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Non-fluent aphasia in Ibero-Romance: a review of morphosyntactic deficits

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Background: Castilian-Spanish, Catalan, Galician, and European Portuguese are the most widely spoken languages of the Ibero-Romance group. An increasing number of authors have addressed the impact of aphasia on the morphosyntax of these varieties. However, accurate linguistic characterisations are scarce and the different sources of data have not been yet compiled.

Aims: To stimulate state-of-the-art research, we provided a comprehensive summary of morphosyntactic aspects of Ibero-Romance and a review of how these are affected in non-fluent aphasia. The topics we dealt with are the use of verb argument structure and morphology, sentential negation and word order, definite articles, personal and reflexive pronouns, passives, topicalised constructions, questions, and relative clauses.

Methods & Procedures: An exhaustive fieldwork and search of PubMed, Web of Science, and Medline records were performed to retrieve studies focused on morphosyntactic issues concerning the Ibero-Romance varieties. A total of 27 studies produced by 46 authors of varying background emerged. We did not review studies of category-specific deficits and aspects related to bilingual aphasia, although we assume that most speakers of Galician and Catalan are bilingual. Studies of spontaneous speech were included when no controlled experimental tasks were available.

Outcomes & Results: The morphosyntactic commonalities of Ibero-Romance have been tackled from different theoretical perspectives. There exist asymmetries in findings which we explain with the use of different tasks (and task complexity) and individual differences between participants.

Conclusions: Discourse-linking factors as well as deviations from the canonical pattern are recurrent answers to these asymmetries. A comprehensive theory of impairments in non-fluent aphasia integrating relevant aspects of both structural and processing accounts seems necessary.

Keywords: non-fluent aphasia; morphosyntax; Ibero-Romance

1. Introduction

Castilian-Spanish (henceforth, Spanish), Catalan, Galician, and European Portuguese (henceforth, Portuguese) are the most widely spoken languages of the Ibero-Romance group.¹ These languages are spoken in the Iberian-Peninsula and developed from Vulgar Latin; hence the term Ibero-Romance (Bergquist, 1982). The number of aphasiological studies on these languages is reduced. Exhaustive fieldwork and bibliographical searches

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in PubMed, Web of Science, and Medline databases revealed a total of 27 studies produced by 46 different authors of varying background. The studies were published in English and Spanish peer-reviewed journals such as *Aphasiology*, *Brain and Language*, *Cortex*, *Journal of Neurolinguistics*, *Journal of Psycholinguistic Research*, *Language Acquisition*, and *Lingua*, as well as *Cuestiones conceptuales y metodológicas de la lingüística*, *Revista de Logopedia*, *Foniatría y Audiología*, and *Revista de Neurología*. We also included work from conference proceedings and master's and doctoral theses. Some of the studies dealt with more than one of these varieties: nine included Catalan, four Galician, 15 Castilian-Spanish, and three European Portuguese (Figure 1, left). The range of topics considered is admirable, even though many authors have left aside in-depth linguistic analyses (Figure 1, right). To stimulate state-of-the-art research, we reviewed the work on morphosyntactic deficits of non-fluent speakers of Ibero-Romance languages, and we related this work to current theoretical insights.

We focused on the morphosyntactic deficits of patients with Broca's aphasia with agrammatism (Goodglass, 1976) and other kinds of non-fluent aphasia, such as global, transcortical motor, and transcortical mixed aphasia. This is because "agrammatic" symptoms (e.g., omission of auxiliaries, connective words, and inflectional morphemes that result in telegraphic speech with rudimentary grammar) may occur in aphasic syndromes other than Broca's aphasia. An example of this is patient C.D.A (Miceli, Silveri, Romani, & Caramazza, 1989). Subjects with different degrees of severity are included, due to variation across studies. We did not review studies of category-specific deficits and aspects related to bilingual aphasia. However, we assume that most speakers of Galician and of Catalan also speak Spanish and therefore are bilingual. Spontaneous speech studies were only included when no controlled experimental tasks were available.

This paper is structured as follows: a general picture of the theories that account for morphosyntactic deficits in aphasia is provided. Afterwards, we describe some particularities of the morphosyntax of Ibero-Romance and the aphasiological evidence in non-fluent aphasia. We focus our attention on the use of verb argument structure and verbal morphology, sentential negation and word order, definite articles, personal and reflexive pronouns, passives, topicalised constructions, questions, and relative clauses. A discussion

Figure 1. Number of studies per Ibero-Romance varieties and themes discussed. VA&M = Verb argument structure and morphology; SN&WO = Sentential negation and word order; ART = definite articles; PRO = personal and reflexive pronouns; PASS = passives; TOPC = topicalised constructions; Q = questions; RC = relative clauses.

of relevant findings is given while considering theoretical accounts of morphosyntax in aphasia.

2. Theoretical accounts of morphosyntax in aphasia

The distribution of impaired and spared morphosyntactic skills in the speech of non-fluent individuals with aphasia has motivated several explanations based on linguistic theory. A general distinction separates structural/representational accounts from processing accounts. Structural/representational accounts regard morphosyntactic impairments as a loss of linguistic knowledge at one or more levels, resulting on atypical linguistic representations and processes. According to the tree pruning hypothesis (Friedmann, 2001; Friedmann & Grodzinsky, 1997), syntactic representations above the tense node are inaccessible. This way, individuals with aphasia may fail to construct phrase markers or to inflect verbs for tense. Differently, Wenzlaff and Clahsen (2004) considered that patients are able to access the *t(ense)/infl(ection)* node, but the interpretable feature of *[±past]* hosted in this node is underspecified. These authors introduced the tense underspecification hypothesis (TUH). Burchert, Swoboda-Moll, and De Bleser (2005) expanded the TUH concept: either Tense or Agreement inflection may be selectively impaired (tense and agreement underspecification hypothesis, TAUH).

Faroqi-shah and Thompson (2007) and Faroqi-Shah and Dickey (2009) also proposed that morphosyntactic features that require a semantic interpretation (e.g., tense, as opposing to agreement) are impaired in agrammatism. While the TUH proposes that tense is underspecified, these authors consider that agrammatic speakers fail in diacritic encoding and retrieval (DER), which includes the selection of semantically appropriate diacritical features and the linkage of these features to the correct verb form. In a more neuropsychological perspective, it has been argued that verb morphology may be processed in a single or dual mechanism. A single mechanism (e.g., Joanisse & Seidenberg, 1999) entails the full listing in the lexicon of all possible morphological variations of a verb. Differently, a dual-mechanism hypothesis falls between representation and processing accounts (e.g., Clahsen, 1999): it ascertains that full listing occurs for irregular verbs; for regular verbs, only the verb stems and the possible inflections are stored, and these are combined through the use of a default rule, and thus grammatical processes are necessary to form inflected regular verbs.

A general criticism to structural accounts is that they fail to explain one central characteristic of the language pattern of individuals with aphasia: language performance is inconsistent. An absolute lack of knowledge entails a consistent error pattern, that is, if individuals are unable to retrieve tense information, then correct tense production is not expected to occur. According to the processing accounts, which are described in the following paragraphs, linguistic knowledge is not lost in aphasia, but its processing may be difficult due to a reduction of the processing resources available for language.

