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Non-native scientists, research dissemination and English neologisms: What happens in the early stages of reception and re-production?[1]

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Abstract

That the English language is the prevailing language in international scientific discourse is an undeniable fact for research professionals who are non-native speakers of English (NNSE). An exploratory, survey-based study of scientists in the experimental disciplines of neuroscience and medicine seeks to reveal, on the one hand, the habits of scientists who in their research practice come across neologisms in English and need to use them in oral and written scientific discourse in their own languages, and, on the other hand, their attitudes towards these neologisms and towards English as the language of international science. We found that all scientists write and publish their research articles (RAs) in English and most submit them unrevised by native speakers of English. When first encountering a neologism in English, scientists tend to pay close attention to these new concepts, ideas or terms and very early in the reception process attempt to coin acceptable, natural-sounding Spanish equivalents for use in the laboratory and in their Spanish texts. In conjunction with the naturalized Spanish term, they often use the English neologism verbatim in a coexistent bilingual form, but they avoid using only the English term and very literal translations. These behaviors show an ambivalent attitude towards English (the language of both new knowledge reception and dissemination of their RAs) and Spanish (used for local professional purposes and for popularization): while accepting to write in their acquired non-native language, they simultaneously recognize that their native language needs to preserve its specificity as a language of science.

Keywords: English for specific purposes, neologism, neuroscience, research article, Spanish.

Resumen

Científicos no-nativos, difusión del conocimiento y neologismos en inglés ¿Qué ocurre en las fases más tempranas de recepción y reproducción?

Para los científicos no nativos de inglés, la redacción de artículos de investigación en una lengua extranjera supone un reto a la hora de difundir sus resultados. En un estudio exploratorio realizado mediante encuestas a una población de neurocientíficos e investigadores médicos en España se busca descubrir, por un lado, qué hábitos prevalecen entre estos profesionales a la hora de procesar neologismos en inglés durante sus investigaciones y transmitirlos tanto verbalmente como textualmente en sus lenguas maternas y, por otro lado, qué actitudes manifiestan hacia los neologismos ingleses y hacia la lengua inglesa misma como lengua de comunicación científica. Se ha comprobado que la totalidad de los científicos encuestados escriben y publican artículos de investigación científica en inglés y que la mayoría lo hacen sin revisión nativa. Al encontrarse por primera vez con un neologismo en inglés, los encuestados dedican una atención especial a este nuevo concepto, idea o término, y en una fase muy temprana del proceso de recepción intentan acuñar expresiones equivalentes que sean aceptables, naturales y funcionales en los contextos orales y escritos donde los han de retransmitir, a menudo empleando también los neologismos primarios en inglés de forma bilingüe pero siempre evitando emplear exclusivamente el término inglés y traducciones muy literales al español. Estos comportamientos muestran una actitud ambivalente hacia la lengua inglesa (la lengua en la que llegan nuevos conocimientos y en la que estos científicos no nativos realizan la difusión de sus descubrimientos) y la española (la lengua en la que se realizan las comunicaciones profesionales más inmediatas y la popularización de sus resultados): mientras que aceptan redactar su producción científica en una segunda lengua, a la vez reconocen que su lengua materna necesita ser reconocida y conservada como lengua de expresión científica.

Palabras clave: artículo de investigación científica, español, inglés para fines específicos, neologismo, neurociencia.

1. Introduction

In today's world of scientific publication, the vast majority of new knowledge appears in English-medium texts. One of the consequences is that English neologisms (new concepts, ideas and terms) are pervasive in scientific communication in other languages. Our study deals with the early reception of English neologisms by non-native English speaking (NNES)

scientists based in Spain[2] and how they feel towards these neologisms and the predominance of English. In this report, we want to provide some preliminary data gathered from questionnaires administered to a small group of neuroscientists and medical researchers.

It was important for us to establish comparability with previously published survey-based, quantitative and qualitative studies centered on scientists and scholars in the cultural context of Spain, the purposes of which were mainly either 1) to demonstrate that local scientists and scholars, subject to language-based asymmetries and inequalities, are in a position of relative disadvantage with respect to native English speakers and NNES from countries with longer traditions of publishing scientific research in English (Pérez-Llantada, 2007; Ferguson, Pérez-Llantada & Plo, 2011; Moreno, Rey-Rocha, Burgess, López-Navarro & Sachdev, 2012), or especially 2) to establish that English-medium publication is increasingly prevalent, particularly in the "hard" sciences (Fernández Polo & Cal Varela, 2009; Díaz Galán & Fumero Pérez, 2010; Pérez-Llantada, Plo & Ferguson, 2011; Mur Dueñas, 2012; Burgess, Gea-Valor, Moreno & Rey-Rocha, 2014). Obviously, the ways these same issues affect scientists and scholars from/in other countries have been addressed by a number of other authors (see, for example, Swales, 1997; Flowerdew, 1999; Ammon, 2001; Tardy, 2004).

