Anglicisms in the Field of IT (GitHub and 3D Slicer): Multilingual Evidence from European Languages (French, German, Italian, Portuguese and Spanish)[*]

Anglicismos en el campo de las TIC (GitHub y 3D Slicer): datos del plurilingüismo en lenguas europeas (francés, alemán, italiano, portugués y español)

CARMEN LUJÁN-GARCÍA AND SORAYA GARCÍA-SÁNCHEZ
Institution address: Universidad de Las Palmas de Gran Canaria. Departamento de Filología Moderna, Traducción e Interpretación. Campus de Tafira. Edificio de Ingenierías. Módulo F. 35015 Las Palmas de Gran Canaria. Spain.
E-mail: carmen.lujan@ulpgc.es; soraya.garcia@ulpgc.es
ORCID: 0000-0001-7050-777X; 0000-0003-1095-9410

Abstract: This paper provides evidence of the noticeable adoption of Anglicisms in the professional field of IT by five European languages: French, German, Italian, Portuguese and Spanish. Two different domains, GitHub and 3D Slicer, have been examined to build a multilingual glossary with the contributions of European and African engineers and technicians cooperating in the Interreg European project MACbioIDi. This multilingual glossary is a useful tool for engineers, as it provides equivalent terminology in these five languages. The use of the studied Anglicisms is documented with interviews to different engineers to verify the oral uses, and the written uses are recorded with examples in context taken from different Internet websites and forums. This is an interdisciplinary and multilingual research that reveals that terminologies and specialized languages are not exempted from adaptation and hybridization processes that the different languages undergo in order to make communication effective.
Keywords: IT; Anglicisms; GitHub; 3D Slicer; Terminology.
Summary: Introduction. Method. Findings. 1. GITHUB multilingual glossary. 2. 3D Slicer. 3. Types of Anglicisms. Conclusions.

Resumen: Este artículo aporta datos sobre las cuantiosas adopciones de anglicismos en el campo de las TIC en cinco lenguas europeas: francés, alemán, italiano, portugués y español. Hemos examinado dos campos distintos, GitHub y 3D Slicer, para hacer un glosario multilingüe, creado a partir de las contribuciones hechas por ingenieros y técnicos europeos y africanos que cooperan en el proyecto europeo Interreg MACbioIDi1. Este glosario se muestra como una herramienta útil para los ingenieros, pues aporta la terminología análoga de las cinco lenguas. Los usos orales de los anglicismos los hemos documentado mediante entrevistas a ingenieros; los usos escritos se muestran a través de ejemplos de foros y páginas web. Este trabajo, de carácter interdisciplinar y multilingüe demuestra que las lenguas especializadas no están exentas de los procesos de adaptación e hibridación que experimentan las lenguas con el propósito de comunicarse de forma efectiva.
Palabras clave: TIC; anglicismos; GitHub; 3D Slicer; terminología.
Sumario: Introducción. Método. Resultados. 1. Glosario multilingüe GITHUB. 2. 3D Slicer. 3. Tipos de Anglicismos. Conclusiones.

INTRODUCTION

The role that English currently plays as a lingua franca is unquestionable. It has become the most widespread vehicle of communication among speakers of multiple languages across the globe. English pervades every single area of people's daily life. For example, in Spanish, some studies have proved the prominent position of lexical Anglicisms in various areas. Sports is a domain where many Anglicisms are used (Rodríguez González; Campos; Rodríguez-Medina). Fashion and beauty are also teemed with English terms as different scholars have reported (Balteiro and Campos; Luján-García, "Analysis"; Tejedor Martínez). Marketing, economy and finance are influenced by this trend (López Zurita "Economic Anglicisms," "El uso de anglicismos"), the area of tourism (De la Cruz, Mancho and Tejedor Martínez "Los anglicismos en el turismo") as well as languages of specialty (Tejedor Martínez, et al.) to mention just a few of the multiple domains in Spanish where English has gained an advantageous role.

In the area of Information Technology (IT), English has gained a dominant position, since many of the terms, employed on a daily basis, are in English. Different studies carried out in multiple countries have provided evidence of this fact. In Italy and Albany, Shehu reported on the use of a large number of Anglicisms in the specific fields of Telecommunications and Informatics, and this author alluded to two reasons: first, the development of technology in English-speaking

countries; and second, the absence of native equivalent words for these concepts. In Portugal, Amorim, Baltazar and Soares have also highlighted the use of Anglicisms in the field of financial media. These authors stated, "In Portugal, it is the second language of most public and private domains influencing its culture and discourses" (49). In Germany, Corr did some research on the extensive use of Anglicisms in the field of German computing terminology. Onysko's *Anglicisms in German* has revealed the important role of English in various language-cultural areas in Germany. This author even examined the perceptions of Germans towards this globalizing role of English ("Exploring Discourse"). In France, Lazarev has reviewed the history and causes of the widespread use of Anglicisms in French. This scholar has provided some examples of English lexical units in the field of IT such as *poster*, *captcha*, *gif*, *spam*, *troll*, *netflixisation* and concludes that "the number of English borrowings will inevitably grow and that this vocabulary is necessary in modern French" (187). Saugera has examined in depth the lexical renewal as a result of the contact situation between French and English. In Spain, different pieces of research (Bolaños-Medina and Luján-García; De la Cruz, Tejedor Martínez and Díez Prados; De la Cruz and Tejedor) have presented the countless adoptions of Anglicisms in the area of IT. The use of English loanwords in the field of Spanish speaking social networks has also been an object of analysis (Luján-García). Núñez Nogueroles has also provided an up-to-date review of the literature on Anglicisms in Spanish.

In other European languages, not included in this study, the situation is quite similar. In Croatia, Liermann-Zeljak sheds some light on the massive use of Anglicisms in electrical engineering terminology. In Romania, Todea and Demarcsek reported on the remarkable presence of English loanwords in the areas of Romanian business and technology. In Finland, Mihaljov found that the presence of English is pervasive in the field of Finnish information technology. In the Czech Republic, Chladová also provided a glossary and alternative native terms for the amount of Anglicisms used in the field of IT in this country. Thus, English seems to be quite spread across many European languages within the field of IT.