Kok, Doorn, and Kolk (2007) argued that the performance of agrammatic speakers in tense and agreement tasks is affected by task complexity, as measured with the number of linguistic operations necessary to perform each task. According to Avrutin (2006), syntactic processing is weakened in aphasia due to this lack of resources and consequently, it becomes slower. Individuals with aphasia may also rely on additional sources of information such as linguistic discourse. Crucially, the resort to different levels of information may originate competition between these levels, resulting in variability in language performance. The integration problem hypothesis (Yarbay Duman & Bastiaanse, 2009) also states that, whereas integration of several layers of information is highly

automatic in the intact language system, it is very problematic for individuals with agrammatic Broca's aphasia. This is thought to occur also during the use of past tense verb morphology, where a link must be established between the time in which the sentence is uttered and the time that the verb form refers to, hence requiring integration of syntactic with discourse-based information (Bastiaanse et al., 2011).

Piñango (2000) provided further evidence that syntactic processing is slower in aphasia, introducing the slow syntax hypothesis (SSH). The author stated that when syntactic linking of N(oun)P(hrase)s and their syntactic roles is slowed down, semantic linking occurs before syntactic linking. Given that linear semantic linking attributes the thematic roles in linear order (i.e., agent role to the first NP and theme to the second), this mechanism results in errors in non-canonical sentences such as passives.

Several accounts attribute the symptoms observed in aphasia to disruption in the application of specific syntactic operations. According to the trace deletion hypothesis (Grodzinsky, 2000), the deficit is related to movement operations. Although language representations are thought to be otherwise normal, the markers of syntactic movement (i.e., traces), which allow tracking back the thematic roles of moved NPs in passive sentences and other constructions, are missing. Without these markers, individuals with aphasia assign thematic roles to the moved constituent assuming a canonical word order. The derived order problem hypothesis (DOP-H; e.g., Bastiaanse, Koekkoek, & Van Zonneveld, 2003) is also based on the idea that sentences in which the verb or the object are not in their canonical position are more difficult to produce and comprehend for individuals with Broca's aphasia. However, the deficit is specifically linked to processing requirements. A different interpretation of movement errors comes from Gavarró (2002). Considering that Move is a composite operation of Agree, the author claimed that agrammatic symptoms result at least partially from inability to apply the operation Agree.

Yet another hypothesis, the hierarchy complexity hypothesis (Pancheva & Ullman, 2001) is based on the assumption that the operation Merge (i.e., putting together syntactic units and forming progressively larger units out of smaller ones) is impaired in non-fluent aphasia. According to this hypothesis, Merge of larger units is more difficult to compute than Merge of smaller units. This is due to differences in structural complexity: larger units have embedded several structures that require further Merge operations. This generates a within-subject hierarchy of impairment.

In the following sections, we report data from Ibero-Romance studies targeting varied morphosyntactic skills. Later, we discuss them in the light of the theoretical accounts for morphosyntactic deficits in aphasia.

3. Verbal morphology and argument structure

Ibero-Romance varieties have a rich inflectional system. Finite verbs consist of a verbal root indicating meaning; a thematic vowel signalling the verbal conjugation; and markers encoding tense, mood, person, and number:

- (1) Sp: Cantaremos.

*cant*_{verbal.root}-*a*_{thematic.vowel}-*re*_{tense.future}-*mos*_{person.number.agreement}

We will sing.

The four languages we reviewed have verbal forms for simple present, simple past, imperfect past, simple future, and simple conditional for the indicative mood as well as simple present, imperfect past, and simple future for the subjunctive mood. A particularity

of Catalan is that it includes a periphrastic form of the simple past that coexists with a simple one (*canti/vaig cantar*, “I sang”). Galician and Portuguese have a simple pluperfect form (*estudara*, “had studied”) and inflected infinitives marked for agreement in embedded clauses (Longa, 1994; Raposo, 1987) (2). Each Ibero-Romance variety has six agreement markers indicating person and number (three markers for the singular and three for the plural). These markers are not always morphophonologically represented in the same way.

- (2) Gal: De acabares axiña, iría a recollerte.
of finish_{inf.2nd.sg}soon go_{cond.1st.sg} to pick-up_{inf}you
 If you finished soon, I would go to pick you up.

Compound tenses and verbal periphrases require a verb in a non-finite form preceded by an auxiliary that stands as the bearer of person and number (Cartagena, 1999; Gómez-Torrego, 1999). Catalan and Spanish use the auxiliary “to have” and the past participle of the main verb (Spanish: *he comido* “(I) have eaten”). Galician and Portuguese have been traditionally accepted to lack compound tenses. However, Veiga (1991) and Giorgi and Pianesi (1997) argued that Galician and Portuguese create verbal periphrasis with the verb *ter* (from Latin *tenere* “to have”) as a substitute of *haber* “to have.”

- (3) Gal: Teño comido con Maria moi amiudo.
have_{pres.1st.sg}eaten with M. very often
 I have been eating with Mary very often.

Periphrastic forms include an inflected modal or aspectual verb that bears tense, person, and number morphology, and that is linked to a non-finite verb form (infinitive, gerund, or past participle). The link can be made through a preposition, a complementiser, an adverb, or the subject in the case of interrogatives:

- (4) Sp.: ¿Puede alguien decirnos cómo llegar?
Can someone tell_{inf.us} how get_{inf}
 Can somebody tell us how to get there?

According to the type and number of arguments, verbs can be classified as unergatives, unaccusatives, transitives, and ditransitives (Burzio, 1981, 1986; Perlmutter, 1978). Some verbs present alternating transitivity; they may be transitive or intransitive depending on the context:

- (5) Sp.: a. María rompió el vaso. (transitive)
M. break_{pret.3rd.sg} the glass
 Mary broke the glass.
 b. El vaso se rompió. (unaccusative)
the glass CLITIC break_{pret.3rd.sg}
 The glass broke.

As seen in (5b), unaccusatives may require the use of a clitic element *se* which is homophonous to the third person singular reflexive form (Grimshaw, 1982; Reinhart, 2000). This occurs as well with unergative verbs and may be obligatory, banned, or optional depending on the verb. The set of verbs requiring a reflexive varies cross-linguistically.

3.1. *The verb in Ibero-Romance non-fluent aphasia*

Peres (1979) studied the spontaneous speech of Portuguese individuals with aphasia. From the subset of four individuals with non-fluent aphasia, four omitted verb phrases, whereas only two omitted other types of phrases, in line with posterior suggestions that verb production can be selectively impaired (see Miera, 1996; Peña-Casanova, Diéguez-Vide, Lluent, & Böhm, 2001; and Almagro-Cardenete, 2002; for Catalan and Spanish).

Diéguez-Vide (1993) studied the production and comprehension of verbs in relation to conjugation (first, second, and third conjugation) and regularity (regular and irregular) in Spanish-Catalan speakers with agrammatism and found no differences for either conjugation or regularity. Absence of differences between regular and irregular forms in Spanish is also reported in Rosell (2005) and Cuetos-Vega, Domínguez, Baauw, and Berthier (2007) (18.40% correct regular vs. 16.80% correct irregular forms), who also documented verb omissions (41% of errors) and tense substitutions (26% of errors). On the contrary, de Diego Balaguer (2003) and de Diego Balaguer, Costa, Sebastián-Galles, Juncadella, and Caramazza (2004) analysed the production of Catalan-Spanish speakers with agrammatism and found that regular verbs are better preserved across languages and tasks (88.2% correct regular forms vs. 53.6% correct irregular forms).