The studies mentioned above largely attest to the increased use of English as the language of science. However, our goal is significantly different because we focus on the attrition of Spanish as a language for scientific communication, i.e. the decreased currency and usage of this language within discourses of specialized communication. Martin et al. (2014: 65), who surveyed Spanish medical researchers, recently reported "a sharp decline in national medical journals that is leading to the progressive disappearance of the RA [research article] in Spanish" towards which they expressed "an ambivalent attitude", on the one hand accepting the increased use of English and on the other admitting that their native language had acquired a diminished role in the conveyance of scientific knowledge. The way scientific language attrition affects Spanish has also been studied by Fernández Polo and Cal Varela (2009), Sánchez Ibáñez (2013), and Sánchez Ibáñez and García Palacios (2014). How the decreased use of national, regional and local languages affects NNES scientists and scholars from/in other countries has also been addressed in the literature (Gunnarsson, 2000; Bennett, 2007; Giannoni 2008).

Our primary object of study is the reception by non-native speakers of English (NNSE) of scientific information, particularly of neologisms coined in English, and also the re-production of scientific discourse, i.e. the secondary production and dissemination in a foreign language of new terms, including English neologisms, in oral and written communication in both their native language (NL) and English. In exploring English neologism reception and re-production, we bring into focus a novel object of study while employing a widely-used, methodologically proven instrument of inquiry, i.e. language user surveys.

1.1. English: The Language of Contemporary Science

In a closer look at the current situation surrounding scientific communication, scholars such as Dutch linguist Abram de Swaan (2001) have noted that we seem to live in the age of English-only science, and other researchers such as the Chilean/German educator Rainer Enrique Hamel (2007: 54) have shown that "English is today's sole globally dominant language, the 'hyper-central' language of the world". Science written in Spanish does indeed represent only a tiny percentage of international science production. As reported by the Science Citation Index, which sources its information from 8,300 journals from 150 different disciplines, "scientific research published in Spanish amounts to only 0.24% of total world scientific production" (our translation, Ansede, 2014: http://esmateria.com/2014/03/05/la-ciencia-en-espanol-es-solo-el-024-deltotal/). According to the Anglo-oriented *PubMed* database, the number of medical publications in Spanish represents 0.8% for the period spanning 2005 and 2010, and according to the more balanced Scopus database (2013) this figure is a mere 1.3%. These extraordinarily paltry numbers underrepresent the amount of published science in the Spanish-speaking world, particularly in Latin America. Scientific databases such as *Digitalia, Infolatina*, *LILACS* and *SciELO* (in alphabetical order) that index peer-reviewed scientific research in Spanish, Portuguese, French and other languages at least partly counteract the disregard of non-English publications (see, for example, Brunner-Ried & Salazar-Muñiz, 2012, cited in Englander, 2014: 8).

The profile of the "standard" Spanish scientist is in line with this situation. Defined predominantly as a native speaker of Spanish who reads and publishes his or her ground-breaking research overwhelmingly in English, the Spanish scientist sees how the use of English opens the door to wider and faster dissemination of research, on the one hand, and to increased academic impact on the other. However, Spanish scientists also conduct vast

amounts of local scientific communication in Spanish or Basque, Catalan and Galician, the other co-official languages of the officially bilingual autonomous communities of Spain. They do so in such places as universities and institutional laboratory floors, on the pages of local, regional and national scientific publications, and in internal reports, memorandums and funding proposals.

Regarding this diglossic situation, Spanish scientists can be seen to represent two opposing trends. Some of them strongly support the use of English only within a conception of monolingual science. As far back as 1993, biochemist Ramón Serrano Salom in a letter to the editor of *El País*, one of Spain's leading daily newspapers, defended the idea that modern science should be disseminated in English:

> Let us redefine, then, what our objectives are, but let us do so within a European context in which we all communicate with our fellow European researchers in English. We should attempt to revive the existence of a universal scientific community and culture as in the days of Erasmus and Luis Vives, a glorious period in which Latin played the role that English plays today. (our translation, 1993)

Others call for the preservation of multilingual science, to pursue a science for all and to prevent the impoverishment of local, regional and national languages and the ways of thinking and making science that may be not only linguistically but also culturally different from what is conveyed through English-only media. A sample of this point of view is the recent declaration by over 30 Spanish-speaking science and language experts who, during a meeting on "Spanish, an international language for the dissemination of knowledge", held at the Universidad Menéndez y Pelayo, defended such a stance: "It is our intent to undertake all measures necessary to promote the use of Spanish as a language of international communication as well as a language of exchange and transmission of scientific knowledge" (*Declaración de apoyo al español como lengua internacional y del conocimiento*, 2013).

1.2. Spanish: A Language of Contemporary Science

The hegemony of English has serious consequences for the volume and quality of scientific text production in Spanish. In a study of the total research production during the 2006-2007 academic year in the University of La Laguna (Spain), Díaz Galán and Fumero Pérez (2010: 120) found that

85% of the articles published by researchers in the "hard sciences" were in English. Fernández Polo and Cal Varela (2009: 156) have reported similar findings, with 77.8% of all experimental scientists reporting that over 75% of their research is published in English. A reverse extrapolation of these data indicates that only 15-22.2% of the articles published by "hard" and "experimental" scientists are written in other languages, mainly Spanish. The consequences for scientific communication in Spanish are serious.

