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Perception of the English element in the scientific register of Croatian ICT university educational material with graduate ICT students

This paper focuses on the results of a questionnaire distributed to 54 second-year graduate information and communications technology (ICT) students at a Croatian university who used to have *English in computer science* as a mandatory course in the first year of their undergraduate studies, but who have been, since then, exposed to English in less formal environment and situations. The questionnaire, prepared as an acceptability judgment test, contained the questions on the English element, i.e. anglicisms at various levels of adaptation to Croatian and unadapted expressions collected from Croatian university textbooks and educational materials on information and communications technology recommended in the students' undergraduate and graduate curricula. The main aim of the research was to establish whether the examined students, according to their language intuition, found the English element acceptable in the scientific register of the standard Croatian language. The questions also tested the comprehensibility at the sentential level and the students' agreement with certain statements regarding Croatian and English terminology. The data were processed by the SPSS software for statistical analysis. The results of our research showed that the English element in the scientific register of ICT textbooks and educational materials is found fairly acceptable among the examined students and not perceived as a foreign element, whereas Croatian forms and adaptations, that is, Anglicisms are usually less acceptable.

Key words: ICT students; the English element; scientific register; acceptability; university educational material.

1. Introduction: theoretical background

Language borrowing is a process resulting from social and cultural contacts of two or more language communities, but a borrowing may also be "defined as a word that at some point in the history of a language entered its lexicon as a result of borrowing (or transfer, or copying)" (Haspelmath 2009: 36). Languages often accept new words from other languages for extra-linguistic (Filipović 1986; Nikolić-Hoyt 2005: 179–180; Sočanac 2005) and quite practical reasons: new extra-linguistic referents have to be named somehow. A country which is a leader or a trendsetter in technology, science or in some social and cultural field will resort to lexical sources of its national language(s). Such a country will not be only technologically or culturally, but also linguistically influential, as it will export its lexical innovations to other countries who lag behind in those fields and whose national languages are different and diverse: "The United States has achieved a certain position of dominance in the technological sphere, as competitors fell by the wayside, (…). However, the language in which research on new technology is published is principally English, no matter what the origin" (Wright 2004: 150). Consequently, the language of such a country becomes prestigious among speakers of other, less scientifically, technologically or culturally influential countries. Nevertheless, prestige may only partly explain why borrowing takes place, because in fact "all languages have the means to create novel expressions out of their own resources" (Haspelmath 2009: 35).

Languages change, but not as entities independent of their users. It is the attitude of speakers toward their mother tongue that can make or break its status, i.e. whether they perceive it as a useful communication tool which contains language devices appropriate for every speech situation, or an imprecise language of old-fashioned lexemes and structures which cannot keep abreast with a modern world, and, as a result, some other, usually foreign, sources have to be tapped in order to communicate in the globalized world.

Occupational varieties or jargons are communication tools and a means of identification for members of a professional group and very often their linguistic features are temporary. ICT expressions may be treated as jargonisms when and as they enter a language. However, these terms tend to quickly gain popularity owing to mass media, since they can reach an audience wider than a community of ICT experts. At least some of rather frequent jargonisms enter the language of ordinary computer and information technology users, and eventually public discourse, providing speakers with practical, ready-made and often fashionable and prestigious expressions. Jargonisms challenge norms of the standard language aimed at

more official public communication with its lack of compliance (Halonja and Mihaljević 2012). However, new terms, and ICT terms, too, as they enter Croatian as a receiving language and its standard variety, should be italicized in text if they keep their original form (Jozić et al. 2013). Eventually, these terms should be adapted and harmonized with the standard language norms, as recommended by, e.g. *Hrvatski pravopis* (Badurina et al. 2007: 217; cf. Mihaljević 2003). Such terms may become part of scientific functional style of the standard Croatian language (Silić 2006), so called in the Slavic stylistics studies, or scientific register ("functional style" is similar but not entirely equal to the English "register", as registers are differentiated on the basis of topic and tone of text (Katnić-Bakaršić 1999: 11)). These styles are various realizations of the standard Croatian language (Barić et al. 1999: 57). Scientific register is characterized by its utmost adherence to the norm and allows authors little leeway in terms of individualistic expression and style (Hudeček and Mihaljević 2012: 43–44). It is sophisticated and demanding as it is supposed to precisely outline and present scientific methodology and to bring objectivity, terminological uniformity, grammatical correctness and syntactic well-formedness (Kovačević andBadurina 2001: 28, 126). This register can be further subdivided into scientific register in the narrow sense of the word and the scientific-pedagogical sub-register. It is used with readers who are yet to master a particular material from university textbooks, manuals or written lectures (Katnić-Bakaršić 1999: 30), in our case, textbook material on ICT.