Given the nature of this corpus, which conforms to a type of specialized language or terminology, it seems reasonable to define what terminology is in its two senses. According to Pavel and Nolet, the first meaning of the word terminology is "the set of special words belonging to a science, an art, an author, or a social entity," for example, the terminology of medicine or the terminology of computer specialists. The

same term, in a more restrictive sense, means "the language discipline dedicated to the scientific study of the concepts and terms used in specialized languages." General language is that used in daily life, while a specialized language is used to facilitate unambiguous communication in a particular area of knowledge, based on a vocabulary and language usage specific to that area (Pavel and Nolet). Authors such as Sager and Cabré Castellví, among others, have defined and developed the concept of terminology and specialized languages. Within the second sense of the word *terminology*, we could refer to a definition by Sager: "the study of and the field of activity concerned with the collection, description, processing and presentation of terms, i.e. lexical items belonging to specialized areas of usage of one or more languages" (2). Cabré Castellví states that, differently from lexicology, "[t]erminology is only concerned with terms or words of a specialized field (such as physics, chemistry, anthropology, art and so on) or a professional domain (trading, industry, sports, etc.)" (22).

This kind of language uses a great amount of technical vocabulary, since its lexis is constantly increasing as new scientific and technical inventions emerge and there is a need for a new term to name a new concept (Pérez Pascual 196). This terminology or specialized language usually has a limited meaning that intends to avoid ambiguity or misunderstandings. According to Gutiérrez Rodilla (22–26), one of the main features of the scientific lexicon is its accuracy, neutrality and economy. This refers to the creation of international terminologies whose main goal aims to facilitate communication among expert users from different parts of the world who also speak different languages. These terminologies intend to fulfil two of the basic principles of specialized languages: accuracy and avoidance of ambiguity. A *pull request*, for example, is a *pull request* in every language and the technicians and engineers working in the domain of GitHub understand and use this unequivocal term, which is, in addition, neutral, since it has neither positive nor negative connotations. This expression also contributes to the economy of the language, as a longer sentence or paraphrase is not needed to express what a *pull request* is.

Pérez Pascual (202) also remarks the universality of this kind of language, since scientific and technical knowledge is universal, and a repertoire of universal terms, which can be understood by any professional within a certain field working in any country, is essential. This is the case

for a great amount of vocabulary that relates to computing science and IT in general.

As discussed in the previous lines, in the field of terminology, the ideal of univocity was proclaimed as the best solution to avoid ambiguity or misunderstandings in specialized languages. However, authors such as Dahm, assert the field of terminology is dynamic and it has moved away from the notion of univocity. In a globalized world where monolingual and multilingual professionals use terminology in a natural context of use, this notion of univocity is not real. Languages, including professional languages, are subject to dynamic changes of meaning from specialized to more general meaning (Dahm 83).

This study, which has an interdisciplinary and multilingual focus, intends to demonstrate, with real evidence, the way in which Anglicisms impact on most modern languages —Italian, French, German, Portuguese and Spanish— and more specifically on international experts who work in the field of IT. It also analyzes the different strategies used by the examined languages in order to make communication effective. Therefore, an initial hypothesis to carry out this research will be asserted with the following statement: the different European languages use anglicized terminology in the field of IT, more precisely in the domains of GitHub and 3D Slicer.

The justification for this study lies on two facts: first, the absence of previous analysis that encompasses so many different modern languages. Several studies have proved the presence of English in the field of IT that affects only one language individually, as shown in the previous lines, but so far, one of the novelties of this work is that no research has covered this phenomenon comparing several languages (French, German, Italian, Portuguese and Spanish). Second, there is an absence of studies dealing with the impact of Anglicisms on the specific IT domains of GitHub and 3D Slicer. In order to confirm or reject the initial hypothesis, some research questions have been posed:

1) To which extent do Anglicisms impact on the different European languages in the field of IT, specifically on the domains of GitHub and 3D Slicer?

2) Which kind of Anglicism is the most frequently used in those languages: non-adapted, adapted, or hybrid combinations as

linguistic strategies employed by the different examined languages?

1. METHOD

This piece of work aims at creating a multilingual glossary. A preliminary glossary included IT terms, mostly words focusing on two areas within the extensive field of IT, particularly on GitHub and 3D Slicer. The reasons to choose these two domains are justified because both fields are relatively new; at this point of development of the European MACBioIDi project, these two domains are essential tools for the technicians and engineers working on this project. Therefore, a glossary like this is a useful resource to facilitate communication among the project's participants.

The sources used to build a preliminary glossary were documents (PPT presentations) posted on the wiki within the framework of the European project MACBioIDi, which aims at training the project's participants (computer science engineers and technicians) in the different areas of the project. This initial or preliminary list of terms contained technical and semi-technical vocabulary employed within the referred fields of GitHub and 3D Slicer. In a second phase, French, German, Italian, Spanish and Portuguese engineers and technicians, who cooperate in the European project MACBioIDi, were offered the initial list of terms for them to provide their views based on their experience. In other words, it was extended and, in some cases, modified after holding the interviews. The purpose of the interviews was that engineers and technicians could confirm whether they knew the proposed terms; whether they used them in their professional lives; whether these Anglicisms co-existed with other native terms to refer to the same concept; the spelling and pronunciation of these terms in their languages; if there was some kind of adaptation or if the terms were used purely as they come from English. This process of listing the initial vocabulary and the interviews with the engineers and technicians of the different nationalities took place during the months of June and July 2018.

In a third phase, the uses of these Anglicisms in the specific domains of this study were documented by accessing different Internet forums addressed to experts working on the examined domains (GitHub and 3D Slicer). The combination of different external sources during the three phases of this study allowed confirmation of the uses of these technical terms in the written language (analysis of written posted documents: PPT

presentations) published on the wiki of the project MACBioIDi. By contrast, the oral uses were recorded by means of the oral interviews with the engineers and technicians. In addition, some websites and internet forums reported on the uses of these terms, which seem to be midway between the written and the oral languages. The language used on websites and internet forums frequently lacks the degree of formality of the written language, and tends to be more informal like the oral language, despite the fact that it is not oral in the strict sense of the word. This multi-phase analysis provided a wider view not only of the meaning of the specialized language in these IT fields, but also of the real uses in context of the examined lexical units.