Martin et al. (2014: 60) report on the almost complete disappearance of prestigious, specialized national journals in the field of medicine. As evidence of this lack of highly specialized scientific texts written directly in Spanish, we should consider that in Spain there are only four neuroscience journals that offer full texts (two of them are Spanish-only, one of them publishes articles in Spanish or English and one is a Spanish and English bilingual edition) and these journals publish mostly clinical and applied topics in a local/regional/national setting. Although *Latindex*, *LILACS* and *SciELO* register 28 journals for Spanish-speaking America (19 are Spanish-only and 9 publish articles in Spanish or English), once again these publications focus on local/national/regional communication. As a result, more and more highly specialized texts are being produced directly in English and few(er) specialized texts are being produced in Spanish.

The lack of corpora of hard or experimental scientific articles in Spanish generates a language problem that can affect technical writers, terminologists and translators who work with/into Spanish, as there is not an ample body of carefully constructed primary texts from which they can retrieve specialized, parallel scientific terminology. Vandaele (2013: 13) has stated that "[i]f there are no well-written and well-thought-out original texts in a language, it becomes extremely difficult to translate scientific texts into that language".

Within this context, a number of international initiatives are supporting the production and dissemination of scientific texts in languages other than English. The *VoxROM* project (García Palacios & De Sterck, 2014), which has officially been adopted by *REALITER* (Red Panlatina de Terminología [Pan-Latin Terminology Network]), consists in the creation of a repository of full text scientific articles in Romance languages. The aim is to give visibility to science in other languages than English – particularly in Romance languages – and to make corpora and terminology in context available. Also in this regard, special mention should be made of the *Medes*

repository (https://medes.com/Public/Home.aspx), a private initiative conducted by scientists and health professionals to encourage scientific medical writing in Spanish.

As front-line science is written almost exclusively in English, and Spanish is confined to local/national/regional communication and less specific, popularizing texts, a gap between specialized discourse in English and popular discourse in Spanish is created. Margarita Salas, a biologist and member of the *Real Academia Española*, seems to support this dichotomy, making all languages but English "second-class languages" relegated to the realm of popularisation, when she states:

> In order to maximize the dissemination of our research results Spanish scientists strive to publish our research in the best possible journals, which means that our publications are written in English. However, when it comes to popularisation, we write in Spanish, as scientific discourse at this level targets the average reader and should be expressed in common terms found in the *Dictionary of the Real Academia.* (our translation, Anon., 2009)

The efforts of the *Spanish Foundation for Science and Technology* (in Spanish, *Fundación Española para la Ciencia y la Technología*, *FECYT*) lead in the same direction, as the goal of this institution is to encourage science culture and popularization in Spanish, whereas it accepts English to be the (only) language of specialized scientific discourse, thus fostering asymmetrical bilingualism.

The lack of specialized knowledge texts written directly in Spanish leads to a lack of terminology flourishing and blooming in its natural context. The continued prevalence of English over Spanish deepens the gap between terminology *in vitro* (terms collected and defined in reference works such as dictionaries, glossaries, data bases, and so forth, which are the result of institutional or private investment and management) and terminology *in vivo* (terms that appear as is in texts generated by specialists within real communicative contexts).

In the field of neurology, there are a number of terminological resources available in Spanish, the most complete of which is the trilingual *Diccionari de neurociència*, by Antoni Valero Cabré, and *Termcat* (http://www.termcat.cat /ca/Diccionaris_En_Linia/140/Presentacio). Nonetheless, resources such as this one are examples of *in vitro* terminology. The very nature of dictionaries, compiled after current usage of terms can be established, means

that they tend to contain only consolidated terms and exclude unsubstantiated neologisms. Without specialized knowledge being disseminated directly in Spanish in natural contexts, i.e terminology *in vivo*, little terminology can be produced and no descriptive terminology can exist.

The pervasive role of English and secondary term formation leads to indiscriminate term importation, favors the principle of least effort (Vera Torres, 2008), and feeds the myth of the terminological superiority of scientific English (Vivanco Cervero, 2009).

1.3. Objectives

The present study is a pilot effort which seeks to collect information about the behaviors and attitudes of Spanish scientists *vis-à-vis* their use of Spanish as a language of science against the backdrop of English prevalence and also about their processing of English neologisms in oral communication and written text production in Spanish.

Though there is no commonly agreed upon definition of what neologisms are, we propose to define them as typically complex words or multi-word lexical items that make their first-known diachronic appearance in a language, corpus of texts or specialized discourse. Neologisms are terminological names for new knowledge items (concepts, ideas, terms) that can result from new scientific or academic research, contact between languages, and changing societal demands and realities. Our composite definition draws on Cabré (1991), Cabré and Nazar (2012) and Faber (2012).