1.1. *English model adaptation*

The influence of the English language on Croatian coincided mostly with the spread of British and American pop-culture which was on the rise after World War II. Before that time this influence had been almost negligible. Expressions which entered Croatian during the post-war period were adapted usually in such a way that original English graphemes would be replaced by closest Croatian ones (Nikolić-Hoyt 2005: 189, Filipović 1990: 28–29), which also represented Croatian phonemes, so there was a certain degree of orthographic and of phonological/phonetic adaptation called transphonemization. Starting from the 1990s the influx of new English expressions has intensified concurrently with global political and economic changes and transitional processes. Consequently, the number of ESL speakers has risen, so has their proficiency in English. Therefore, new entries to Croatian are not perceived as foreign and unadapted forms are often retained as such (Nikolić-Hoyt 2005: 183).

When analyzing a borrowed word, one or the other, or sometimes both, orthog-

raphy and pronunciation, are taken into consideration (Filipović 1990: 26), since phonetic realization of a word in the receiving language is the result of the interaction between these two factors. Apart from new entries to Croatian being adapted according to the English pronunciation, there is also orthographic adaptation which combines original pronunciation and original English orthography (Nikolić-Hoyt 2005: 191, Filipović 1990: 29), so that one part of an expression is formed according to the Croatian pronunciation, and the other according to the original orthography, most usually at the boundary of two morphemes.

Words can be adapted at morphological level by transmorphemization, which means that English morphemes are substituted by Croatian ones (Filipović 1986: 68). Such words, English models, adapted at orthographic, phonological or morphological level(s) become loanwords, and in the case of English, Anglicisms (Filipović 1990: 16). If the term keeps certain features of the giving language and is only partially adapted, it becomes a compromise replica (Filipović 1986: 38; Sočanac 2005: 11–14). This stage is temporary, at least theoretically, but some words retain the form of a compromise replica or a foreign loan. Unadapted words are not Anglicisms, they are foreign words.

Many ICT terms which have fairly recently (in the past twenty or twenty-five years) entered Croatian have kept their original orthography and are, by and large, unadapted, and as such, may not always be labeled "Anglicisms" since this linguistic term implies a certain level of adaptation and integration of the English word into the receiving language. Nikolić-Hoyt (2005: 181, 189), therefore, proposes a redefinition of "Anglicism", as the imported forms do not quite match the current scope of the definition. This is why we tend to use the expression "the English element", also used by Rudolf Filipović in his work on contact linguistics, as an umbrella term to cover all the cases and forms of English influence on the Croatian language.

Since the expressions we collected originate from written texts, we can speak only of phonological adaptations which have been done orthographically, and which are combinations of pronunciation and orthography. As we do not and cannot know what the phonetic realization, in fact, is in immediate ICT users, we can only theoretically support Filipović's opinion (1990: 50) that the Anglicism may be orthographically unadapted but that its pronunciation should be adapted to Croatian as much as possible. However, as Sočanac points out (2005: 10) some expressions may enter the receiving language, fail to adapt to it and drop out of usage, not having gained a wider circulation. Their extralinguistic referents may soon disappear, which can be expected, considering a very quick development of ICT technologies

and subsequent creation and disappearance of extralinguistic referents. Some expressions enter the language and remain in use for a short period, not surpassing the level of occasionalisms.

1.2. *ICT students as native speakers*

According to Davies (2003: 210), the native speaker is a person who acquired a L1 in childhood and uses it, "has intuitions (in terms of acceptability and productiveness) about his/her Grammar 1" and "has intuitions about those features of the Grammar 2 which are distinct from his/her Grammar 1." Here, Grammar 1 represents the speaker's own linguistic system, idiolect, and Grammar 2 is "that shared set of rules which seems to bring together members of the same language group," the standard language (Davies 2003: 53). However, intuition cannot stand alone as the only criterion when deciding on the acceptability of some language expression as native speakers' intuition is subjective and depends on the level and quality of their education as well as their interest in language issues (Barić et al. 1999: 49–50). Still, native speakers are able to recognize expressions and structures which belong to the mother tongue even if they have not encountered them before and thus are able to decide whether some expression is acceptable in a wider community of speakers. It is the norm of common usage, based on the native speaker's assessment whether these expressions are common and acceptable or not, that is the decisive factor (Matešić 2013: 39–40).

ICT students are users of ICT and hence, of its terminology and jargonisms, both in Croatian and English. As future engineers, these students may start their career in an ICT magazine and write articles, or they may start an academic career, which also requires good writing skills in both Croatian and English. This means that they may be active participants in scientific discourse and even innovate or propose certain linguistic solutions and thus help create scientific register of the standard Croatian. Therefore, we wanted to establish how the ICT students as native speakers (Davies 2003; Ellis 1994) perceive and respond to the English element in their university materials. However, we are not of the opinion that students in general, even though native speakers, can make acceptability judgments which would be normative and not subject to questioning (acceptability tests in Davies 2003, Ellis et al. 2009). Still, they do not have to refrain from voicing their opinion whether they see various linguistic phenomena as acceptable in scientific register and compliant with the norms of the standard Croatian language.

2. Research

2.1. *Aim*

The main motive for conducting this research first were Croatian ICT magazine articles: namely, having established that the magazines abound in the English element in various forms, we wanted to see if the scientific register of university textbooks had any consistent policy regarding the English element.