Regarding tense morphology, Peres (1979) documented that three of the four Portuguese non-fluent participants studied produced tense errors, one of which additionally produced aspectual errors. In the same analysis of spontaneous speech, the author reported that two participants produced subject–verb agreement errors. Importantly, one participant produced agreement errors, but no tense errors. A dissociation between tense and agreement has also been reported by Benedet, Christiansen, and Goodglass (1998). Tense substitutions accounted for 90–95% of the responses in the Spanish-speaking group, while only 35–40% of agreement substitutions were attested. Even though most studies are consistent in finding greater deficit for tense than for agreement (Diéguez-Vide, Gich-Fullà, Puig-Alcántara, Sánchez-Benavides, & Peña-Casanova, 2012; Gavarró & Martínez-Ferreiro, 2007; Martínez-Ferreiro, 2003, 2010; Moreno-Torres Sánchez, 2005), the opposite pattern (Peres, 1979) or similar degrees of impairment (Cerdeira, 2006) are also reported.

Other authors looked at tense morphology and focused on the production and comprehension of simple and periphrastic verbs in the present, past, and future tenses. Diéguez-Vide (1993) revealed that the present tense is not normally impaired (0% to 20% errors in the different tasks) and the past and the future are similarly impaired (past tense: 10% to 25% errors in repetition and comprehension and 87% errors in production; future tense: 5% errors in repetition, 45% in comprehension, and 27% and 97% in each production task). Rosell (2005) and Martínez-Ferreiro and Bastiaanse (2013) confirmed that the present is less impaired than the other tenses for Spanish, Catalan, and Galician. However, Martínez-Ferreiro and Bastiaanse (2013) reported that the past is more impaired than the future (78.2% correct present, 69.8% correct future, and 49% correct past), in line with previous studies (Martínez-Ferreiro, 2010). Rofes, Bastiaanse, and Martínez-Ferreiro (2014) studied the production of the conditional and the future tense in Catalan *if*-sentences. These authors also found that tenses indicating past reference are significantly more impaired than tenses referring to the future in Catalan speakers with Broca's and transcortical motor aphasia.

Regarding the nature of errors, omissions and substitutions coexist, and there is evidence for the prevalence of both at the individual level. Diéguez-Vide (1993) and de Diego Balaguer et al. (2004) noted preference for tense omissions. On the other hand,

Benedet et al. (1998), Cerdeira (2006), Diéguez-Vide, Gich-Fullà, Puig-Alcántara, Sánchez-Benavides and Peña Casanova (2012), Gavarró and Martínez-Ferreiro (2007), Martínez-Ferreiro (2003, 2010), Moreno-Torres Sánchez (2005), and Rosell (2005) noted a preference for substitutions. The pattern of substitutions, however, is clearer: plural markers in verbs are substituted by singular markers (Diéguez-Vide, 1993) and past markers by present markers (Diéguez-Vide, 1993; Martínez-Ferreiro, 2010; Martínez-Ferreiro & Bastiaanse, 2013). A summary of results per study and language is given in Table 1.

A less addressed topic is the dissociation between auxiliary verbs and verbal periphrases. Miera (1996) and Benedet et al. (1998) found that the verbs “to be” and “to have” are problematic in Spanish (with percentages of correct performance ranging from 20% to 25% in the latter study). These results are replicated for Spanish and Catalan in Bastiaanse, Rispens, Ruigendijk, Juncos-Rabadán, and Thompson (2002), Rosell (2005), and Martínez-Ferreiro (2010). Rosell (2005) reported a clear preference for the usage of simple forms in the spontaneous speech of individuals with agrammatism (77.94% simple tenses; 5.69% compound tenses). Martínez-Ferreiro (2010) found impaired production of verbal periphrases. A dissociation was found in this task between mild and moderate agrammatic individuals for the number of errors and for the strategies used: the individual with moderate aphasia tended to respond with *don't know* or to produce verbless structures, whereas the individuals with mild aphasia produced finite sentences in all cases. Table 2 includes a summary of results per study and language.

Sánchez-Alonso, Martínez-Ferreiro, and Bastiaanse (2011) and Martínez-Ferreiro, Bachrach, Sánchez Alonso, and Picallo (2014) found an effect of verb argument structure in action verbs. In elicited production, unergative and reflexive verbs were better preserved than transitives, and transitives were better preserved than unaccusatives. For verbs of alternating transitivity, the transitive reading was easier than the intransitive. The effect of argument structure was found to prevail in the absence of context. The pattern described earlier was also attested at the single-word level, i.e., when verbs are presented as singletons (e.g., in a naming task; Thompson, Lange, Schneider, & Shapiro, 1997). See Table 3.

Martínez-Ferreiro et al. (2014) found similar results using psychological verbs. Percentages of correct responses for intransitive forms were as low as 11.8% in elicited production and 38% in a forced-choice task (vs. 57.6% and 80%, respectively, for transitive forms).

4. Sentential negation and word order

Ibero-Romance varieties express sentential negation syntactically (Zeijlstra, 2004). Galician, Portuguese, and Spanish use a single negative adverb placed before the verb. Some varieties of Catalan may show the negative adverb *pas* before or after the verb in addition to the negative and preverbal adverb *no* (Espinal, 1991, 2002). This is shown in (6). Otherwise, Catalan behaves like the other Ibero-Romance varieties.

- (6) Cat: La Sara no va (pas) menjar (pas).
 the S. not aux_{pres.3rd.sg} (neg.adv) eat_{inf} (neg.adv)
 Sara did not eat.

Table 1. Summary of verbal inflection results across studies and languages.

Study	Language	N [†]	Task	Tense errors	Agreement errors	Main error type
Peres (1979)	Portuguese	4	Spontaneous speech	2/4	2/4	*
Diéguez-Vide (1993)	Spanish	3	Repetition	*	*	Omission
			Comprehension	*	*	Omission
			Elicitation (I)	*	*	Omission
			Elicitation (II)	*	*	Omission
Benedet et al. (1998)	Spanish	6	Oral production subtests	94.5%	35–40%	Substitution
Peña-Casanova et al. (2001)	Catalan	1	Spontaneous speech + BAT	*	*	Finiteness
Martínez-Ferreiro (2003)	Catalan	7 ⁺	Delayed repetition	6%	1.4%	Omission Substitution
	Spanish	7	Sentence completion	18%	5.1%	Substitution
			Delayed repetition	2%	0.9%	Substitution
			Sentence completion	25.7%	10.9%	Substitution
de Diego Balaguer et al. (2004)	Catalan	2	Morphological transformation task	16.2%	0.7%	DKs
	Spanish	2	Morphological transformation task	2.1%	2.6%	DKs
Moreno-Torres Sánchez (2005)	Spanish	10	Sentence completion	25%	17%	Substitution
			Grammaticality judgement			—
Rosell (2005)	Spanish	9	Repetition	29.3%	28.9%	Substitution
			Sentence completion	53.3%	54%	Substitution
Cerdeira (2006)	Portuguese		Delayed repetition	41%	41%	Substitution
			Sentence completion	48%	45%	Substitution
Gavarró and Martínez-Ferreiro (2007)	Galician	7	Delayed repetition	1.4%	0.6%	Substitution
	Spanish	7	Sentence completion	41.7%	8.9%	Substitution
			Delayed repetition	2.6%	0.3%	Substitution
			Sentence completion	28.9%	13.1%	Substitution
Martínez-Ferreiro (2010)	Catalan	5	Elicitation	14.5%	5.7%	Substitution
			Forced choice	17.6%		—
		1	Elicitation	88%	84%	Omission
		MOD				
			Forced choice	52%		—
	Galician	5	Elicitation	15.6%	0.8%	Substitution
			Forced choice	13.6%		—
	Spanish	5	Elicitation	13.6%	0.8%	Substitution
			Forced choice	16.8%		—