It is beyond the scope of the present study to discuss how neologisms are formed and the types of neology that exist but we are interested in their functional, pragmatic and sociological roles, particularly in the role that English-language neologisms have in the early stages of new term reception and formation in other languages. A neologism coined in one language can be called into service by a second language, which needs to incorporate it by some means into its lexicon. In these cases, very frequent in all specialized (scientific) discourses, the primary, or source, language term is borrowed or shaped into a secondary, or target, language term. In this process, called *secondary term formation*, foreign languages like Spanish, which use neologisms coined originally in English, will use a variety of techniques to adapt them to their specialized lexicons in oral communication and in written texts. The adoptive/adaptive techniques used by other languages include (García Palacios & Sanz Vicente, 2011: 17):

Using the *English neologism as is*, i.e. non-adapted term borrowing, often using some special way of marking the neologism (in oral communication, using effective pauses or special intonation, and in written texts, using the cursive or quotation marks).

Using a *very literal translation* of the English neologism, i.e. complete loan translation, often using some special way of marking (in oral communication, using effective pauses or special intonation, and in written texts, using the cursive or quotation marks).

Attempting to *coin an acceptable, natural-sounding equivalent* in the other language, i.e. paraphrase, without mentioning the English neologism nor using a very literal translation.

In order to achieve a one-to-one correspondence between primary and secondary terms, as well as greater precision of meaning and clear intertextual referencing, a number of combinatory techniques can be used, including:

Using the English neologism as is, then *explaining or defining the neologism*, often using special marking (in oral communication, using meta-language in which to couch the definition or explanation, and in written texts, using commas or parenthesis).

Using the English neologism as is, then *adding a very literal translation* of the neologism.

Using the English neologism as is, then *attempting to coin an acceptable, natural-sounding equivalent* in the other language.

Using a very literal translation of the English neologism with or without mentioning the neologism in English, often using some *special way of marking* (in oral communication, using effective pauses or special intonation, and in written texts, using the cursive or quotation marks).

Using a very literal translation of the English neologism, then explaining or defining the neologism in the other language, often using special marking (in oral communication, using meta-language in which to couch the definition or explanation, and in written texts, using commas or parenthesis).

We hypothesize that the predominance of English and the scientists' attitudes towards English and their native language(s) as (a) vehicle(s) of scientific communication will be particularly noticeable in the early reception and re-production of English neologisms by Spanish scientists. We surmise that in the current scenario, they would not pay close attention to neologisms and to how they would need to be communicated in Spanish, whether orally

or in writing, because the Spanish language will supposedly play a minor role in the transfer of scientific knowledge. Therefore, we suspect that Spanish scientists will tend merely to borrow English neologisms *verbatim*, translate them literally or use both of these techniques jointly (borrowed neologism + literal translation). The design of the study is described in the following section.

2. Methodology

In a small scale study of native Spanish-speaking, laboratory-based neuroscientific and medical researchers, using an anonymous survey created with *Google Forms*, we have sought to obtain measurable data on a range of questions pertaining to language-related behavior and attitudes regarding the neologisms each scientist uncovers during the research process. On the one hand, we wanted to assess "attitudinal factors" and, on the other, we wanted to collect data about the "actual behavior" of neurologists when gathering specialized knowledge and when disseminating their own findings, both in English and in Spanish. The questions in the survey explore issues such as the usefulness of languages other than English for scientific communication, the prevalence of certain commonly held notions about languages for scientific communication, and the habits NNES scientists use to record English neologisms when they come across them in texts. Of particular interest is what the survey reveals about (1) how NNES scientists handle and record English neologisms when they first encounter them, (2) the habits of NNES scientists when transmitting English neologisms in L2 oral communications in the laboratory, and (3) the range of strategies used by NNES scientists to transmit English neologisms in L2 in written texts beyond their immediate laboratory surroundings. The questionnaire itself was divided into three basic parts, and the data received were self-reported in Spanish. All responses were translated into English by the authors.

3. Results

3.1. English Publication Practices of Neuroscientists and Medical Researchers

The survey was sent to fourteen scientists who collaborate with the *Instituto de Neurociencias* de Castilla y León (*INCYL*) and six professors of

medicine at the University of Salamanca, of whom ten responded (N=10; 50%). All of these respondents were native speakers of Spanish. Three of the respondents were also native speakers of Galician, while none of them were native speakers of other co-national or other foreign languages.

All respondents claimed to be proficient in reading, writing and speaking Spanish and English, though several respondents claimed skills in aother languages. The three native speakers of co-national Galician were the only ones in the group who had skills in this language. Three people can read Catalan, but none of the respondents have any knowledge of Basque. Three of our surveyed group claimed to have a full skill set in three foreign languages (English and Spanish, plus Portuguese (2) or Italian (1), while one scientist claimed to have complete proficiency in four foreign languages (Spanish and English, plus French and Italian) and also reading skills in Portuguese and Catalan.

After English and Spanish, the third most widely known language was Portuguese (two claimed full knowledge of this language and three claimed reading skills) followed by French (two claimed full knowledge and two claimed reading skills). With over half of those surveyed in possession of a full skill set in at least three languages and three of the ten with reading skills in at least six languages, the overall impression is that this group of scientists can cover quite a bit of Western European ground and transmit this content proficiently in English and Spanish and, in some cases, in other (foreign) languages.