The aim of the research was to find answers to the following questions:

1. What is the graduate students' attitude toward the English element in Croatian ICT university educational materials;
2. What is their attitude toward Croatian ICT terms;
3. Do their attitudes support certain statements regarding English and Croatian ICT terminology (some of them referred to as common misconceptions in Mihaljević 2006, 2007)?

All these questions were tested with respect to the students' exposure to English during regular secondary education and to additional classes they took in language schools or as private tutorials. The null hypothesis was that the form of instruction, i.e. regular secondary education and additional classes, would be unrelated to their answers. In view of the students' exposure to the ICT content on the Internet, magazines and mass media in general, we hypothesize that a number of examples will be acceptable with the students, but statistical analysis will show which ones and to what extent.

The acceptability of English borrowings in Croatian ICT terminology was the focus of some other research papers (Mihaljević 1993 and Stojaković 2004), but within different samples and different questionnaires.

2.2. *Participants*

This research took place in the academic year of 2014/15. The participants in this research were 54 second-year graduates of ICT at the Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, University of Split. This was, all in all, the fifth year and also the last year of their university education when they have already covered a significant number of ICT textbooks in both Croatian and English. They all finished four-year secondary education. We did not obtain all the answers to the questions since some students either had skipped them

or had not understood them, so the total number of answers and students is slightly discrepant in several instances.

Following "the usual methodological expectations of experimental psychology", as Wasow and Arnold put it (2005: 1483–1484), the number of participants was large enough so that the results could be processed statistically. This sample represents the Croatian population of second-year ICT graduates (there are three more universities which have graduate studies in ICT: Tehnički fakultet, University of Rijeka, Elektrotehnički fakultet, University of Osijek and Fakultet elektrotehnike i računarstva, University of Zagreb). Furthermore, the linguistic expressions were presented randomly and the students did not know what the purpose of the questionnaire was.

The results of our questionnaire-based research drew on the students' acceptability judgments which they made as native speakers of Croatian who had developed certain linguistic intuition. Here we deal with "primary intuitions," "simply introspective judgments of a given linguistic expression's well-formedness or of its meaning" (Wasow and Arnold 2005: 1482).

2.3. *Methodology*

For the purposes of this research a questionnaire was prepared in Croatian and it was divided into two parts: the first part contained questions related to sociodemographic variables (gender, age, completed secondary education) and their attitude toward their knowledge of English, language they read computer texts in and the reasons for choosing one language over the other. The central part of the questionnaire contained questions on the English element, i.e. decontextualized Anglicisms at various levels of orthographical, phonological and morphological adaptation to Croatian and unadapted expressions collected from Croatian university textbooks and educational materials on information and communications technology (ICT) recommended in their undergraduate and graduate curricula (five-year period). Presented were only those expressions which were not preceded or followed by Croatian equivalents. These expressions were not graphically marked in the materials, that is, bolded, italicized, underlined, as recommended, e.g., by both *Hrvatski pravopis* (Badurina et al. 2007: 217 or Jozić et al. 2013)

The questions tested the acceptability of the English element at the level of one word, at the level of hybrid two-word syntagmas (usually one English and one Croatian word), at the sub-sentential level where a noun premodifies the head noun following the English syntactic model, and the comprehensibility at the sentential

level where exchanges of Croatian and English expressions resemble code-switching, as well as the questions on agreement with certain statements commonly heard among students and non-linguists. The statistical analysis was done by the SPSS software.

3. Results and interpretation

3.1. *Questionnaire, part 1*

The age range of the 54 examined students was between 21 and 41, most of them being at the age of 23 (61.1%), 46 of them male (85.2%) and 8 female (14.8%).

In the questionnaire they were also asked to rate themselves according to the Common European Framework of Reference (CEFR), and most of them would rate their knowledge in the range between B2 and C1 (40.7% and 29.6% respectively).

Still, most of them (87.7%) said that their knowledge of general English was sufficient for everyday use and that they encountered no difficulty reading computer science literature in English. They found that they needed this language skill in most cases (66.7%).

When asked how they found information on breakthroughs in computing, the most frequent answer was "I search the Internet", 77.8% of them, and then the language of their search was most frequently English for 50 students (92.6 %), the reason being that texts in English were more available, at least in their opinion.

More than a half of them had attended grammar high school (55.6 %), as opposed to 44.4% of them coming from various vocational schools. For all of them English was a compulsory course in their secondary education, but some of them, 38.9% attended English courses in language schools or took some private lessons, whereas 61.1% had English only in school.

The table below (Table 1) correlates the following categorical data: the high school the students attended and graduated from and a type of formal instruction they were exposed to. There are two variables that divide each set of data - grammar or vocational school and mandatory formal instruction in school and optional in foreign languages school or private lessons. The null hypothesis would be that the type of high school students went to and the number of classes they were exposed to are unrelated.