Notes: Notice that individuals vary across studies as for the degree of severity of their deficits.

[†]N = number of participants. *No data available. ⁺The same subjects were analysed in Gavarró and Martínez-Ferreiro (2007).

BAT: bilingual aphasia test (Paradis & Libben, 1987)—Catalan and European Spanish version: J. Elías, modified by M.I. Gómez-Ruiz; Galician version: M. González Gil, O. Juncos Radadán, L. Pellitero, H. Puente, X. Rodríguez, N. San José, and X. Valladares; MOD: moderate agrammatic subject (as reported by author); DKs: don't know responses.

Table 2. Summary of complex verbal clusters across studies and languages.

Study	Language	N	Task	Auxiliary errors	Main error type
Benedet et al. (1998)	Spanish	6	Morphosyntax battery ⁺ production	75–80% 30–35%	Omission —
Bastiaanse et al. (2002)	Spanish	2	Comprehension Anagrams—pictures	Positive: 80% Negative: 50%	Misplacement
Martínez-Ferreiro (2010)	Catalan	5	Elicitation compound tenses	12.3%	Tense substitution
			Elicitation verbal periphrases	48.3%	Omission
		1 MOD	Elicitation compound tenses	84.6%	Omission
			Elicitation verbal periphrases	100%	Omission
	Galician	5	Elicitation verbal periphrases	44%	Omission
	Spanish	5	Elicitation compound tenses	26.7%	Omission
			Elicitation of verbal periphrases	36.7%	Omission

Notes: Positive/negative actives/passives: including or not sentential negation; MOD: moderate agrammatic subject (as reported by author).

⁺Translated from the original English version by Goodglass, Christiansen, and Gallagher (1993).

Table 3. Summary of argument structure results across studies.

Study	Language	N	Task	Unergative errors	Transitive errors	unaccusative errors
Sánchez-Alonso et al. (2011)	Spanish	11	Sentence completion	25%	46.9%	48.7%
Martínez-Ferreiro et al. (2014)	Spanish	6	Naming	36.7%	64.6%	62.4%
			Sentence completion	43.3%	58.3%	71.2
			Forced choice		13.6%	50%

4.1. Negation in Ibero-Romance non-fluent aphasia

Bastiaanse et al. (2002) found that negative sentences were more impaired than affirmative constructions in actives, passives, and sentences with present perfect tense. Errors consisted in the misplacement of the negative marker at the end of the sentence or in the replacement of sentential negation with constituent negation. Juncos-Rabadán, Pereiro, and Souto (2009) reported the same disruption for Galician and Spanish active and passive constructions. Contrarily to the high error rates reported in these studies, Martínez-Ferreiro (2010) recounted spared production of

Table 4. Summary of negation results across studies and languages.

Study	Language	N	Task	Negation errors	Main error type
Bastiaanse et al. (2002)	Spanish	2	Anagrams + pictures	66%	Misplacement
			Anagrams – pictures	Actives: 90%	Misplacement
				Passives: 100%	Misplacement
Juncos-Rabadán et al. (2009)	Galician	14	BAT	PPT: 80%	Misplacement
				Actives: 52.4%	—
		14	Comprehension BAT	Passives: 60.1%	—
Martínez-Ferreiro (2010)	Catalan	5	Comprehension Elicitation task	Actives: 67.5%	—
				Passives: 67.3%	—
	Galician	5	Elicitation task	0.8%	Omission
		1 MOD	Elicitation task	4%	Omission
		5	Elicitation task	2.8%	Omission
	Spanish	5	Elicitation task	4%	Omission

Note: PPT: perfect tense sentences; BAT: bilingual aphasia test; MOD: moderate agrammatic subject (as reported by author).

negation in participants with mild and moderate aphasia, during the production of canonical sentences (Table 4).

5. Definite articles

Definite articles indicate finiteness, gender, and number. For that matter, they are inflected for gender (masculine/feminine) and number (singular/plural). Galician and Portuguese share the same inventory (singular masculine/feminine: *o/a*; plural masculine/feminine: *os/as*) and Catalan and Spanish partially coincide (Catalan singular masculine/feminine/ elided form: *el/la/l'*; plural masculine/feminine: *els/les* vs. Spanish singular masculine/feminine: *el/la*; plural masculine/feminine: *los/las*). Definite articles are normally used in combination with nouns, and they can also appear with proper names. In this last case, their degree of acceptability differs across varieties: in Catalan and Portuguese, definite articles followed by proper names are frequent (Catalan: *la Maria*; Portuguese: *A Maria*); in Spanish, this is restricted to colloquial varieties.

5.1. Definite articles in Ibero-Romance non-fluent aphasia

Peres (1979) reported determiner repetition errors in the spontaneous speech of two out of four Portuguese speakers with non-fluent aphasia. Peña-Casanova et al. (2001) and Diéguez-Vide et al. (2012) found that Spanish speakers with non-fluent aphasia produced both omissions and substitutions of definite articles during (semi-)spontaneous speech. Arsenijević, Martínez-Ferreiro, and Rofes (2011) found similar results in the production of mild and moderate Catalan speakers with agrammatism. Definite articles heading subject determiner phrases (DPs) were better preserved than those in object DPs. Interestingly, the forms that are less common (plural and feminine) were preferred in substitution for the target forms. Table 5 includes a summary of the results.

Table 5. Summary of results for definite articles across studies.

Study	Language	N	Task	Article errors	Main error type
Peres (1979)	Portuguese	4	Spontaneous speech	1/3	Repetition
Diéguez-Vide (1993)	Spanish		Repetition	3.7%—Subject	Omission
		3	Comprehension	0%—Object	Substitution
			Elicitation (I)	5.6%	—
				8.6 %	Omission
				17.48%	Substitution
			Elicitation (II)	64.55%	Omission
				15.66%	Substitution
Peña-Casanova et al. (2001)	Catalan	1	Spontaneous speech	*	Omission
Arsenijević et al. (2011)	Catalan	5	Repetition	0%—Subject	—
			Elicitation	0%—Object	—
				4%—Subject	Substitution
				0%—Object	—
		1 MOD	Repetition	25%—Subject	Substitution
			Elicitation	100%—Object	Omission
				41.7%—Subject	Substitution
				83.3%—Object	Omission
Diéguez-Vide et al. (2012)	Spanish	1	Picture description	*	Omission

Notes: MOD: moderate agrammatic subject (as reported by author).