Regarding what language the neuroscientists received new knowledge in, as could be expected all respondents consider English the main source language (10). As the scientists were asked to list the top three languages in which they received new scientific information, half of the respondents (5) placed Spanish second on the list, and French (1) and German (1) were also mentioned. A number of scientists ranked Spanish (1) and French (1) third, while the contribution of Galician and Portuguese also merited one mention each. Interestingly, three out of ten scientists considered English the only source language for new knowledge and listed no others. A visual ranking of the languages in which new scientific knowledge is received is depicted in Figure 1.

Figure 1. The most important languages in which new scientific information is received.

Regarding the production of new scientific knowledge, all of the scientists publish in English (10), while eight out of ten publish in English only. Insofar as their writing process is concerned, none of the respondents write scientific articles in Spanish, then self-translates (with or without native-speaker revision prior to submission) or uses professional translation (0). All of them write directly in English (10), and most of them do this without revision by a native speaker prior to submission (6). Four (4) authors write their articles in English, then have their texts revised by a native speaker.

Two of those surveyed indicated that they publish in both Spanish and English, though they stated that they used Spanish only for unspecialized or semi-specialized publications. The implications of the use of English for "real" scientific publication and of Spanish for "popular" science will be discussed at some length below.

In response to the questions regarding the scientists' attitudes towards the role of English and Spanish as languages of science, the data obtained reveals that, perhaps not surprisingly, all respondents show a positive attitude towards English (10), arguing that it fosters scientific dissemination, and they also believe that English-only scientific communication will likely cause no detriment to scientific development in non-native countries (7). At the same time, however, most respondents show that they do not support English being expressly promoted in this way (8), that they do not believe that major scientific conferences should be held only in English (6), and that most were willing to maintain Spanish as a language of science (7). Based on these seemingly contradictory opinions, we can construe that the scientists surveyed hold complex opinions, both accepting the reality of English as the language of science and recognizing its benefits and simultaneously supporting an active role for scientists in the use and defense of other languages coexisting with English in a multilingual world of science.

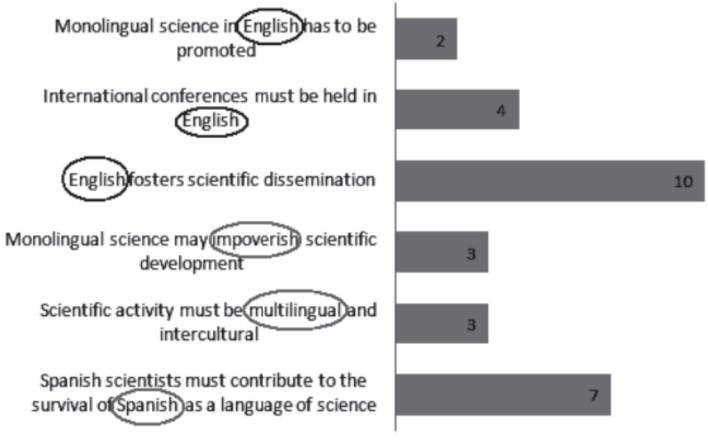

Figure 2. The role of English and other languages, in particular Spanish, in the international world of science (Respondents could choose one or more responses).

3.2. English Neologisms in Spanish Oral and Written Communication

The responses to our four questions in specific reference to neologisms will be discussed here. In order to analyze the way Spanish scientists deal with neologisms, we considered three different situations: 1) when reading in English, 2) when talking to a Spanish-speaking colleague, and 3) when writing in Spanish. Those surveyed were also asked about who they believed should take the most prominent role in secondary term formation: scientists, translators, terminologists, specialized journalists, or others.

When encountering neologisms in written texts, most respondents do pay attention to these new terms (7) and either memorize them (2), highlight them (4) or write them down (1). Only three respondents stated that they paid no attention to them.

When Spanish-speaking scientists talk to other NNS colleagues in the laboratory and need to convey an English neologism, seven of them use an adaptive/adoptive technique plus a combinatory, bilingual solution for conveying in Spanish newly encountered neologisms. Only one respondent tends to use a very literal translation and two of them use a natural-sounding Spanish equivalent only. Six of the respondents use the English term then either try to coin an acceptable, natural-sounding equivalent (4/6) or formulate an explanation in their own words (2/6). It is notable that four of the five choices involving literal translations of the terms went unchosen,

leading us to conclude that this kind of terminological or translational solution tends to be discarded by scientists at the very early stages of neologism reception.

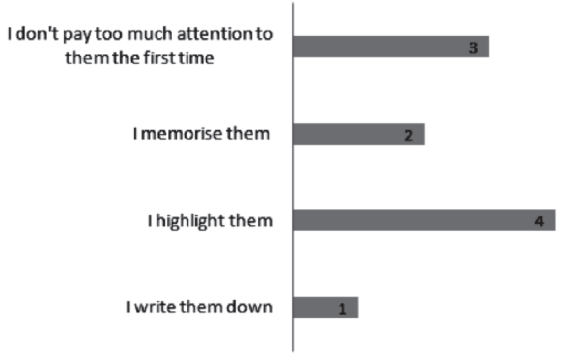

Figure 3. How scientists react to neologisms when first encountered (one response only).