Eventually, in a fourth phase, aiming at answering the second research question of this paper, the categorization of Anglicisms used in this analysis was the most recent one, which is by Pulcini, Furiassi and Rodríguez González. These authors define non-adapted Anglicisms as "a word or multi-word unit borrowed from the English language without or with minor formal or semantic integration, so that it remains recognizably English in the RL" (6–7). By contrast, Adapted Anglicisms represent "a word or multi-word unit borrowed from the English language with orthographic, phonological and/or morphological integration into the structures of the RL" (7). Eventually, Hybrid Anglicisms are "multi-word units which freely combine an English element with a RL element" (7). Obviously, Pulcini et al.'s categorization is more complex, but it has been adapted to corpus compiled in this research.

2. FINDINGS

The technical words within the areas of GitHub and 3D Slicer, gathered in our multilingual glossary, will be examined in this section. Therefore, a breakdown of the two domains' object of study will be described in the following sub-sections.

2.1 GitHub multilingual glossary

GitHub is, as its own website announces, "a community where more than 28 million people learn, share, and work together to build software." This company, created in 2016 in San Francisco, supports the following philosophy: "GitHub was created for developers by developers. To build the best platform for you, we need to build a company that reflects the

world we live in today." Therefore, it is based on the generation of knowledge by means of the cooperation of professionals from different countries all over the world. This is, to a certain extent, the philosophy that also lies behind the European project MACbioIDi, within which this paper is included: cooperative work among professionals from different fields and specialties.

The following table presents the terminology gathered from the domain of GitHub, showing a list of Anglicisms used within the platform and their uses in the different examined languages. The definitions of the terms of GitHub have been taken from the official GitHub Glossary.

Table 1. Multilingual glossary of GitHub terminology

English	Italian	German	French (Maghrib)	Portuguese	Spanish
branch (*n*)	branch / ramo	Branch	branche	branch / ramo	rama
clone (*v*)	clone	clone, klone	vloner	clone / duplicar / clonar	hacer un clon / clonar
commit (*n*)	commit	Commit	valider	commit / validar / fazer un commit	hacer un commit
diff (*n*)	differenze	Diff	différence	diferença	hacer un diff
fetch (*v*)	fare un fetch	fetchen	ammener	fetch / obter	fetch, hacer un fetch
fork (*n*)	fork	Fork	forchette	fork	fork, hacer un fork
git (*n*)	git	Git	–	–	–
markdown (*n*)	–	Markdown	langage de balisage léger	ficheiro md	fichero md
merge (*v*)	integrare / fare il merge	mergen	merge < en. merge	mesclar / fazer un merge	hacer un merge
pull (*v*)	fare il pull	pullen	tirer	pull, fazer un pull	hacer un pull
pull / request (*n*)	fare il pull request	Pull / Request	requête	fazer un pull / request	hacer un pull / request
push (*v*)	fare il push	pushen	push	push	hacer un push
SSH key	chiave SSH	SSH Key	clé SSH	chave SSH	SSH

Source: Created by the author.

The first examined term is *branch*, which is also present in the rest of the analyzed languages. Table 1 displays terms such as *branch,* which has been adapted in French with the addition of a final -*e*. In the rest of the languages, there is a co-existence of *branch* with the native versions of the term, *ramo* (Italian), *ramo* (Portuguese) and *rama* in Spanish. A branch is a parallel version of a repository.

The term *clone*, which is a verb, is also present in the different analyzed languages. In some of them, *clone* co-exists with other terms such as the German adaptation *klone* or the adaptation to French by adding the final   -*r* to make this word a verb, and in Portuguese, *clonar*. In Spanish, the expression used is *hacer un clon* and *clonar*. A *clone* is a copy of a repository that lives in your computer instead of on a website's server somewhere, or the act of making that copy.

Commit is a noun which is present in all the languages studied, except for French, where they say *valider*. However, in Italian and German, technicians use the English term without adaptation. In Portuguese, the word is used without adaptation and is even employed as a verb by adding the verb 'to make,' as in *fazer un commit*. In Spanish, the expression used is *hacer un commit*, which means to make a change or modification in a GitHub repository. Therefore, the English term is used not only as a noun (as in English), but also as a verb. A *commit* is a revision or an individual change to a file or set of files.

In the case of the English noun *diff*, which is the abbreviation of 'difference,' German uses the term without adaptation, and Spanish turns the term into a verb by adding *hacer un diff*. The rest of the examined languages uses their native equivalents. A *diff* is the difference in changes between two commits or saved changes. The *diff* will visually describe what was added or removed from a file since its last commit.

The English verb *fetch* is also used in all examined languages, except for French, which uses *ammener*. In Italian, they add the verb 'fare,' giving the resulting expression *fare un fetch*. In German they add the ending -*en*, *fetchen*. In Spanish they add *hacer un fetch*, which co-exists with the non-adapted Anglicism *fetch*. In Portuguese, they also use *fetch* along with the Portuguese version 'obter.' This expression is used to refer to the action of obtaining the last changes of an online GitHub repository without mixing them up.

Fork is the next English noun, shown in Table 1. It is used as a non-adapted Anglicism in all languages except for French, where *fourchette* is used. In Spanish it is also used as a verb with the expression *hacer un fork*,

and it is normally used among the GitHub repository users with the sense of a personal copy of another user's repository that lives in your account.

Git is a noun which is only used as an Anglicism in Italian and German. In French, Portuguese and Spanish it seems not to be used yet. A *git* is an open source program for tracking changes in a text file and is the core technology that GitHub, the social and user interface, is built on top of.

Markdown is an English noun which seems to be used in German. In the rest of languages, the native equivalent words or expressions are employed (*langage de balisage léger* in French, *ficheiro md* in Portuguese and *fichero md* in Spanish). A *markdown* may be defined as a simple semantic file format, not too dissimilar from .doc, .rtf, and .txt.