Table 1: Correlation of the type of high school and the form of English instruction

Q: Which high school did you attend? / Q: I studied General English:		a) grammar school	b) vocational school	Total
a) only in school	Number of students	13	20	33
	% within Which high school did you attend?	43.3%	83.3%	61.1%
b) in school and in a foreign languages school/private lessons	Number of students	17	4	21
	% within Which high school did you attend?	56.7%	16.7%	38.9%
Total	Number of students	30	24	54
	% within Which high school did you attend?	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asympt. Sig (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	8.977[a]	1	.003	.005	.003
Continuity Correction[b]	7.372	1	.007		
Likelihood Ratio	9.490	1	.002	.005	.003
Fisher's Exact Test				.005	.003
N of Valid Cases	54				

In both Pearson Chi-Square test and Fischer's Exact test *p*-value is 0.005, which is lower than 0.05. It shows that there is a statistically significant difference in answers, a 0.5% likelihood that the null hypothesis is correct and, of course, a high probability of interdependence of the two sets of data. In other words, the numbers show that more students who graduated from grammar schools had invested more time and effort in optional English language instruction than those who had not. On the other hand, the number of students who graduated from vocational schools and who had not taken up any additional English language course is considerably high-

er than those who had attended some courses or private lessons.

3.2. *Questionnaire, part 2*

The second part of the questionnaire, which is central to our research, contained a number of decontextualized language expressions, Anglicisms at various levels of orthographical, phonological and morphological adaptation to Croatian and unadapted expressions. The aim was to establish whether the varied length of exposure to English in formal environment had any impact on the students' answers regarding the English element at the level of acceptability, comprehensibility and the level of agreement with certain statements on English and Croatian ICT terminology.

3.2.1. *Level of acceptability*

According to the amount of time they spent studying English there were two groups of students (referred to as group A and group B). The following table (Table 2) correlates the question where they studied English and the acceptability judgment of language expressions, nouns both singular and plural, gerund nouns and adjectives. The acceptability was rated on a 5-point Likert scale. The question ran as follows: *Do you find the following forms of Anglicisms (adapted and unadapted)* ***acceptable*** *in the standard Croatian? Rate the acceptability by circling a digit on a 5-point scale (1=totally unacceptable, 2=mostly unacceptable, 3=neither acceptable nor unacceptable, 4=mostly acceptable, 5=totally acceptable).* The English model has been provided in italics below some expressions adapted to Croatian up to a point.

Table 2: The relationship between the form of instruction and the acceptability of single-word expressions

FORM OF INSTRUCTION / SINGLE-WORD EXPRESSION	I studied general English	N	Mean	Std. deviation	Std. error	Min. grade	Max. grade	ANOVA Sig. between groups
assembler	A in school	32	2.94	1.318	.233	1	5	
	B in school and in a for-	21	3.05	1.431	.312	1	5	

	eign languages school/private lessons							
	Total	53	2.98	1.352	.186	1	5	0.775
asembler	A	33	4.03	1.132	.197	1	5	
	B	21	4.05	.921	.201	2	5	
	Total	54	4.04	1.045	.142	1	5	0.953
canvasi *canvases*	A	33	3.55	.971	.169	1	5	
	B	21	3.71	.956	.209	2	5	
	Total	54	3.61	.960	.131	1	5	0.534
rutiranje *routing*	A	33	2.55	1.252	.218	1	5	
	B	21	3.00	1.225	.267	1	5	
	Total	54	2.72	1.250	.170	1	5	0.196
dibagiranje *debugging*	A	33	1.94	1.088	.189	1	4	
	B	21	1.57	.676	.148	1	3	
	Total	54	1.80	.959	.131	1	4	0.172
videostream-ing	A	33	4.18	.950	.165	1	5	
	B	21	4.29	.717	.156	3	5	
	Total	54	4.22	.861	.117	1	5	0.670
linkanje *linking*	A	33	4.15	1.034	.180	1	5	
	B	21	4.14	.793	.173	3	5	
	Total	54	4.15	.940	.128	1	5	0.974
middleware	A	33	4.21	.927	.161	2	5	
	B	21	4.19	.814	.178	3	5	
	Total	54	4.20	.877	.119	2	5	0.931
bitovna *bit* (adjec-tivalized)	A	33	4.30	.810	.141	2	5	
	B	21	4.52	.680	.148	3	5	
	Total	54	4.39	.763	.104	2	5	0.304
dithering	A	33	3.27	1.232	.214	1	5	
	B	21	3.29	1.007	.220	1	5	
	Total	54	3.28	1.140	.155	1	5	0.968
splineovi *splines*	A	33	3.24	1.091	.190	1	5	
	B	21	3.14	1.352	.295	1	5	
	Total	54	3.20	1.188	.162	1	5	0.767
antialiasing	A	33	4.21	1.083	.188	1	5	
	B	21	4.00	1.342	.293	1	5	
	Total	54	4.13	1.182	.161	1	5	0.526
paketizacija *packetization*	A	33	2.73	1.257	.219	1	5	
	B	21	2.62	1.284	.280	1	5	
	Total	54	2.69	1.256	.171	1	5	0.761
firmver	A	33	2.24	1.251	.218	1	5	

firmware	B	21	2.38	1.244	.271	1	5	
	Total	54	2.30	1.238	.169	1	5	0.693

Both *assembler* and *asembler* as **singular nouns** retain the English morpheme signifying the agent, *-er*. The difference between the two is only in spelling, but this case shows that this partially adapted word, *asembler* was more accepted with both groups than the English model, which had a low acceptability. The reason could be that *asembler* already has a wide circulation in the ICT community.