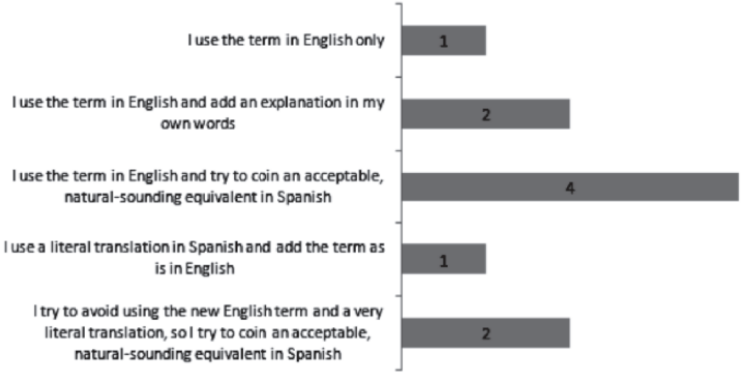

Figure 4. Strategies used by Spanish-speaking scientists which are used to convey English neologisms when speaking Spanish with colleagues (one response only).

When writing in Spanish, similar strategies are used to transmit English neologisms. As we have just seen, literal translation solutions are not preferred at the earliest stages of reception, as even at this early stage scientists are already thinking about Spanish acceptability and naturalness rather than overly faithful, word-for-word equivalents excessively rooted in the English source term. Like above, a significant number of those surveyed opt for a combinatory, bilingual solution. None of the respondents use the English-only option. In fact, the most commonly-chosen option (4/10) is a

Spanish-only choice, either "I try to coin an acceptable, natural-sounding Spanish equivalent" or, as one respondent added in the "other" text box, "I try to find an already-existing equivalent in Spanish texts" (our translation).

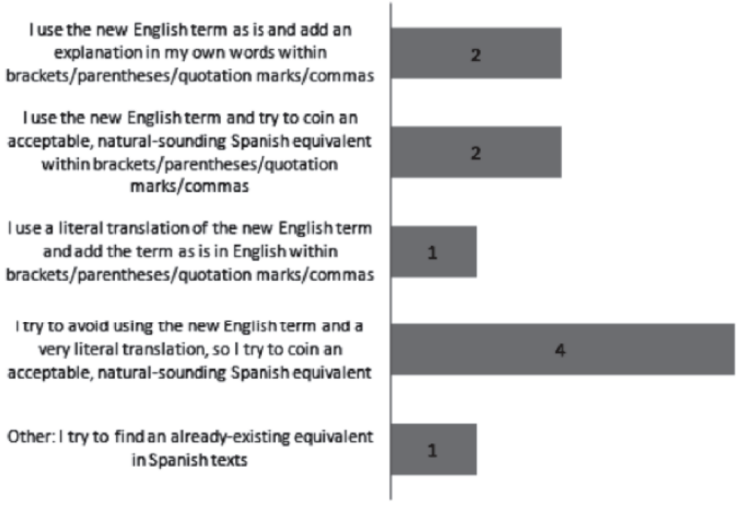

Figure 5. Strategies used by Spanish-speaking scientists to convey English neologisms when speaking Spanish with colleagues (one response only).

When asked about who should bear the responsibility of secondary term formation in Spanish, nine respondents consider that it is up to scientists to create neologisms, in two cases recognizing that specialized translators should also share this responsibility with scientists. None of them see this question as an exclusive responsibility of specialized translators. Within the context of dissemination, five respondents pointed to the role they feel specialized translators should play, while three assign dissemination to specialized translators only, exempting scientists from this role. There were two "other" responses to this question, one of which noted that scientists should always be responsible for creating secondary neologisms because specialized translators often use neologisms in the wrong way. The second stated that the role of scientists, specialized translators and specialized journalists in secondary neology creation and dissemination was context-dependent. None of the respondents believed that specialized journalists had any role to play, neither as creators nor as disseminators of secondary neologisms, and none of them believed that primarily specialized translators should create neologisms and scientists should disseminate them.

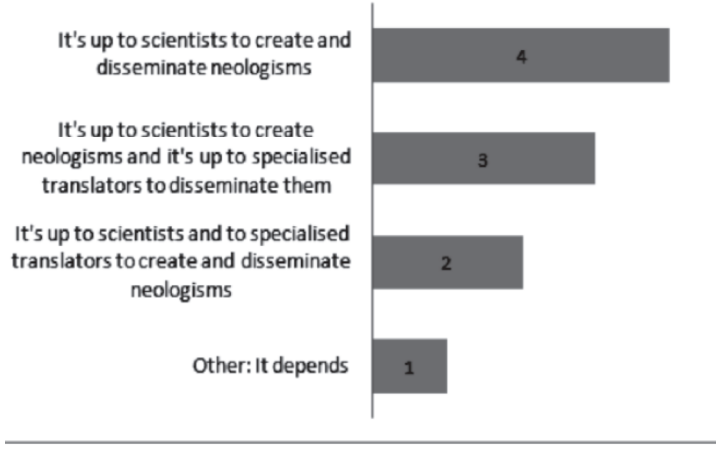

Figure 6. The perceived role of scientists, specialized translators and specialized journalists in secondary term formation (one response only).