*Data not available.

6. Personal and reflexive pronouns

In Ibero-Romance, personal and reflexive pronouns are monosyllabic, phonologically dependent elements which occupy an unstressed position close to the verb to which they are adjoined (Duarte & Matos, 2000). The opposition between reflexive and non-reflexive forms is only expressed in the third person, where reflexive pronouns are not subject to gender and number variation. Third-person non-reflexive forms are variable so that their antecedents can be traced back (Portuguese: reflexive pronoun *-se* vs. personal pronouns *-o, -a, -os, -as*). First- and second-person accusative clitics are invariable forms in all cases (Portuguese: *me, te, os, vos*).

Catalan and Spanish object pronouns and reflexives occur in pre-verbal position with finite forms and post-verbally with non-finite forms and imperatives. In Galician and Portuguese, in positive declarative sentences with canonical order of constituents, they tend to occupy a post-verbal position (7).

- (7) Reflexive: Cat: *S'ha vist/Veure's*.
 Port: *Viu-se/Ver-se*.
 'S/he has seen *herself* / To see *herself*'
- Non reflexive: Gal: *Vixiábaa/Vixiala*.
 Sp: *La vigilaba/Vigilarla*.
 'I/He/She watched over *her* / To watch over *her*'

6.1. Personal and reflexive pronouns in Ibero-Romance non-fluent aphasia

Juncos-Rabadán, Pereiro, and Souto (2001) found that Galician individuals with Broca's aphasia performed at chance in the bilingual aphasia test (BAT) subtests with object pronouns in pre- and post-verbal position. Errors were more frequent with singular than with plural forms. Similar results are reported in Juncos-Rabadán et al. (2009).

A dissociation between personal pronouns in object position and reflexive pronouns has been documented in Catalan, Galician, and Spanish (Baaui & Cuetos, 2003; Gavarró, 2008; Martínez-Ferreiro, 2010; Sánchez-Alonso et al., 2011). Diéguez-Vide et al. (2012) also found omissions of personal pronouns and their substitution by reflexive forms in Catalan. The results show that reflexives are better preserved than direct object clitics in production and comprehension. See Table 6 for a summary.

7. Non-canonical structures

The canonical order in Ibero-Romance varieties is subject–verb–object (SVO). In spite of this consistency, there is some variation across languages in certain constructions. For instance, in constructions that allow post-verbal subjects to appear in declarative and

Table 6. Summary of direct object clitic and reflexive results across studies and languages.

Study	Language	N	Task	Clitic errors	Reflexive errors	Main error type
Juncos-Rabadán et al. (2001)	Galician	12	Forced choice	55–60%	—	—
		2	Grammaticality judgement	18 ⁺	—	—
Baaui and Cuetos (2003)	Spanish	4	Truth value judgement task	32.25%	17.5%	—
Gavarró (2008)	Catalan	3	Truth conditional task	19.3%	0%	—
Juncos-Rabadán et al. (2009)	Galician	14	BAT: Comprehension	55.1%	—	—
	Spanish	14	BAT: Comprehension	63.3%	—	—
Martínez-Ferreiro (2010)	Catalan	5	Elicitation	60%	16.7%	Omission
		1	Forced choice Elicitation	7.7% 100%	6.7% 100%	— Omission
		MOD	Forced choice	66.7%	7.7%	—
	Galician	5	Elicitation	46.1%	16.7%	Omission
	Spanish	5	Forced choice Elicitation	18.5% 69.2%	6.7% 11.7%	— DO clitic: Repeated DP
Sánchez-Alonso et al. (2011)	Spanish	11	Forced choice	6.1%	10%	—
			Sentence completion	70.3%	25%	DO clitic: Repeated DP Reflexive: Omission

Notes: DO: direct object; DP: determiner phrase; BAT: bilingual aphasia test; MOD: moderate agrammatic subject (as reported by author).

⁺Total number of errors across conditions.

interrogative sentences (Belletti and Leoni, 2004; Rizzi, 1982), the subject must follow all complements in Catalan (e.g., *Avui portarà *en Marc el diari/el diari en Marc* “Today Marc will buy the journal”), but in Spanish, different positions with respect to verbal complements are allowed (Ordoñez, 2007; Solà, 1992). However, data from four Spanish patients and one Catalan-speaking patient indicate that the post-verbal subject construction is not preferred, as non-fluent individuals reported by Almagro-Cardenete (2002) showed a clear preference for SVO order in elicited production. In this section, we review constructions violating the SVO pattern: reversible passives, topicalised constructions, and questions.

7.1. Passive sentences

Passive sentences are low-frequency structures in the varieties under investigation. These constructions provide valuable data relative to the processing of constituent movement. In passive sentences, the semantic agent occupies the final position in the form of an optional *by*-phrase and loses its function as syntactic subject. The passive voice is expressed with the auxiliary verb *ser* “to be” + past participle. The past participle must agree with the subject of the verb in gender and number in almost all Ibero-Romance varieties. In Galician, however, the periphrastic form *estar a ser* “to be being” + past participle is generally preferred in oral registers (8) (Álvarez, Monteagudo, & Regueira, 1986).

- (8) Gal: As mazás están a ser comidas por María
 the apples_{fem.pl} *be_{pres.3rd.pl} at be_{INF} eat_{pp,fem.pl}* *by Mary*
 Apples are being eaten by Mary.

7.2. Passive sentences in Ibero-Romance non-fluent aphasia

Benedet et al. (1998) and Miera and Cuertos (1998) reported that Spanish speakers performed at chance with passive constructions. Similar results were obtained in later studies: Beretta et al. (2001) and Martínez-Ferreiro et al. (2014) for Spanish, Juncos-Rabadán et al. (2009) for Spanish and Galician, and Gavarró and Romeu (2010) and Gavarró and Dotti (2014) for Catalan. Contrary to these, Bastiaanse et al. (2002) reported percentages of error almost at ceiling for Spanish passive sentences.

Miera and Cuertos (1998) also found a dissociation between passive sentences and object–verb–subject (OVS) structures in Spanish. The latter were better produced than passives (37.5% vs. 67% errors) but worse than actives (24% errors). Contrary to this, Peña-Casanova et al. (2001) reported data of one Catalan speaker with aphasia whose comprehension of passive sentences was better preserved than his comprehension of verb–subject–object (VSO) sentences (100% correct). In production, the patient replaced both passives and VSO constructions by the canonical SVO structure. Additionally, scrambled actives and passives are analysed in Beretta et al. (2001). The results (45% and 35% errors, respectively) indicate that the active–passive dissociation also fades in these contexts. A summary of results is available in Table 7.

7.3. Topicalised constructions

Different constituents, including subjects and objects, can appear in topicalised positions. In Ibero-Romance, these are constructions where what is being talked about (i.e., the topic) appears at the front of the sentence. See “tiempo” in sentence (9).

Table 7. Summary of active and passive results across studies and languages.