The English verb *merge* is also extensively employed in the different languages. In Italian, *fare il merge* co-exists with *integrare*. In German, the addition of the final *-en*, *mergen*, makes the noun a verb. In French, *merge* is used, and in Portuguese, the native word *mesclar* co-exists with *fazer un merge*. In Spanish, the interviewees use the expression *hacer un merge*. The action of *merging* consists in taking the changes from one branch in the same repository or from a fork, and applying them in another.

The English verb *pull* is present in all examined languages, except for French, where the word *tirer* is used. In the rest of the languages this Anglicism is used as an expression: *fare il pull* (Italian), *pullen* (German), *fazer un pull*, or simply *pull* (in Portuguese), and *hacer un pull* (Spanish). This last expression refers to the action of fetching in changes and merging them. For instance, if someone has edited the remote file you are working on, you will want to pull in those changes to your local copy so that it is up to date.

Similar is the situation with the next English noun, *pull request*, which is used as a verb in Italian (*fare il pull request*), in Portuguese (*fazer un pull request*) and Spanish (*hacer un pull request)*. In German, the word keeps the original English form and grammatical category, and in French, the equivalent used is *requête*. *Pull requests* are proposed changes to a repository submitted by a user and accepted or rejected by a repository's collaborators. Those nouns with a verb equivalent in other languages — *clone*, *commit*, *fork*, *fetch*, *merge*, *pull*— are terminological mismatches, since the grammatical category of the terms is being modified/adapted in the RL.

The next English verb is *push*, which is used as the original form, without adaptation, in French and Portuguese. In Italian and Spanish the

verb *to make* is added, *fare il push*, and in Spanish, *hacer un push*. In German, once more the addition of an ending *-en* turns this Anglicism into a verb, *pushen*. *Push* is the action of sending your committed changes to a remote repository, such as a repository hosted on GitHub.

The expression *SSH Key* is another sample of an expression that is used in all the examined languages. The term key is kept in German, and in the other languages the native equivalents are used: *chiave* (Italian), *clé* (French) and *chave* (Portuguese). In Spanish *llave* is not used, but just the original abbreviation: *SSH*. It refers to a way of identifying yourself to an online server, using an encrypted message.

In quantitative terms, out of the total 13 examined terms in the domain of GitHub, four of them (30.7%) —*merge*, *pull*, *push* and *request*— are employed in the five analyzed languages with their non-adapted form, with the addition of the verb *to make*, or the suffix *-en* in the case of German. In all these cases, they are used as verbs. Four more terms (30.7%) —*commit*, *fetch*, *fork* and *pull request*— are used in four of the examined languages. Two terms (15.3%) —*branch* and *clone*— are used with their non-adapted form in three languages. Two terms (15.3%) —*diff* and *Git*— are used in two languages, and eventually, one term (7.6%) —*markdown*— is used as an Anglicism in only one language.

These terms come originally from English, as would be expected, as this platform to share knowledge and talent on technology has been created in the United States. However, what seems to be interesting is the way each of the examined languages develops different strategies in terms of choice, by technicians and engineers to use these terms in English without adaptation or adapt them to the RL, or just by creating hybrid combinations such as *hacer un pull* (Spanish). The use of non-adapted, adapted Anglicisms and hybrid combinations reveals the degree of exposure to English by professionals working on any area of IT. What is more, this analysis provides evidence of the 'invasion' of Anglicisms the different European languages are exposed to. Some of the uses of these terms are documented with real examples taken from the website and the forum of GitHub (see Appendix). The number of Anglicisms which are freely used by the contributors to these forums are noticeable.

2.2 3D Slicer

The second analyzed area in the field of IT is 3D Slicer, which is an open source software platform for medical image informatics, image

processing, and three-dimensional visualization, as explained on its own official website.

The following table compiles a number of Anglicisms employed by doctors, engineers and technicians working on the topic Building 3D Slicer in the MACBioIDi project. Some of them will be described next.

Table 2. Uses of 3D Slicer anglicized terms in the examined languages

English	Italian	German	French (Maghrib)	Portuguese	Spanish
build (*v*)	build	build	–	fazer un build	hacer un build
command (*n*)	comando	Befehl / Command	commande	comando	comando
Cmake (*n*)	Cmake	Cmake	Compilateur Cmake	Cmake	compilador para lengua C (Cmake)
checkout (*n*)	checkout	Checkout (*n*) / auschecken (*v*)	–	checkout	checkout
click (*v*)	click	Click (*n*) / klicken (*v*)	clic (*n*) / cliquer (*v*)	click	hacer click
database (*n*)	database	Datenbank	base de données	base de dados	base de datos
download (*v*)	download	runterladen (*v*) / Download (*n*)	télécharger	baixar / descaregar	bajar / descargar
environment (*n*)	ambiente	Umgebung / Environment	environnement	ambiente	entorno
file (*n*)	file	Datei / File	fichier	ficheiro / arquivo	archivo / fichero
folder (*n*)	cartella	Orduer	dossier	pasta	directorio / carpeta
framework (*n*)	framework	Framework	framework	framework	framework / entorno de trabajo
hardware (*n*)	hardware	Hardware	–	hardware	hardware
IDE (acronym)	IDE (*Italian pronunciation*)	IDE (*English pronunciation*)	IDE	IDE	IDE / ambiente de desarrollo integrado
interface (*n*)	interfaccia	Schnittstelle / Interface	interface	interface	interfaz

