxiliaries and verbal inflection, as in 'Jean sings (every day)' vs. 'Jean is singing (right now)'. Subjects are expected to show impaired sensitivity to such distinctions when no modifier is given in comprehension and grammaticality judgement tasks, and omission or misselection of auxiliaries and inflectional endings in production tasks.

- *Lenition*: In Scots Gaelic, lenition (a type of phonological conditioning) is induced primarily through the syntactic combination of elements and in compounds. Agrammatic subjects should fail to lenite in syntactically-triggered environments but continue to lenite in compounds. In English, related phenomena can be expected in production/recognition of derivational vs. inflectional morphology, for example 'Mary is playing in the field' vs. 'Mary is in the playing field'.

- *Agreement*: Agreement in English is predicted to be disrupted, so subjects should fail to distinguish 'The sheep walks' vs. 'The sheep walk'. Gaelic does not show verbal agreement so no cross-linguistic comparison will be available.

4 Statistical parsing: a complementary approach

We will complement the formal linguistic account described above with one which recognises agrammatism as a processing impairment. These approaches are not mutually exclusive; they are reconciled by the assumption that a transparent relationship should exist between grammar and processor. Both approaches can produce important insights, generalisations and predictions. The particular processing approach we take is based on recent developments in the sentence processing behaviour of normal readers and listeners, specifically a general constraint-based lexicalist model (see, e.g., Tanenhaus & Carlson 1989; Pearlmutter *et al.* 1994) in which all relevant linguistic information acts to constrain the eventual parse, with no priority being given to any particular type of information. In such a model, verbs are stored along with statistical information regarding past contexts of occurrence, such as the proportion of times that they occurred with a particular argument structure. Studies have shown that it is possible to predict the finegrain parsing behaviour elicited by a particular sentence by consulting language corpora and calculating the statistics of occurrence of particular verbs and particular constructions. As the discussion above demonstrates, research into agrammatism has become increasingly concerned with comparing agrammatic performance on particular constructions; this approach is motivated by the formal linguistic distinctions between the different constructions. From the perspective of the general lexicalist, constraint-based model discussed above, we might derive the following Construction Frequency Hypothesis:

> The pattern of syntactic loss in agrammatism is predictable from the frequency with which the particular constructions occur in speech and text. Frequently occurring constructions are more likely to be spared than less frequently occurring constructions.

While we adhere to the idea of a central, syntactic account, this is not incompatible with the notion of certain aspects of agrammatism being accounted for at other levels of explanation. As an example, Kilborn (1991) demonstrates that non-specific stress applied to language production can result in grammatical impairment resembling agrammatic production. Similarly, Shillcock *et al.* (1993) show that non-specific damage to phonological sequencing can differentially disrupt the processing of closed-class words. Such specific linguistic outcomes of non-specific damage or pressure are parsimonious accounts, given the gross nature of the damage that causes agrammatism.

We will use existing online corpora of text and spoken language to characterise syntactic processing in terms of the frequency of specific constructions, and to test the hypothesis above. This will allow us to order constructions such as progressive/perfective aspect, negation with auxiliaries and so on, in terms of the frequency with which they are encountered in speech and text. In general, psychological theories of cognitive processing have associated greater frequency with greater strength and reliability of representation, for most of this century. The statistical assessment we propose here will reflect the functional, communicative importance of the different constructions and might be expected to have some reflection in the psychological organisation of syntactic processing for that reason. The statistics can readily be calculated in some cases by searching for particular closed-class words, such as negation and auxiliaries, and in other cases by using readily available syntactically tagged corpora. Each construction type will be assigned a frequency of occurrence per 1000 words. Non-parametric statistics will be used to compare this order with the order of observed impairment in the literature and in the experiments we will conduct.

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Appendix: A sketch of some relevant constructions in Scots Gaelic

These examples are (mainly) taken from D. MacAulay (ed). 1992. *The Celtic Languages*. Cambridge: Cambridge University Press.

Word Order

Word order in Scots Gaelic (like the other Celtic languages) is basically Tensed Verb - Subject - Object (1) or Tensed Copula - Subject - Predicate (2).[3]

(1) a. *Chunnaic am balach an cú*
Saw the boy the dog
'The boy saw the dog'

b. *Ceannaichidh Iain an leabhar*
will buy Ian the book
'Ian will buy the book'

(2) a. *Tha mi gu math*
is I PRT good
'I am well'

b. *Bha an leabhar agad*
was the book at you
'You had the book' (lit. 'There was a book at you')

[3]In the examples that follow, PRT stands for 'particle'.