4. Discussion

4.1. What are the English Publication Practices and Attitudes of Spanish Neuroscientists and Medical Researchers towards English?

In an attempt to summarize our findings and put them into a meaningful perspective, we offer the following discussion.

Not surprisingly, the respondents consider English the main (and occasionally the only) language for reception of new knowledge. In our study we found that all respondents write and publish their scientific texts in English, with only 20% of those surveyed stating that they publish in both Spanish and English and 80% stating that they publish exclusively in English. Many scientists claim reading, writing and speaking skills in a wide number of other European languages.

All of our sampled authors disseminate the scientific knowledge they generate in English, with only a small portion (20%) also stating that they publish in Spanish. According to these data, 80% of the authors publish solely in English and none of the respondents write and publish their articles solely in Spanish. Fernández Polo and Cal Varela (2009), Pérez-Llantada et al. (2011), and Martin et al. (2014) conducted similar surveys in which they found results that clearly support the fact that most present-day scientists and academics tend to write directly in English, and their findings were

similar to ours. Pérez-Llantada et al. (2011) found that of the ten senior Spanish academics (five from the physical sciences and engineering, and five from the social sciences) they surveyed 80% wrote their articles directly in English. Fernández Polo and Cal Varela (2009) report that 77.8% of experimental scientists wrote over 75% of their work in English (2009: 156). A study conducted by Hauaner and Englander (2011: 407-8) found that amongst scientists in two higher education institutions in Mexico 75% of respondents published at least half of their work exclusively in English, though only 5 out of 148 did so exclusively in English.

There is a current tendency for non-native scientists to write directly in English. St. John, in 1987, found that scholars, at the beginning of their careers, had often tried writing first in their native language and had their papers translated. However, over time scientists have abandoned this practice because it is often too difficult to find native-speaking translators who have the right area expertise and also because the process of working with the translator can be too time-consuming (St. John, 1987: 116). Mur Dueñas (2012: 145) states that "scholars have moved from having their R[esearch] A[rticle]s translated into English to drafting the first version in English themselves". Our research provides additional evidence of this tendency. The subsequent implications of writing solely in English, and consequently abandoning scientific Spanish, have therefore had quite a long history. For a language like Spanish to remain active and viable as a language of science it is required that autonomous texts be produced in that language; these texts form the basis of *in vivo* terminology research, corpus-building and parallel text searching.

Other authors also provide data on this potential risk. Pérez-Llantada et al. (2011: 22) report:

> interviewees were aware that the emphasis on English-language publication came at a cost, especially to scientific publishing in Spanish. As one social scientist explained, writing research papers in Spanish was little valued with the result that Spanish was increasingly restricted to popular science publications (e.g. the Spanish equivalent of *Scientific American*), national conference proceedings, and regional government reports, all of which are considered necessary for knowledge transfer but of limited prestige: "In publishing internationally we tend to neglect the Spanish context. Therefore, every now and then we try to publish science literature within the professional Spanish circuit so as to transfer the knowledge gained from our research to working practitioners.

Martin et al. (2014: 61) report that "the informants were well aware of the negative consequences of writing in English, namely that this hinders the development of academic writing in Spanish, research on topics of local concern and the survival of medical journals in Spanish".

The scientists we surveyed hold complex, even contradicting, opinions about the use of Spanish and other languages within specialized discourse communities as vehicles of scientific and academic communication. At the same time, they both accept the reality of English as the language of science and recognize its benefits, and they support an active role for scientists in the use and defense of other languages coexisting with English in a multilingual world of science. Only two specified that they use Spanish for publication at all, and curiously both of them felt the need to "justify" the reason why they wrote in Spanish at all: they used Spanish for popular science texts.

How can we interpret the divergent responses? Do they mean that scientists think Spanish scientific discourse should be preserved? Do they mean that scientists think highly specialized scientific discourse, terminology and neology in Spanish are a lost cause? To our minds, the complex, conflicting responses indicate that NNES scientists would welcome initiatives that can bridge the language gaps and make the communicative pathways bidirectional. For proposals that explore ways in which increased English scientific dissemination can co-occur with publication of scientific knowledge in Spanish see Menenghini & Packer (2007), who propose such initiatives as bilingual publications, and Salager-Meyer (2013), who proposes such ideas as extended abstracts in languages other than English.

4.2. How do Spanish Scientists Deal with English Neologisms in the Early Stages of Reception and Re-production?

In an attempt to observe what happens with English-language neologisms at the closest possible location of reception and re-production by NNESs, we tried to trace how they are first perceived, how they are dealt with in reception and how these are transmitted orally and in writing to fellow non-native scientists. This is the first attempt to trace non-native scientists' neologistic behaviors and poll their attitudes using a self-reporting methodology. We hypothesized that the predominance of English as the preferred language of publication for Spanish neurological and medical researchers, a situation that has caused Spanish in these fields to be used for (mostly) popularizing purposes, would have an effect on the manner in which English neologisms