English	Italian	German	French (Maghrib)	Portuguese	Spanish
libraries (*n*)	librerie	Bibliotheken / Libraries	bibliothèque	biblioteca	bibliotecas
login (*n*)	accedere	Login (*n*) / Einloggen (*v*)	–	login	login
loop (*n*)	ciclo	Loop	boucle	loop / ciclo / laço	bucle
master (*n*)	master	Master	–	mestre	maestro
multi-platform (*n*)	multi-platform, multi-piattaforma	Multi-plattform	multi-plateforme, multiplateforme	multiplataforma	multiplataforma
open source (*n*)	open source	Open Source	–	código aberto	código abierto
package (*n*)	package / pacchetto	paket / package	paquet	pacote / package	paquete
password (*n*)	password	passwort	mot de passe	password / palavra passe	password / contraseña
path (*n*)	path / percorso	Pfad	–	caminho	ruta
plug-in (*n*)	plugin	Plug-In, Plugin	plugin	plugin	plugin, plug-in
registration (*n*)	registrazione	Registrierung	enregistrement	registar	registrarse
run (*v*)	eseguire	Ausfueren / Run	exécuter	executar	ejecutar / correr / lanzar
script (*n*)	script	Skript (*n*) / skripten (*v*)	script	script	script
search engine (*n*)	motore di ricerca	Suchmaschine / Google (*n*)	moteur de recherche	motor de busca	buscador
setup (*n*)	setup	Setup	setup	setup	setup / configuración
sign up (*v*)	registrazione	anmelden / registrieren (*v*)	s´inscrire	sair da aplicação	salir de la aplicación
sign in (*v*)	accedere	anmelden / eingloggen (*v*)	s´identifier	entrar na aplicação	entrar en la aplicación
slave (*n*)	slave	Slave	–	escravo	esclavo
software (*n*)	software / programma	Software	logiciel	software	software
tool (*n*)	tool / strumenti	Tool	outil	ferramenta	herramienta

English	Italian	German	French (Maghrib)	Portuguese	Spanish
tool-bar (*n*)	tool-bar, barra degli strumenti	Toolbar	barre de tâche	barra de ferramentas	barra de herramientas
tool-kit (*n*)	tool-kit	Toolkit	tool-kit	tool-kit	tool-kit
update (*v*)	update / aggornamento	aktualisieren (*v*) / Update (*n*)	actualiser	atualizar	actualizar
upload (*v*)	upload	hochladen (*v*) / Upload (*n*)	–	carregar	subir / cargar
upgrade (*v*)	upgrade / aggiornamento	Upgrade (*n*)	mise à niveau	melhorar	mejorar
user (*n*)	utente	Benutzer / User	utilisateur	utilizador / user	usuario

Source: Created by the author.

Build is an Anglicism used in most examined languages. Curiously enough *build* is used as a noun in Italian and German, whereas in Portuguese and Spanish, they use the expression *fazer un build* and *hacer un build*, which makes the word *build* function as a verb.

The expression *Cmake* is also used in a pure (non-adapted) way in Italian, German and Portuguese. In French and Spanish, this English expression is preceded by *compilateur* and *compilador para lengua C* (*Cmake*).

The Anglicism *environment* seems to be used with the English spelling along with the German term *Umgebung*. In the other examined languages, the interviewed technicians use their native equivalents for this concept: *ambiente*, *environnement*, *entorno*.

Framework is used with no adaptation in all the five examined languages. In Spanish, it is used alongside the Spanish expression *entorno de trabajo*. The following one is the acronym *IDE*, which stands for Integrated Development Environment, and it is also used in the different examined European languages, in some cases with changes in pronunciation as in Italian, Portuguese and Spanish, but with English pronunciation in German. A framework, or software framework, is a platform for developing software applications. It provides a foundation on which software developers can build programs for a specific platform.

Libraries is another lexical unit which refers to collections of complementary software used to perform certain tasks. In German, this

term co-exists with the German word *Bibliotheken*. In Spanish, technicians and engineers do not use the Spanish equivalent term *bibliotecas*, but *librerías* instead, which has the meaning of a book shop in this language. In the IT domain, *loop* is employed in German as an Anglicism, and in Portuguese this term co-exists with other native words. In the rest of the examined languages, native terms are employed to refer to this concept. *Loop* is used in software to refer to something that repeats itself several times.

However, the case of the Anglicism *plugin* is totally different, as in all the examined languages. The non-adapted English version is used in the different languages with two different spellings: *plugins* or *plug-ins*. This refers to a small computer program that makes a larger one work faster and have more features.

As displayed in Table 2, the non-adapted borrowing *open source* is used in an exclusive way in some languages like Italian and German, where there seems not to be any equivalent. In Portuguese and Spanish, there are the translations *código aberto* and *código abierto* respectively, both considered calques from English as well, which constitutes another type of borrowing. The expression *open source* means that a document is accessible on the Internet for everyone and that it is free of charge. It is a method of publication that is becoming more and more popular.

The term *setup* is employed in all analyzed languages with exactly the same spelling and pronunciation as in English. In Spanish, this term co-exists with *configuración*. The verb *set up* means installing a computer program or environment.

Similar is the case of the noun *password*, which is employed in most languages along with other native terms. In Portuguese and in Spanish the English word is used along with the native equivalents, *palabra passe* and *contraseña*, respectively. French is the only language that still uses its native equivalent *mot de passe*. *Password* refers to a secret word, or combination of letters or numbers, used for communicating with another person or with a computer to prove who you are.

The next term is *user* and it is employed in German and Portuguese along with their native equivalents: *benutzer* and *utilizador* respectively. It refers to a person who uses a machine, service or product. The uses of the rest of the terms may be consulted in detail in Table 2.

In order to summarize the contents of the second table, the examined Anglicisms which are used in the five different languages of this project are: *plug-in*, *set-up*/*setup*, *framework*, *IDE*, *software*, *tool-kit*, *checkout*,

click and *script*. It makes a total of nine (22.5%) out of the total 40 examined Anglicisms. There are also four terms that are used in four of the examined languages: *build*, *Cmake*, *password* and *hardware*. In most cases, French is the only language that does not use the original English terms. There are some Anglicisms that are used in three of the examined languages: *libraries*, *package*, *interface* and *login*. The rest of the English loanwords are employed in one or two of the examined languages. It is necessary to note that most of these terms are employed with the same English spelling, with no adaptation to the RL. In some cases, the English loanword co-exists with another native term, but in many cases the Anglicism is the only term employed to refer to a specific concept.