Other singular nouns had a varied acceptability and one pair of nouns illustrates the students' preferences: on the one hand, the English model *middleware* was almost equally well accepted with both groups, whereas *firmver*, orthographically and phonologically adapted to Croatian, had a rather poor average acceptability (2.30). Finally, we tested *paketizacija*, a word derived from Croatian *paket* and an English borrowing *packet* which had been integrated into General Croatian as a loanword long before it developed a specialized ICT meaning. This noun received a morpheme *–izacija*, which suggests a process, corresponding to the English *-tion*, and though it well exemplifies transphonemization and transmorphemization being carried out, the noun rated rather low in the students' responses, even lower in group B.

The **plural nouns** *canvasi* and *splineovi* were added the plural morpheme *–(ov)i*, but such forms were moderately accepted with both groups (*canvasi* fared slightly higher in group B, but not significantly). No orthographical changes that would indicate some attempts at transphonemization were made in the texts.

In **gerund nouns** we noticed two groups: one in which English models were transphonemized and transmorphemized and the other group in which English models retained their form as it is. *Rutiranje* (slightly higher in group B) and *dibagiranje* (the lowest grade of all, but slightly higher in group A), that is, *routing* and *debugging*, were adapted, up to a point, orthographically, probably phonetically and morphologically, since the gerund morpheme *–ing* was replaced with its Croatian counterpart *–nje*. These gerunds did not rate very high with both groups of students. *Linkanje* was highly accepted in both groups, but the word *link* had no orthographical changes to undergo - phonologically and then phonetically, it slightly differs from the English model, so it is well integrated into Croatian at these levels. On the other hand, the gerund nouns which kept the English form, *videostreaming*, *dithering* and *antialiasing* were perceived as rather acceptable, *videostreaming* being the most acceptable of all, probably due to its wider use, in mass media as well.

Surprisingly, the highest acceptability of all expressions was found in the **adjective** *bitovna*, derived from *bit* (as in *bit matrix*), slightly higher in group B. The rea-

son may be that the model *bit* is well adapted to Croatian as it is, and integrated phonetically (the only difference is in [t], which is a dental consonant in Croatian and a velar in English), has a high circulation, so that all derived forms are acceptable. On the other hand, its level of integration and acceptability contradicts the low rate of *paketizacija* and *firmver*. As to the differences in results between groups A and B, they are slight and statistically not significant.

The results in Table 1 show that a longer or shorter exposure to English in formal, educational environment had no impact on the students' perception and, subsequently, acceptability of single-word expressions, i.e., the difference in answers was not statistically significant.

The following table (Table 3) correlates the form of instruction with the acceptability of hybrid structures consisting of one or two English words and one Croatian word. The question ran as follows: *Do you find the following structures consisting of one or two original English words and one Croatian* ***acceptable*** *in the standard Croatian? Rate the acceptability by circling a digit on a 5-point scale (1=totally unacceptable, 2=mostly unacceptable, 3=neither acceptable nor unacceptable, 4=mostly acceptable, 5=totally acceptable).* Words italicized in the table are either Croatian words or international words which have been integrated into Croatian for a considerable amount of time. They were not originally italicized in the studied materials nor were English words.

Table 3: The relationship between the form of instruction and the acceptability of hybrid structures

FORM OF INSTRUCTION / HYBRID STRUCTURE	I studied general English	N	Mean	Std. deviation	Std. error	Min. grade	Max. grade	ANOVA Sig. between groups
Heap *struktura*	A in school	33	4.30	.984	.171	2	5	
	B in school and in a foreign languages school/private lessons	21	4.24	.768	.168	2	5	
	Total	54	4.28	.899	.122	2	5	0.799
Pitch period *glasa*	A	33	4.12	1.244	.217	1	5	
	B	21	4.05	.921	.201	2	5	
	Total	54	4.09	1.120	.152	1	5	0.817
String *operator*	A	33	4.33	1.137	.198	1	5	
	B	21	4.52	.750	.164	3	5	