Study	Language	N	Task	Active errors	Passive errors	Main error type
Benedet et al. (1998) Miera and Cuetos (1998)	Spanish	6	Morphosyntax battery ⁺	36.6%	38.3%	Active sentences
	Spanish	4	SPM: Short sentences	25%	66%	—
Peña-Casanova et al. (2001) Beretta et al. (2001) Bastiaanse et al. (2002)	Catalan	1	Long sentences	23%	68%	—
	Spanish	2	BAT: Comprehension of passives	*	20%	Active sentences
	Spanish	2	Sentence–picture matching	25%	42.5%	—
	Spanish	2	Anagram task—pictures	Positive: 0% Negative: 90%	Positive: 100% Negative: 90%	*
Juncos-Rabadán et al. (2009)	Galician	14	BAT: Comprehension of passives	Positive: 13.2% Negative: 52.4%	Positive: 50.5% Negative: 60.1%	—
	Spanish	14	BAT: Syntactic comprehension	Positive: 14.8% Negative: 67.5%	Positive: 41.1% Negative: 67.3%	—
Gavarró and Romeu (2010) Gavarró and Doti (2014)	Catalan	4	Comprehension	20.8%	46.6%	—
	Catalan	7	Truth-value judgement task	16.7%	Long: 46.2% Short: 47.1%	—
Martínez-Ferreiro et al. (2014)	Spanish	6	Auditory sentence–picture matching task	28.3%	45%	—

Notes: SPM: sentence–picture matching; long/short passives: with or without by phrase; positive/negative actives/passives: including or not sentential negation; BAT: bilingual aphasia test.

⁺Translated from the original English version by Goodglass et al. (1993); *Data not available.

Table 8. Summary of topicalised constructions results across studies.

Study	Language	N	Task	Subject topic errors	Object topic errors
Juncos-Rabadán et al. (2009)	Galician	14	BAT: Comprehension of passives	35.7%	73.8%
	Spanish	14	BAT: Syntactic comprehension	33.3%	57.2%
Salmons and Gavarró (2013)	Catalan	10	Picture-matching task	7.8%	67.2%

- (9) Sp: **Tiempo** tiene a montones.
time (s/he) have_{pres.3rd.sg} to piles
 S/he has a lot of time.

7.4. Topicalised constructions in Ibero-Romance non-fluent aphasia

Miera (1996) reported comprehension problems associated to moved constituents and sentences in which the canonical order was altered for Spanish. In a later study, Juncos-Rabadán et al. (2009) found that constructions with topicalised objects were harder to comprehend than constructions with topicalised subjects. In their analysis, both constructions lead to many errors in Galician and Spanish. Salmons and Gavarró (2013) found the same pattern in Catalan. In this case, the error rates for topicalised subjects were similar to those attested for ordinary SVO sentences (8.1% errors). The results are summarised in Table 8.

7.5. Questions

We restricted our discussion to direct question formation because, to the best of our knowledge, there are no studies discussing disjunctive, echo, and multiple interrogatives. Ibero-Romance *wh*-questions are headed by an interrogative operator in sentence initial position. The subject of *wh*-questions cannot intervene between the *wh*-phrase and the verb and it cannot occupy a position between the auxiliary and the main verb (Cardinaletti, 2007). *Wh*-phrases and topicalised constructions cannot be fronted in the same clause. Negation, frequency adverbs, and aspectual adverbs such as *still* or *never* can be inserted between the *wh*-element and the verb (Barbosa, 2001; Zagona, 2002).

Wh-questions are divided into argumental and non-argumental depending on the information they request. Non-argumental *why* questions show a particular behaviour in what concerns V-fronting. V-fronting is obligatory for argumental questions. Differently, in *why* questions, both pre- and post-verbal subjects may be accepted as grammatical, at least in Galician and Spanish (Rizzi, 1990, 2001). Additionally, the *why* operator can co-occur in a topicalised construction. Example (10) illustrates the three alternative subject positions (“os nenos” = the kids):

- (10) Gal: Por qué (os nenos) van (os nenos) ó parque (os nenos)?
Why do the kids go to the park?

Yes/no interrogatives differ from *wh*-interrogatives in that they require an affirmative or a negative answer. Also, in *yes/no* interrogatives adverbs and topicalised elements are allowed between the verb and the interrogative operator (Cruschina, 2007). Importantly,

Table 9. Summary of question production results across studies.

Study	Language	N	Task	Wh-questions	Yes/no questions	Wh-words
Martínez-Ferreiro (2010)	Catalan	5	Elicitation	40%	28.3%	
		1 MOD	Sentence–picture matching	7.7%		3.3%
			Elicitation	92.3%	100%	
	Galician	5	Sentence–picture matching	38.5%		7.7%
			Elicitation	55.4%	48.3%	
	Spanish	5	Sentence–picture matching	9.2%		6.7%
			Elicitation	47.7%	20%	
			Sentence–picture matching	6.1%		3.3%

Note: MOD: moderate agrammatic subject (as reported by author).

these sentences can be constructed using intonation (SVO) and, although this is not compulsory, by changing the order of constituents (VSO/VOS). Therefore, some authors argue that *yes/no* interrogatives may not require inversion (Ordoñez, 1996; Payrató, 2002; Suñer, 1994; Wheeler, Yates, & Dols, 1999; Zagona, 2002).

A singularity of Catalan is that, in some dialects, *yes/no* questions can be headed by the complementiser *que* (11) (Payrató, 2002; Rigau, 1998).

- (11) Cat: Que hi ha una esquerda al sostre?
INT there is a fissure in-the ceiling
 Is there a fissure in the ceiling?

7.6. Questions in Ibero-Romance non-fluent aphasia

Martínez-Ferreiro (2010) revealed a dissociation between the comprehension and production of questions in Catalan, Spanish, and Galician, with comprehension being better preserved. In production, participants with mild aphasia showed better performance for *yes/no* questions than for *wh*-questions. The pattern of errors was also different across question types. *Yes/no* questions were mainly substituted by *why/how come* questions, while *wh*-questions were substituted by *yes/no* questions. In *yes/no* questions, a systematic avoidance of the overt operator *que* was attested in the Catalan agrammatic sample. No differences were found between argument and adjunct *wh*-questions. The results of a moderate agrammatic patient, speaker of Catalan, showed a general deficit in question production independently of question type. The results are summarised in Table 9.

In addition to production results, Table 9 also includes the results of a sentence–picture matching task judging the comprehension of subject/object questions with animate subjects and *wh*-words. Mild agrammatic subjects performed virtually perfectly for both question types. The individual with moderate agrammatic aphasia performed above chance for *wh*-question production and showed mastery of *wh*-word comprehension.

8. Relative clauses

Restrictive relative constructions are headed by relative pronouns that behave as modifiers of a nominal head, which serves as their antecedent (Bianchi, 2002, 2004; Brucart, 1999;

Solà, 2002). The relative constructions that are typically examined depend on the movement of one constituent from the embedded subject or object position and its co-indexation with a noun outside the relative clause (Chomsky, 1981, 1995). Consequently, relative clauses can also be classified according to the position from which constituents are moved: subject vs. object relatives. In some colloquial varieties, the position of the trace can be filled by a resumptive pronoun (12) (Pusch, 2006).