Regarding both examined domains in general terms, the prominent presence of English loanwords in all the examined European languages at the lexical level is remarkable. But what is even more noticeable is the influence on the grammatical functions of these terms, some of which frequently change word class from nouns into verbs, as in the case of *commit* that changes to *fazer un commit* (Portuguese) or *hacer un commit* (Spanish). In this kind of domain, grammatical categories seem to easily change as a linguistic strategy by users in order to make communication effective. As presented in the introduction, terminologies and specialized languages, far from the ideal of univocity to avoid ambiguity, are dynamic fields subject to changes and adaptations to the real needs of communication of speakers, and this research provides evidence of that fact. Despite the English origin of most of these terms, which is discussed in the next section, they are later on adapted to each language for the sake of communication.

In addition, it is also noticeable the switch of many of these originally specialized terms to a more general type of language, as in the case of terms like *software, click, password* and *login*, present in this study; their meanings are not limited to experts in the field of IT, but may also be understood and even used by any average speaker.

All in all, this section has attempted to answer the first research question: to what extent do Anglicisms impact on the different European languages in the field of IT, specifically on the domains of GitHub and 3D Slicer? Far from doubt, the presence of Anglicisms is higher in the field of 3D Slicer than in the domain of GitHub. In general terms, the six languages subject to analysis seem to have been impacted by the use of anglicized lexical units, which mostly belong to a kind of specialized language or terminology. Despite the existence of some equivalent terms in the target

languages, most technicians and engineers tend to use non-adapted English terms. To a lesser extent, some terms adapted to the RL are used, and even some hybrid forms. In the global era in which we are living, IT is a field that allows easy transfer of specialized terms from English to other languages. So far, most IT advances have come from Anglo-American countries, and consequently, the emergence of new vocabulary to call those new inventions is in English. The next natural step, which may be evidenced in this research, is the exportation of those terms to other languages, so that international professionals working in this field use them.

2.3 Types of Anglicisms

This section deals with the second research question in this piece of research. Which kind of Anglicism is the most frequently used in those languages: non-adapted, adapted, or hybrid combinations as linguistic strategies employed by the different examined languages?

As mentioned above, the categorization of Anglicisms by Pulcini et al. was used, though adapted to the sample compiled in this study. The following Tables 3 and 4 summarize each kind of Anglicism in the examined languages. In the case of the field of GitHub, except for the case of French, the use for the rest of the languages ranges from 10 to 13 Anglicisms, the non-adapted ones being the most frequently used, except for Spanish, whose higher percentage is in the use of the hybrid Anglicisms.

Table 3. Breakdown of types of Anglicisms in the field of GitHub

	Italian	German	French	Portuguese	Spanish
Non-adapted	5	8	2	7	2
Adapted	–	5	–	–	–
Hybrids	6	–	1	5	8
Total	11	13	3	12	10

Source: Created by the author.

Table 4 shows the frequency of anglicized terms in the domain of 3D Slicer, which is higher than the one of GitHub because the sample of terms

is also higher. German and Italian seem to be the languages where more Anglicisms are used. In quantitative terms, French is once more the language which presents the lowest use of Anglicisms.

In all of the examined languages, non-adapted Anglicisms are the most frequently used, followed by adapted ones in the case of German.

Table 4. Breakdown of types of Anglicisms in the field of 3D Slicer

	Italian	German	French	Portuguese	Spanish
Non-adapted	25	23	8	17	11
Adapted	1	5	–	–	–
Hybrids	–	–	–	1	2
Total	26	28	8	18	13

Source: Created by the author.

2.3.1 *Non-adapted Anglicisms*

The data reports that the most frequently used type is the non-adapted Anglicism. The following sub-sections show the examples of this type of Anglicism found in each language in the field of GitHub.

2.3.1.1 In the field of GitHub, the following terms were used without adaptation:

Italian: *branch*, *clone*, *commit*, *fork*, *git*.
German: *branch*, *clone*, *commit*, *diff*, *fork*, *git*, *markdown*, *pull-request*.
French: *merge* and *push*.
Portuguese: *branch*, *clone*, *commit*, *fetch*, *fork* and *pull*.
Spanish: *fetch* and *fork*.

As the previous lines reveal, terms like *fork* are used in all languages except for French. Similarly, *commit* and *branch* are used in most of these languages. These are terms that are also used in professional contexts. The employment of these anglicized lexical units is expected in these contexts, where the need to be effective and accurate in communication is important for technicians and engineers.

2.3.1.2 In 3D Slicer

This subsection shows the different non-adapted Anglicisms used in the field of 3D Slicer in the different examined languages:

Italian: *build*, *Cmake*, *checkout*, *click*, *database*, *download*, *file*, *framework*, *hardware*, *master* and *multiplatform*.

German: *build*, *command*, *Cmake*, *Checkout*, *environment*, *file*, *framework*, *hardware*, *IDE* (with the English pronunciation), *libraries*, *login*, *loop*, *master*, *open source*, *package*, *plug-in*, *setup*, *slave*, *software*, *tool*, *toolbar*, *toolkit*, and *user*.

French: *Cmake*, *framework*, *IDE*, *interface*, *plugin*, *script*, *setup*, and *tool-kit*.

Portuguese: *Cmake*, *checkout*, *click*, *framework*, *hardware*, *IDE*, *interface*, *login*, *loop*, *package*, *password*, *plugin*, *script*, *setup*, *software*, *tool*-kit, and *user*.

Spanish: *checkout*, *framework*, *hardware*, *IDE*, *login*, *password*, *plugin*, *script*, *setup*, *software*, and *tool-kit*.

In the domain of 3D Slicer, the use of Anglicisms is higher, but it may be noticed that not all of them are such specialized terms as in the domain of GitHub. Terms like *hardware*, *file*, *login*, *package*, *software* and *password* can be used by almost any average user of computers.

2.3.2 *Adapted Anglicisms*

This type of Anglicism is less frequently used in both fields, GitHub and 3D Slicer. These are the examples that seem to be used. In German, different English nouns become German verbs by adding a spelling adaptation (ending *-en*). In the case of SSH Key, the English spelling is kept, but the expression is used with a phonetic adaptation to German.

2.3.2.1 In the domain of GitHub

German: *fetchen*, *mergen*, *pullen*, *pushen*, *SSH key* (with a phonetic adaptation, pronounced in German).

2.3.2.2 In the domain of 3D Slicer

Italian: *IDE*, with a phonetic adaptation, pronounced in Italian.
German: *click*, *download*, *update*, *upload*, and *upgrade* are English verbs, but in German they are used as nouns.