	Total	54	4.41	1.000	.136	1	5	0.500
Hash *tablica*	A	33	4.64	.549	.096	3	5	
	B	21	4.67	.577	.126	3	5	
	Total	54	4.65	.555	.076	3	5	0.847
Head-mounted *uređaj*	A	33	3.18	1.236	.215	1	5	
	B	21	3.24	1.261	.275	1	5	
	Total	54	3.20	1.234	.168	1	5	0.872
Interlace *tehnika*	A	33	3.30	.951	.166	2	5	
	B	21	3.33	1.197	.261	1	5	
	Total	54	3.31	1.043	.142	1	5	0.918
Step *signal*	A	33	3.91	1.208	.210	1	5	
	B	21	3.71	1.102	.240	1	5	
	Total	54	3.83	1.161	.158	1	5	0.553
Lossy *kodiranje*	A	33	3.73	1.257	.219	1	5	
	B	21	3.57	1.207	.263	1	5	
	Total	54	3.67	1.229	.167	1	5	0.654
Proprietary *tehnologija*	A	33	3.12	1.341	.233	1	5	
	B	21	3.29	1.419	.310	1	5	
	Total	54	3.19	1.361	.185	1	5	0.669
Bubble-jet *glave*	A	33	3.45	1.227	.214	1	5	
	B	21	2.86	1.352	.295	1	5	
	Total	54	3.22	1.298	.177	1	5	0.100
Bit-*polja*	A	33	4.03	1.185	.206	1	5	
	B	21	3.86	1.236	.270	1	5	
	Total	54	3.96	1.197	.163	1	5	0.609
Roadmapping *metoda*	A	33	3.52	1.326	.231	1	5	
	B	21	3.57	1.207	.263	1	5	
	Total	54	3.54	1.270	.173	1	5	0.876

These hybrid structures in most cases are nouns as lexical segments juxtaposed according to an English syntactic patterns which is not a standard structure in Croatian. There are also cases where an English adjective (*lossy kodiranje*), or an adjectivized English participle (*head-mounted uređaj*) premodify a Croatian head noun.

The results show a high acceptability of the hybrid English-Croatian structure as a syntactic and a lexical pattern and it was not perceived as a foreign element by this sample of the graduate ICT population. The response differences between groups A and B were slight except in the case of *bubble-jet glave* which was rated as rather unacceptable by group B (average response 2.86). Still, the differences between the groups are not statistically significant, not even close to *p*-value lower than 0.05, to affect the overall result of high acceptability, so once again the length of exposure to English in formal education did not prove to have some impact upon their responses. All other results of acceptability can be found in the range between

3.12 and 4.67, which is even higher than in single-word units where the results were more varied. What makes these hybrid structures different from the single word units in Table 2, apart from the Croatian element, is the fact that the English parts of the structures were not changed and adapted in any way to the receiving language, but remained in their original form and the students found them acceptable.

As an extension to the above issue we had the following question (Table 4) where the students were asked to rate the acceptability of structures exceeding one word. Marked A were the structures collected from the university materials, which follow the English syntax pattern according to which a head noun may be premodified by another noun, in our cases a Croatian noun, a numeric expression, an abbreviation or an acronym. It is a juxtaposition of language elements classified as a syntactic calque and is not standard in Croatian syntax. The structures marked B were those that followed Croatian syntactic rules. The question ran as follows: *in columns A and B there are pairs of expressions collected from university textbooks and which differ in the word order or part of speech. Choose the expression which you find* ***more acceptable linguistically****.*

Table 4: The acceptability of syntactic calques in Croatian and corresponding Croatian structures

	Structures	Frequency	Percentage
Example 1 Valid answers	A) Funkcije C jezika	38	70.4
	B) Funkcije jezika C	11	20.4
	Total	49	90.7
Missing answers		5	9.3
Total		54	100.0
Example 2 Valid answers	A) IP adresa	50	92.6
	B) adresa IP	0	0
	Total	50	0
Missing answers		4	7.4
Total		54	100.0
Example 3 Valid answers	A) Prema IEEE standardu	48	88.9
	B) Prema standardu IEEE	2	3.7
	Total	50	92.6
Missing answers		4	7.4
Total		54	100.0
Example 4	A) Iz ASCII skupa	45	83.3

Valid answers	B) Iz skupa ASCII	5	9.3
	Total	50	92.6
Missing answers		4	7.4
Total		54	100.0
Example 5 Valid answers	A) MSF (Market Supply Flow) model	44	81.5
	B) Model MSF	6	11.1
	Total	50	92.6
Missing answers		4	7.4
Total		54	100.0
Example 6 Valid answers	A) Z transformacijom	46	85.2
	B) Transformacijom Z	4	7.4
	Total	50	92.6
Missing answers		4	7.4
Total		54	100.0
Example 7 Valid answers	A) Windows komandni prozor	47	87.0
	B) Komandni prozor Windows	3	5.6
	Total	50	92.6
Missing answers		4	7.4
Total		54	100.0
Example 8 Valid answers	A) Na Unix sustavima	48	88.9
	B) Na sustavima Unix	2	3.7
	Total	50	92.6
Missing answers		4	7.4
Total		54	100.0
Example 9 Valid answers	a JPEG format	49	90.7
	b Format JPEG	1	1.9
	Total	50	92.6
Missing answers		4	7.4
Total		54	100.0
Example 10 Valid answers	A) HDSL tehnologija	49	90.7
	B) Tehnologija HDSL	1	1.9
	Total	50	92.6
Missing answers		4	7.4
Total		54	100,0

A number of students did not choose anything. The percentage of students who chose structures marked A ranges from 70.4% to 92.6%; therefore, we conclude that the students overwhelmingly perceived structures marked A as linguistically more acceptable than structures B even though they are not compliant with the Croatian syntax. The reasons for such responses could be diverse but they can probably be attributed to reading English texts, especially ICT articles where such

syntax is standard and Croatian texts whose authors have accepted such order of lexical elements from English texts and transferred it mechanically without any adaptation to the Croatian syntax, and finally, somewhat longer examples marked B which would make ICT texts longer and less compact. The students are obviously accustomed to such structures since they mostly receive information relevant to their profession in English through written media, in our case, university educational materials which have adopted this juxtaposition of elements.