- (12) Gal: **A rapaza** que sua nai **a** peitea.
 the girl_i that her mother her_i comb_{pres.3rd.sg}
 The girl that her mother combs her.

The inventory of relative pronouns available for these constructions is similar to question words in Ibero-Romance including forms such as *que* or *a qui/a quen/a quem/a quien* in Catalan, Galician, Portuguese, or Spanish, respectively. In addition, they share the characteristic of appearing in initial position in the embedded clause (Zagona, 2002). The relative pronoun can be followed by an adverb, the verb, by another constituent, or by more than one element (13). This flexibility varies across Ibero-Romance varieties and dialects. The Catalan counterpart of (13) is dispreferred.

- (13) Sp: El restaurante donde ayer Andrés trabajó.
 the restaurant where yesterday Andrés worked.
 Cat: ??El lloc on ahir Andrés va treballar.
 the place where yesterday Andrés worked

As shown in the previous example, relative clauses admit pre-verbal subjects, although the inverted form is claimed to be the unmarked form (Sp: *la manzana que comió Juan* “the apples that John ate”) (Contreras, 1989). This is attributable to the application of the (free) subject inversion option operative in null subject languages (Belletti, 2004; Torrego, 1984).

8.1. Relative clauses in Ibero-Romance non-fluent aphasia

Miera and Cuetos (1998) reported 40% of errors in the production of relative clauses in four Spanish-speaking individuals with agrammatism in a sentence–picture matching task. Ferreira (2008) found no dissociation between the production of subject and object relatives in a group of Portuguese individuals with agrammatic aphasia, with both structures impaired (46.7% and 35% of correct responses, respectively). At the individual level though, a dissociation is documented in production with subject relatives better preserved for three out of the six subjects tested. Regarding error type, the omission of the complementiser was the most frequently attested mistake. Comprehension was found to be better preserved, but the pattern found in some individuals in the production task was replicated in the comprehension task at the group level: accuracy decreased with direct object relatives (73.2% comprehension errors).

In Catalan, Galician, and Spanish, the production of subject relatives was found to be impaired in Martínez-Ferreiro (2010). Errors consisted of omitting the relative pronoun by using a simple declarative. The only instance of object relative included in the design revealed an increase in the number of errors (53.3% errors). Results per study and language have been summarised in Table 10.

Table 10. Summary of embedding results across studies and languages.

Study	Language	N	Task	Subject-related errors	Object-related errors	Main error type
Ferreira (2008)	Portuguese	5	Picture description	53.3%	65%	Omission
			Preference task	0%	22.5%	—
Martínez-Ferreiro (2010)	Catalan	5	Elicitation	25.6%	80% ⁺	Omission
		1 MOD	Elicitation	100%	100%	Omission
	Galician	5	Elicitation	54.4%	60% ⁺	Omission
	Spanish	5	Elicitation	32%	60% ⁺	Omission

Notes: MOD: moderate agrammatic subject (as reported by author).

⁺Orientative: based in five responses.

9. Discussion

The production of verbs has been consistently found to be affected in non-fluent aphasia (Almagro-Cardenete, 2002; Miera, 1996; Peña-Casanova et al., 2001; Peres, 1979). Taken together, data on verbal morphology indicate no differences across conjugations (Diéguez-Vide, 1993), and contradictory results regarding the effects of regularity (Cuetos-Vega et al., 2007; Diéguez-Vide, 1993; Rosell, 2005; vs. de Diego Balaguer, 2003; de Diego Balaguer et al., 2004), which do not allow favouring single of dual-mechanism hypotheses (Clahsen, 1999; Joanisse & Seidenberg, 1999). Reports of dissociations between tense and agreement (Benedet et al., 1998; Gavarró & Martínez-Ferreiro, 2007; Martínez-Ferreiro, 2003, 2010; Moreno-Torres Sánchez, 2005; or Diéguez-Vide et al., 2012) can be explained with processing accounts such as the TUH (Wenzlaff & Clahsen, 2004) or the TAUH (Burchert et al., 2005), which ascertain that the specification of tense and/or agreement features may be selectively impaired. Notably, the differences between error rates for tense and agreement are not visible in sentence repetition (Table 1). This task effect may indicate that dissociations of tense and agreement can be mediated by task complexity, as suggested by Kok et al. (2007).

The direction of tense errors and the typology of errors of verbal morphology indicate strong trends in the preferred forms of substitution. The plural is substituted by the singular and the past tense by the present tense. Present tense morphology is overall less impaired than past and future morphology, and past morphology has been shown to be equally or more impaired than future morphology (Diéguez-Vide, 1993; Martínez-Ferreiro, 2010; Martínez-Ferreiro & Bastiaanse, 2013; Rofes et al., 2014; Rosell, 2005). These differences may be explained with processing accounts such as Bastiaanse et al. (2011), Kok et al. (2007), Avrutin (2006), Yarbay Duman and Bastiaanse (2009), and Piñango (2000). Past- and future-referring forms are more difficult to produce than present forms, probably because of the complexity they entail, which may be attributed to an impairment of overall syntactic processes and/or the integration of different levels of information. In particular, past tense production is thought to require integrating syntactic with discourse-based information (Bastiaanse et al., 2011).

Verb argument structure data (Martínez-Ferreiro et al., 2014; Sánchez-Alonso et al., 2011) indicate that unergatives and reflexives may be better preserved than transitives due

to a reduced number of arguments in the case of the former. The finding of transitives being better preserved than unaccusatives may relate to impairments of syntactic movement. These results are predicted by the argument structure complexity hypothesis (Thompson, 2003) and the DOP-H (Bastiaanse et al., 2003). According to these hypotheses, the number of arguments and their surface position (canonical vs. non-canonical) are key to determine their degree of preservation. However, Martínez-Ferreiro et al. (2014) findings with psychological verbs are not in line with these theories, as transitive verbs were found to be better preserved than intransitives. These results indicate that, in addition to argument structure, thematic roles have to be taken into consideration when accounting for the deficits in non-fluent aphasia. Those verbs whose theta grids contain an agent (e.g., *to chase*, which requires a performer of the action) are less impaired when there is argument movement than those containing an experiencer (e.g., *to amuse*, *to frighten*, which require a receiver of the input).

Leaving verbs aside, the production of definite articles has been found to be impaired (Arsenijević et al., 2011; Diéguez-Vide et al., 2012; Peña-Casanova et al., 2001; Peres, 1979). Patients produce both omission and substitution errors. Further research on definite articles is needed to clarify the patterns of impairment reported, such as a pattern of substitutions favouring low-frequency forms (Arsenijević et al., 2011). Other studies may also compare definite and indefinite articles. Definite articles are typically used when the noun has been already introduced in discourse. This may lead to larger processing costs for definite articles as it may require some sort of discourse linking that is not necessary for indefinite articles. This is in line with Avrutin (2000, 2006), where it is argued that discourse linking is susceptible to impairment in non-fluent aphasia, and the integration problem hypothesis (Yarbay Duman & Bastiaanse, 2009), which predicts larger impairment when multiple levels of information are incorporated.