were received, transmitted orally and used in written texts. Our initial hypothesis, namely that English neologisms would tend to be borrowed *verbatim*, translated literally or used jointly (borrowed neologism + literal translation), has not been borne out by the results of the study. We conjectured that, if Spanish had truly become a non-scientific language used only for popularization of science, then scientists would pay little attention to how English neologisms would be conveyed in Spanish, borrow them *verbatim* or use literal translation strategies. However, we found that most respondents (70%) did pay close attention to neologisms and tried to coin acceptable, natural-sounding Spanish equivalents when speaking in the laboratory (60%) and when writing in Spanish (60%). Both in spoken and written communication in Spanish, literal translation was barely used (10% in both cases) and English-only oral communication was used by 10% of the respondents, while in many cases the *verbatim* English neologism was used jointly with one of two explicitation types: (1) a Spanish explanation (20%); or (2) an acceptable, natural-sounding Spanish equivalent (20%). A significant number of the researchers (40%) stated that they often avoided using the English term entirely. Based on these findings, we conclude that at very early stages of English neologism reception and re-production NNES Spanish scientists use the English term plus an acceptable, natural-sounding Spanish equivalent that they take upon themselves to coin. Therefore, Spanish scientists are creating secondary terms, not merely echoing English terms, immediately after receiving knowledge of them, and they are proposing mostly bilingual solutions that live side-by-side in conversation and on the page.

One of the respondents stated that he or she "[tried] to find an already-existing equivalent in Spanish texts". This comment prompted in us the following reflection: in order for such equivalents to be found, specialized, scientific texts written directly in Spanish need to be available. Without authentic texts, there can be no truly specialized scientific language, no *in vivo* terminology and no neology in Spanish or indeed in any language other than English. Another pertinent observation we would like to make is that all respondents recognize that they write in Spanish, though this may be in non-article genres such as essays, book chapters, books, progress reports, informal communications and funding applications. Concerned as we are with the disappearance of Spanish as a language of science, it can be surmised here that in other types of writing apart from the research article Spanish is used regularly and assiduously. In fact, Díaz Galán and Fumero Pérez (2010: 121) found that a significant amount of research dissemination in the hard sciences

was written in Spanish. For prestigious, international research articles, these authors found that Spanish is used much less frequently (14.8%), but for the totality of scientific production, including books and book chapters, essays, edited volumes and conference addresses and oral communications, Spanish has a more significant presence (27.16%). We can surmise that in addition to published research, Spanish scientists are producing a large volume of unpublished letters, e-mails, reports, applications, and other documents in which they report on their research in their native language.

As for who scientists believe should bear the responsibility for secondary term formation in Spanish, they overwhelmingly believe that scientists should create neologisms (90%). Only 20% of the respondents recognize that this duty could be shared with specialized translators and, rather surprisingly, none of them envisioned specialized journalists as having any role to play, neither as creators nor as disseminators of secondary neologisms. This bullish attitude towards shared responsibility for neology in Spanish is noteworthy, especially since both of these groups of language professionals are deeply and actively involved in secondary term formation and dissemination. On the one hand, specialized translators are often involved in cutting-edge, front line production of scientific communication, and on the other, specialized journalists are often asked to produce convincing and potentially long-lasting equivalents in popularizing texts and their texts reach a much wider audience than the scientific articles they are reporting on.

5. Conclusion

We found that the non-native speaking Spanish scientists who responded to our questionnaire consider English the main (or even the only) source language for reception of new knowledge and they write and publish their research articles in English. The respondents call for wide use of English, but at the same time most of them advocate the use of Spanish, though most of their texts in Spanish are written only for "local" professional use and popularization purposes.

Most respondents pay close attention to English-language neologisms in the field of neurosciences. When talking in Spanish with colleagues, most of them communicate English neologisms in English plus they add an explanation or a newly created equivalent in Spanish. When writing in Spanish, they tend to coin natural-sounding terms in Spanish, sometimes

adding the term in English alongside. They tend to do this in the early stages of new term reception. Most respondents believe that it is up to scientists, rather than terminologists and journalists, to create neologisms, though some scientists believe that specialized translators have a role to play.

Our small scale study confirms that Spanish neuroscientists and medical researchers receive and disseminate new scientific knowledge virtually exclusively in English and over the years have gained the language skills to do so. However, the survival of Spanish as a language of cutting-edge, front-line science has diminished, as evidenced by the fact that few of these scientists publish anything in Spanish except locally-relevant texts and popularizing articles, books, chapters and essays. Despite the recognition that the kind of research articles that bring academic prestige are written exclusively in English, there is also concern among these NNES scientists for the well-being of Spanish, for the persistent use of Spanish as a language of real science, not merely a language of popular scientific discourse.

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NOTES

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[2] This pilot study is limited to Spain and the behavior and practices of a core group of neuroscientists and medical researchers. In a subsequent stage, we will conduct a larger-scale survey including Latin American respondents and covering a wider representation of Spain and the Spanish-speaking world. After conducting the subsequent large-scale survey mentioned above, the results about attitude will be compared to real practice. To this end, a semiautomatic extraction tool for neologisms is being developed. This will allow scientists to submit proposals for new terms to a group of terminologists in such a way that both scientists and terminologists will end up collaborating on the creation of appropriate Spanish equivalents which then will be disseminated jointly by the scientists and translators/interpreters (García Palacios et al., 2013).