3.2.2. *Level of comprehensibility*

The following table (Table 5) correlates the question on the form of instruction with the comprehensibility of sentences containing a number of adapted and unadapted expressions. The question ran as follows: *In the table below there are several sentences collected from the textbooks recommended for computer science studies. Read every sentence and by circling a digit on a 5-point scale (1=totally incomprehensible, 2=mostly incomprehensible, 3=neither incomprehensible nor comprehensible, 4=mostly comprehensible, 5=totally comprehensible) try to estimate how much you understand the contents of the sentences.* The bolded expressions represent "the English element", which includes English expressions, adaptations and also hybrid structures. They were not originally bolded in the studied materials.

Table 5: The relationship between the form of instruction and the comprehensibility of sentences

FORM OF INSTRUCTION / SENTENCES	I studied general English	N	Mean	Std. deviation	Std. error	Min. grade	Max. grade	ANOVA Sig. between groups
1. Koeficijenti se mogu kodirati ili koristeći context-based adaptive VLC (CAVLC) ili koristeći context-based adaptive binary arithmetic coding (CABAC).	A in school	33	3.88	.960	.167	2	5	
	B in school and in a foreign languages school/ private lessons	21	3.57	1.207	.263	1	5	
	Total	54	3.76	1.063	.145	1	5	0.305
2. WMV je	A	33	3.64	1.113	.194	1	5	

proprietary *tehnologija* Microsofta koji ju je prepustio SMPTE *organizaciji*.	B	21	3.43	1.326	.289	1	5	
	Total	54	3.56	1.192	.162	1	5	0.537
3. Interlace *tehnika* je pogodna kada je izlaz u interlace *formatu*.	A	33	3.79	1.053	.183	1	5	
	B	21	3.62	1.284	.280	1	5	
	Total	54	3.72	1.140	.155	1	5	0.600
4. Tonski i kolor prelazi se dobijaju screening-om ili error diffusion dithering-om.	A	33	3.39	1.248	.217	1	5	
	B	21	3.48	1.250	.273	1	5	
	Total	54	3.43	1.238	.168	1	5	0.814
5. Sync doubling je pogodan.	A	33	3.67	1.190	.207	1	5	
	B	21	3.57	1.326	.289	1	5	
	Total	54	3.63	1.233	.168	1	5	0.785

In these sentences the function words remain Croatian as well as some adjectives and verbs, but those words that have most informational content are unadapted English expressions and structures. Two expressions (example 4) are morphologically "croatized" by an instrumental case ending *–om*. The average comprehensibility of the sentences was 3.62, which would mean that English expressions and unadapted forms did not prevent the students from understanding the message to a significant extent, but still, it was not high, considering the fact that these sentences were extracted from the materials which the students had covered or should have covered by that time. All the results of comprehensibility can be found in a rather restricted range between 3.39 and 3.88. The response differences between groups A and B are slight and statistically not significant, as the *p*-value is above 0.05.

However, we do notice that the students' responses to the questions concerning the acceptability of the English element were more varied, whereas the comprehensibility centered in the middle of the range. It seems that, notwithstanding the fact that the students generally accepted adapted and, even more, unadapted English expressions in isolation, they did not always comprehend such expressions at the sentential level. This could also mean that they accepted some expressions even though they did not know what the expressions actually signify, but they seemed acceptable.

3.2.3. *Level of agreement - students' attitude toward English and Croatian terminology*

The last question tested their attitude toward English and Croatian terminology and their agreement or disagreement with a number of statements (Table 6) that were partially taken from Mihaljević (2006), where they were presented as common misconceptions, and partially from the opinions collected from some of the students during our ESP teaching experience. The question ran as follows: *The table below contains a number of statements concerning the use of English ICT terms and Anglicisms as well as Croatian ICT terms. Read each statement and by circling a digit on a 5-point scale (1=strongly disagree; 2= disagree; 3=neither agree nor disagree; 4=agree; 5= strongly agree) express your agreement or disagreement with the statements.*