It is worth mentioning the grammatical swaps of some of the anglicized terms when they are exported to other languages, especially to German.

2.3.3 *Hybrid Anglicisms*

2.3.3.1 In the field of GitHub

Italian: *fare un fetch*, *fare il merge*, *fare il pull*, *fare il pull request*, *fare il push*, *chiave SSH*.
French: *clé SSH*.
Portuguese: *fazer un commit*, *fazer un merge*, *fazer un pull*, *fazer un pull request*, *chave SSH*.
Spanish: *hacer un commit*, *hacer un diff*, *hacer un fetch*, *hacer un fork*, *hacer un merge*, *hacer un pull*, *hacer un pull request*, *hacer un push*.

2.3.3.2 In the area of 3D Slicer

Portuguese: *fazer un build*.
Spanish: *hacer un build* and *hacer click*.

The use of hybrid forms is a useful strategy to make communication effective among speakers of a shared language, but the key English term that expresses the action is kept. For example, a Spanish engineer can ask another Spanish colleague to *hacer un commit* using this expression which is understood by both speakers of the same language. They use *hacer un…*, which is Spanish, but they still keep the English term *commit*, because it is essential for the sake of communication since there is no other way to express that action in Spanish.

In general terms and considering the data displayed in Table 3, in the field of GitHub, German is the language that uses more anglicized lexical units to refer to these technical concepts, with 13 borrowings (100%) out of a corpus of 13 terms. The second position is for Portuguese with 12

borrowings (92.3%) of the corpus, and the third for Italian with 11 Anglicisms (84.6%) of the corpus. Spanish is in the fourth position with 10 terms (76.9%) of the corpus. French is in the last position with only 3 borrowings (23%) of the total corpus. French is undoubtedly the most conservative language, since it uses more native words to refer to these technical concepts.

Summarizing the contents of Table 4 (3D Slicer terminology), out of a corpus of 41 anglicized terms, German is once more the language that uses more borrowings. A total of 28 terms (68.2%) are Anglicisms. Italian is in the second position with 26 borrowings (63.4%) used in this field. Portuguese is in the following position with 18 Anglicisms (43.9%) of the total corpus. Spanish employs 13 anglicized lexical units (31.7%) of the corpus, and French is once more in the last position regarding the number of English borrowings with only 8 terms (19.5%) of the corpus.

German is the language which uses the highest percentage of Anglicisms in the fields of GitHub and 3D Slicer, as opposed to French, which tends to use more native terms, and consequently, shows less influence from English than the other languages in the examined fields.

In summary, and related to the second research question, there seems to be a tendency to use non-adapted Anglicisms rather than adapted or hybrid ones. The reason could be related to the fact that this is a type of specialized language where the avoidance of ambiguity is essential for the sake of an effective technical communication. It is more efficient to use the original anglicized term that is going to be understood by any technician or engineer than using an adapted or hybrid one that is probably not going to be understood by other foreign users.

CONCLUSIONS

With regards to the first research question, it has been demonstrated that Anglicisms impact the European languages in the field of IT. This study reports the results of the compilation of a multilingual glossary with Anglicisms employed in the areas of GitHub and 3D Slicer. Despite the limited number of terms included in the glossary, this paper provides plenty of evidence of the influence of English in the examined areas of IT, GitHub and 3D Slicer. The kind of Anglicisms used in the domain of 3D Slicer seems to be more various than in the domain of GitHub. By various, it is meant that it combines highly specialized terminology (e.g. *build*), but

also other English lexical units that may be used by any average user of computers (e.g. *password*, *login*, *sign in*, *upload*, among others).

This piece of research has shown that these five European languages use language strategies in order to solve any communication problem. The multilingual glossary has revealed that, in some cases, there is a co-existence between the Anglicism and the native term (e.g. *branch* and *ramo* co-exist in Italian and Portuguese). Secondly, in other cases, the English term is the only one that is used in different languages, like in the case of *branch*, *push*, *click*, *plugin*, *checkout*, to list some of them. Thirdly, there are cases in which the native language is the only one employed, for example, *valider* is the only term used in French.

When it comes to the second research question, the most frequent type of Anglicism is the non-adapted one. To illustrate, in Italian or German, many of the English loanwords are used with no adaptation, as in *branch*, *clone*, *commit*, *fork*, *git*, to mention just a few examples.

Some cases of adaptations may also be observed: for example, *plugin* without a hyphen in all examined languages, or the German ending *-en*, as in *mergen*, *pushen*, *pullen,* which turns some English nouns into verbs. These examples are evidence of adaptations of Anglicisms to the RL.

The hybrid combinations seem to be common in the Romance languages, i.e. Italian, Portuguese and Spanish. The cases in which a verb —*fare*, *fazer* o *hacer* + *pull*, *pull request*, *push*, *fetch*— combine in order to turn a noun into a verb in the RL are some examples of hybrid combinations. These three languages use the same strategy to solve this linguistic gap. In all the cases, they keep the key word in English, which is the one that expresses the action to be carried out.

In summary, there are multiple reasons for engineers, technicians and doctors to use these Anglicisms, such as absence of a native equivalent, higher exposure and familiarity with English documents and websites, the need to use terms that are internationally understood by any professional working in these fields across the globe, a desire to look modern and cool by using these English words, the economy of language, and the North American origin of all these terms. IT is a field that is constantly undergoing changes, improvements and innovations and most of these terms generate in countries like the United States and Great Britain. Despite the fact that there are equivalents for many of these terms, sometimes experts still prefer to use the English loanword, since the native word does not seem to reflect the whole meaning of the concept. In other words, there is not only one single reason that could justify the uses of

English loanwords in the European languages of this study. Terminologies and specialized languages are far from the ideal of univocity to avoid ambiguity. In this paper, we have witnessed that the English language is at the root of most of the analyzed terms, but we have also observed a number of adaptations and hybrid formations which combine an English word or root with another native term in order to make communication effective. Specialized languages are dynamic fields subject to changes and adaptations. This research provides evidence of this fact.