Tense and Aspect

There are two tenses in Scots Gaelic, present and past, except that only the copula (*tha/is*) has forms for both tenses (3). All other verbs appear in the past tense only. The present tense is signalled by the use of a periphrastic aspectual construction (4 and below).

(3) a. *Tha an càr air an rathad*
is the car on the road
'The car is on the road'

b. *Is math sin!*
is good that
'That is good'

c. *Bha an càr air an rathad*
was the car on the road
'The car was on the road'

d. *Bu math sin!*
was good that
'That was good'

(4) a. *Chaidh Iain chun an dorus*
went Ian to the door
'Ian went to the door'

b. *Tha Iain a dol chun an dorus*
is Ian PRT go-VN to the door
'Ian is going to the door'

In aspectually marked sentences, like (4b), the initial position is taken by a tensed copula and the main verb appears as a verbal noun following a prepositional type particle that varies to indicate the aspect. This gives the order Tensed Verb - Subject - Particle - Verbal Noun - Object. In (5) we see examples in the progressive aspect and (6) shows some perfective examples, including one (6b) which has a preposed direct object to give the order Tensed Verb - Subject - PRT - Object - PRT - Verbal Noun. Note that with prepositional objects they appear either as preposed clitics or induce agreement on the aspectual particle (5c and 6c).

(5) a. *Tha am balach a' falbh*
is the boy PRT leave-VN
'The boy is leaving' (lit. 'The boy is at leaving')

b. *Bha Iain a' ceannach an leabhair.*
was Ian PRT buy-VN the book-GEN
'Ian was buying the book'

c. *Tha am balach ga cheannach*
is the boy PRT-3sg.m buy-VN
'The boy is buying it'

(6) a. *Tha am balach air falbh*
is the boy PRT leave-VN
'The boy has left' (lit. 'The boy is after leaving')

b. *Bha Iain air an leabhar a cheannach*
was Ian PRT the book PRT buy-VN
'Ian has bought the book'

c. *Bha Iain air a cheannach*
was Ian PRT-3sg.m buy-VN
'Ian has bought it'

Negation

Negation is signalled by a non-inflecting auxiliary-like element that appears sentence initially. The verb appears immediately following in its dependent form. The order is Negative - Dependent V - Subject - X as shown in (7).

(7) a. *Chaidh am balach don sgoil*
went the boy to school
'The boy went to school'

b. *Cha deachaidh am balach don sgoil*
not go-DEP the boy to school
'The boy didn't go to school'

As with non-dependent forms, verbs other than the copulae have only past dependent forms. Present tense negations involve the use of aspectual constructions. The copula has both past and present dependent forms (8).

(8) a. *Chan eil am balach a' falbh*
not is-DEP the boy PRT leave-VN
'The boy is not leaving'

b. *Cha robh Iain a' ceannach an leabhair*
not was-DEP Ian PRT buy-VN the book-GEN
'Ian was not buying the book'

In questions and subordinate clauses the negative form is *nach* (9).

(9) a. *Nach deachaidh am balach don sgoil?*
not go (dep.) the boy to school
'Didn't the boy go to school?'

b. *Thubairt Iain nach deachaidh am balach don sgoil*
said Ian not go (dep.) the boy to school
'Ian said that the boy didn't go to school'

c. *Nach robh Iain a' ceannach an leabhair*
not was-DEP Ian PRT buy-VN the book-GEN
'Wasn't Ian buying the book?'

A third negative particle is *gun* which is used with non-finite clauses and nominalisations (10). In origin it is a preposition meaning 'without' (10a).

(10) a. *Chaidh am balach don sgoil gun Iain a fhaicinn*
went the boy to school NEG Ian PRT seeing-VN
'The boy went to school without Ian seeing him'

b. *Thubairt Iain gun am balach a dhol don sgoil*
said Ian NEG the boy PRT go to school
'Ian said that the boy should not go to school'

Lenition

In Scots Gaelic, like other Celtic languages, certain initial segments undergo phonological changes induced by preceding elements. For example, the third singular masculine possessive pronoun induces lenition in the following noun while the third person feminine singular does not:

(11) a. cu /k^{h}u:/ 'dog'

b. a cu /ək^{h}u:/ 'her dog'

c. a chu /əx^{h}u:/ 'his dog'

Lenition is primarily induced through the syntactic combination of elements, as above. However, it is also found in nominal compounds where the second (noun) element appears with a lenited initial segment.

(12) a. cis-mhaor /kiʃvɔr/ 'tax gatherer' < maor /mɔr/ 'officer'

b. leth-shuil /lehu:l/ 'one eye' < suil /su:l/ 'eye'

c. mion-dhuine /minɣuɴə/ 'little man' < duine /duɴə/ 'man'