A similar argument to that of definite articles may apply to pronouns and reflexives. The data indicate that object personal pronouns are more impaired, and that they are replaced by reflexives (Baauw & Cuetos, 2003; Diéguez-Vide et al., 2012; Gavarró, 2008; Juncos-Rabadán et al., 2001, 2009; Martínez-Ferreiro, 2010; Sánchez-Alonso et al., 2011). This may be the case because of processing costs. Personal pronouns are more demanding because they are bound to a referent outside the sentence (in discourse), whereas reflexives are bound to a reference within the same sentence. Interestingly, there is relation between pronoun type and argument structure. On the one hand, reflexive verbs are sometimes taken as unergative entries (see Reinhart & Siloni, 1999; and references cited therein). On the other hand, object clitics (found to be harder to produce for non-fluent individuals with aphasia) compulsorily appear in the context of a transitive verb. This complex interaction should be taken into account when designing stimuli aiming to test differences between reflexives and pronouns in Ibero-Romance.

The data of sentential negation is contradictory. Bastiaanse et al. (2002) and Juncos-Rabadán et al. (2009) found impaired negation. Martínez-Ferreiro (2010) did not. The studies that found effects were studies with non-canonical sentences. The study with canonical sentences did not find such effects. Here, the problems may be related to the use of non-canonical sentences and not the use of negation per se. Replication of the paradigm used by Martínez-Ferreiro (2010) seems relevant.

At the sentence level, even if the number of studies is more reduced, there seems to be a preference for canonical vs. non canonical structures and for simple vs. embedded sentences. This calls for an integrative account in line with Abuom, Shah, and Bastiaanse's (2013) who proposed that these factors are key to define the complexity of an utterance. Passive sentences are consistently found to be more impaired than actives in

the languages under investigation (Bastiaanse et al., 2002; Benedet et al., 1998; Beretta et al., 2001; Gavarró & Dotti, 2014; Gavarró & Romeu, 2010; Juncos-Rabadán et al., 2009; Martínez-Ferreiro et al., 2014; Miera & Cuetos, 1998). The same holds for OVS and VSO structures (Miera, 1996; Miera & Cuetos, 1998; Peña-Casanova et al., 2001). No data are available for Portuguese as for canonicity effects.

Regarding questions, Martínez-Ferreiro (2010) reported better performance for *yes/no* than *wh*-questions. Preserved comprehension overall indicates that the problem in production is not semantic in nature. These findings are supported by Friedmann and Grodzinsky (2000), who claimed that the concept of question is preserved in agrammatism. The possibility of producing grammatical *yes/no* questions without SV inversion seems to favour *yes/no* questions. This is because *wh*-questions depend on the movement of the *wh*-constituent to a preverbal position, where *yes/no* questions do not depend on movement. This argument is reinforced by the analysis of errors. *Wh*-questions are mainly replaced by *yes/no* questions, compatible with the canonical SVO order. *Yes/no* questions are mostly substituted by simple declaratives and by *why/how come* questions, which can be built in the absence of movement, depending on the movement of the *wh*-constituent and the inversion of the subject and the verb. The data are in line with the trace deletion hypothesis (Grodzinsky, 1990), the DOP-H (e.g., Bastiaanse et al., 2003), and Gavarró (2002).

Finally, the few data on embedded structures reveal problems with relative clauses (Ferreira, 2008; Martínez-Ferreiro, 2010; Miera & Cuetos, 1998). At this point, the data on the contrast between subject and object relatives are contradictory; while Ferreira (2008) reported no dissociation in the aphasia group, Martínez-Ferreiro (2010) found indication of a more severe deficit affecting object relatives. This would resemble what is observed in topicalised constructions: object topicalised constructions are more difficult than subject topicalised constructions, as confirmed by the results of Catalan, Galician, and Spanish (Juncos-Rabadán et al., 2009; Salmons & Gavarró, 2013). This is again in line with the idea that sentences that are not in canonical order are more difficult for people with aphasia, as predicted by the trace deletion hypothesis (Grodzinsky, 1990), the DOP-H (Bastiaanse et al., 2003), and Gavarró (2002).

10. Future directions

The results we reviewed show asymmetries within the four Ibero-Romance varieties investigated. Contrary to factors such as age, gender, and education, which have led to contradictory results, severity of the deficit and recovery patterns have generally been reported to correlate with the site, type, and size of the insult (Berthier, 2005; Laska, Hellblom, Murray, Kahan, & Von Arbin, 2001; Pedersen, Vinter, & Olsen, 2004). We attribute the asymmetries across studies to two main factors: the use of different tasks (and task complexity) and the varying degree of severity of the deficits. This latter factor points to the existent variation across individuals as for aetiology and lesion site. Martínez-Ferreiro (2003) and Gavarró and Martínez-Ferreiro (2007) reported a task-dependency effect, with sentence completion being more susceptible to errors than delayed repetition. The analysis of one Catalan moderate agrammatic subject in Martínez-Ferreiro (2010) showed a relation between degree of severity and increased number of errors. A comprehensive theory aiming to explain the pattern of impairment and sparing of language functions in non-fluent aphasia should be able to account for the large scope of symptoms that are observed.

The existing theories so far point towards two directions. Structural or representational accounts argue for impairment in specific morphosyntactic processes, but the inconsistency in the performance of patients compromises the strict predictions made by these accounts. The alternative is to adopt the views of processing accounts, but these are also too vague in their assumptions as they indicate that linguistic complexity affects language capacities, but there does not seem to be an agreed-upon hierarchy of linguistic complexity. At this respect, more articulated speech production models have been explored in order to accommodate the complex pattern unravelled by the data. Levelt's (1989) model is organised into three levels, including lemma insertion, grammatical encoding, and phonological encoding. This distinction provides a fine-grained description of the locus of impairment of verb production in individuals with Broca's aphasia, as a product of a disruption at the level of grammatical encoding (Bastiaanse & Van Zonneveld, 2004; Popov, 2013). The integrated model of online computation (MINC—after the Portuguese original *Modelo Integrado de Computação online*) by Corrêa and Augusto (2007, 2011) constitutes an attempt to merge the minimalist program (Chomsky, 1995; and much subsequent work) and processing models. However, adjustments are still being made to overcome Poeppel and Embick (2005) ontological incommensurability problem and to find the primitives allowing the integration of neuropsychology and theoretical linguistics into a single model.²

Data point to different types of errors that may result from disruptions in different morphosyntactic processes. Integration hypotheses such as Yarbey Duman and Bastiaanse's (2009) that analyse canonicity and case, or Abuom et al.'s (2013) that focus on canonicity and embeddings, also consider the interaction of different factors to provide a definition of complexity. Tax complexity, that is, the complexity entailed by a linguistic aspect per se (measured as a factor of the nature and number of linguistic operations and the linguistic levels necessary to perform the task), may play a role in delimiting the pattern of errors, together with the severity of the language impairment. Deviations from the canonical pattern and discourse-linking factors have been recursively evoked in these lines to account for the data revisited in this paper. However, an overarching hypothesis that accounts for the apparent consistencies as well as the inconsistencies present in the data, and that integrates aspects related to complexity, is still unavailable.

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Notes

1. We could not include Bable, Mirandese, and Fala. To the best of our knowledge, there are no aphasiological studies for these languages.
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