This is a piece of research where not only professionals from different areas of knowledge are involved (linguists, engineers and technicians), but also people from different nationalities and continents (Africa, America and Europe). This type of interdisciplinary and cooperative work is very useful in order to generate, share and exchange knowledge in this current globalized society and culture of knowledge. Not only international engineers and technicians working in the MACbioIDi project, but also experts who work in the domains of GitHub and 3D Slicer can easily access, understand and use a particular technical term in another language. This multilingual glossary is a helpful tool that contributes to make communication more effective among engineers and technicians who speak different native languages. The final aim of this research would be the creation of a multilingual glossary which is still in process of construction and will probably encompass other IT domains such as Python, and VTK.

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APPENDIX

The Anglicisms in Table 1 are underscored in the following excerpts with the goal of highlighting their use, but they occurred with no marks on the internet forums that they have been taken from. In some of the listed examples, there are not specific terms from the GitHub glossary. They can be consulted in Table 1, but they have been included to demonstrate the high presence of Anglicisms employed in this area and in all examined languages.

Examples from Spanish-speaking websites and forums dealing with GitHub

(1) Por eso no publicamos una errata: porque la errata es el diff entre el enunciado al momento de publicarlo y la versión actual. (foro github.com, 19/11/2015)

(2) Este cuatrimestre usamos GitBook para publicar el enunciado, y lo lindo que tiene (además de poder escribir en Markdown) es que está versionado en un repositorio git. (foro github.com, 19/11/2015)

(3) El siguiente paso, una vez subido el commit, es realizar el Pull Request. En tu fork observarás un icono en verde que sirve para comparar y revisar para crear un Pull Request. (desarrolloweb.com, 09/11/2015)

(4) Con esta serie de pasos hemos aprendido a realizar una operación de Pull Request, aportando código en un repositorio Open Source. Esperamos que puedas poner en práctica esta actividad que sin duda resultará enriquecedora tanto para el software libre como para tu propio perfil de GitHub y tu formación profesional. (desarrolloweb.com, 09/11/2015)

(5) Utilizando formato markdown para explicar el trabajo que has hecho en tu branch:

Resume el cambio propuesto.

Menciona al equipo de formadores usando @githubteacher.

Utiliza la palabra clave closes seguida inmediatamente por el número de tu issue (ej. closes #3) para indicar a qué Issue se refiere este Pull Request. Cuando haces esto, el issue se cerrará automáticamente cuando se haga merge del pull request. (services.gitthub.com)

(6) Ahora que ya has hecho algunos commits locales, es hora de que envíes tus cambios a la copia remota de tu repositorio en GitHub.com y abras un pull request. (services github.com)

(7) My two cents sería un canal de chat en Gitter (en base al repositorio de Github). Transparente y de libre acceso y un blog por medio de <u>Markdown</u> en jekyll en el repositorio <u>main</u>, ese blog con comentarios en Disquss. (github.com/folkswhocode/base/issues,10 12/11/2017)

Examples from German-speaking websites and forums dealing with GitHub

(8) Abholle weil ansonschde <u>fetch</u> un <u>checkout</u> es gleiche sin (github.com/danielauener/git-auf-deutsch, 23/06/2018)

(9) Vereinen   einiger   <u>commits</u>   von   pyropeter (github.com/danielauener/git-auf-deutsch, 24/07/2016)

Examples from French-speaking websites and forums dealing with GitHub

(10) Un conseil: vu que tu proposes les top par pays et par ville, j'aurais plutôt mis une google map en full page avec des photos dont la taille est fonction de la popularité (forum.humancoders.com, 15/02/2015)

(11) Je cherche à avoir du <u>feedback</u> sur un projet perso que j'ai mis en ligne pour le fun. J'ai crawlé les archives de Github pour calculer un classement des devs par language et par ville. Vous êtes curieux de savoir   quel   est   votre   classement   sur   Github? (forum. humancoders.com, 15/02/2015)

(12) Il faudrait prendre en compte les contributions faites sur des repositories qui ne nous appartiennent pas, peut-être au prorata du nombre de <u>commit</u> total? (forum.humancoders.com/t/decouvrez-votre-ranking-sur-github/1361/12, 02/03/2015)

Examples from Italian-speaking websites and forums dealing with GitHub

(13) Ci sono altre PA di paesi differenti dal nostro su GitHub? Se la risposta è SI dobbiamo esserci anche noi. Tra le altre cose che problema c'è ad hostare sorgente su GitHub se si tratta di codice <u>open source</u>? Se proprio vogliamo mettere su un repo GIT con hosting in Italia facciamolo pure ma non ne capisco l'utilità (forum.italia.it/ t/repository-su-github, 27/03/2017)

(14) vorrei sapere perchè quando provo a caricare i dati su <u>github</u> oltre che non me li carica mi da questo errore, non so più come risolvere il   problema   lo   provate   tutte <u>Username</u>   for   <u>Password</u>   for   (forum.italia.it/t/repository-su-github,11/09/2017)

(15) Il <u>Wireframe Kit</u> fa parte di un progetto più ampio che si chiama Designers Italia e che include una serie di <u>kit di design</u> utili a progettare e realizzare i servizi digitali destinati ai cittadini. (github.com/italia/design-wireframe-kit/blob/master/README.md, 04/07/2018)

(16) Il <u>wireframe</u> serve a costruire la struttura di un sito web, ad impostare i layout delle pagine, la gerarchia delle informazioni e l'interazione, senza essere distratti dai colori e dagli stili. (github.com/italia/design-wireframe-kit/blob/master/README.md, 04/07/2018)

Examples from Portuguese-speaking websites and forums dealing with GitHub

(17) Faça um <u>fork</u> deste repositório no GitHub, BitBucket ou servidor de sua preferência. Sugerimos que a visibilidade seja definida como privada, para que outros candidatos não tenham acesso aos seus *insights* (github.com/g-portugues/teste-dev-php-senior)

(18) Como usuário da API, quero ser capaz de editar tags de modo que eu possa definir uma cor para uma dada tag e isso reflita na forma como o front-end exibe as tasks (github.com/g-portugues/teste-dev-php-senior)