Table 6: The relationship between the form of instruction and the statements

FORM OF INSTRUCTION / STATEMENT	I studied general English	N	Mean	Std. deviation	Std. error	Min. grade	Max. grade	ANOVA Sig. between groups
1) English computer terms are much more precise than Croatian terms – English term precisely describes the concept.	A in school	33	4.48	.508	.088	4	5	
	B in school and in a foreign languages school/ private lessons	21	4.38	.805	.176	3	5	
	Total	54	4.44	.634	.086	3	5	0.562
2) Everyone knows what an English computer term means – everyone speaks like that.	A	33	4.15	.906	.158	2	5	
	B	21	4.43	.676	.148	3	5	
	Total	54	4.26	.828	.113	2	5	0.234
3) Croatian terms do not describe the concept precisely.	A	33	3.64	1.113	.194	2	5	
	B	21	3.90	.944	.206	2	5	
	Total	54	3.74	1.049	.143	2	5	0.365
4) Accepting English terms	A	33	3.94	.966	.168	2	5	
	B	21	4.24	.944	.206	2	5	

will increase and improve the knowledge of English in users.	Total	54	4.06	.960	.131	2	5	0.269
5) Croatian terms are often too long.	A	33	3.76	1.251	.218	1	5	
	B	21	4.33	.913	.199	2	5	
	Total	54	3.98	1.157	.157	1	5	0.074
6) I use English terms more often when speaking.	A	33	4.09	.843	.147	2	5	
	B	21	4.67	.577	.126	3	5	
	Total	54	4.31	.797	.108	2	5	0.008
7) Croatian computer terms are sometimes funny.	A	33	4.52	.939	.164	1	5	
	B	21	4.57	.676	.148	3	5	
	Total	54	4.54	.840	.114	1	5	0.813
8) English terms are more attractive, more prestigious and they sound better.	A	33	4.15	1.034	.180	1	5	
	B	21	4.14	1.062	.232	1	5	
	Total	54	4.15	1.035	.141	1	5	0.976
9) It is not necessary to create Croatian computer terms when we have English ones.	A	33	3.39	1.456	.254	1	5	
	B	21	4.05	1.244	.271	1	5	
	Total	54	3.65	1.403	.191	1	5	0.095
10) It is difficult to translate English terms into Croatian because the Croatian language vocabulary is less developed than English.	A	33	2.48	1.417	.247	1	5	
	B	21	3.71	1.271	.277	1	5	
	Total	54	2.96	1.479	.201	1	5	0.002

The results obtained in this question reveal at least some of the reasons for the students' reluctance to use Croatian ICT expressions and for their preference of English terms, but also somewhat different answers in the two groups which are statistically significant.

The statement that had the highest rate of agreement (average 4.54) is 7. The result shows that either Croatian terminologists and ICT experts[1] have not succeeded

[1] "STRUNA is a database of Croatian Special Field Terminology. It was officially inaugurated on the web in February 2012. Its aim is to gradually make available to the public the standardized Cro-

in creating Croatian terms which the students would find preferable to English ones or that the students', having seen, read or used an English term first, have difficulty accepting a Croatian term for something which they have already named and which is in their current use. Both groups of students agreed almost consensually. Two more statements, 1 and 2, give some insight into the reasons for such reluctance to use Croatian terms: English terms are (allegedly) more precise (average 4.44) and used generally (allegedly again) by everyone (average 4.26). Still, when presented with statement 3, the students did not agree to such an extent with the statement which is in fact the reverse of statement 1. Another statement, 6, with a high agreement rate (average 4.31) maybe shows that English is generally perceived as a more practical means of oral communication, because the statement also contains a presupposition that the students maybe do not frequently use English terms in writing. The difference in responses between groups A and B is statistically significant – 0.008, where group B had a higher rate of agreement, which could indicate that they feel more competent and at ease to express themselves in English in a productive skill which requires swiftness and fluency, especially in some practical, problem-solving situations. The statement on the prestigious status of English and its attractiveness among its ICT users (statement 8) has a consensually high agreement rate (average 4.15), so does statement 4 (average 4.06), although group A finds it less applicable, but the difference of opinion is statistically not significant.

Finally, there are three statements the results of which speak in favor of Croatian. Average results are lower than in the aforementioned statements, but they indicate that, in the students' opinion, Croatian terms are not to be dismissed altogether. The result of statement 5 (average 3.98) shows that this opinion on Croatian terms being too long is not so widespread. Namely, sometimes English terms are awkwardly translated into somewhat longer phrases that resemble definitions; therefore, more effort should be invested into finding effective and short Croatian equivalents. The responses between groups A and B differ up to a point: they are

atian terminology for all professional domains. The Development of *Croatian Special Field Terminology* project started in 2007 as part of the initial coordination project launched at the initiative of the Croatian Standard Language Council, and has since been financed by the Croatian Science Foundation. The program supports the strategic values of the Foundation and fits into two basic areas of the National Strategy for Science Development – development of information technology and sociocultural transition from an industrial to a knowledge-based society. The Institute of Croatian Language and Linguistics was chosen to serve as the national coordinator" (http://struna.ihjj.hr/en/about/, and on collaborators, http://struna.ihjj.hr/page/o-struni/#suradnici, accessed March 8, 2017).

not statistically significant (0.074), but show a slightly different attitude toward their mother tongue.

Statement 9 (average 3.65) also shows disagreement between groups A and B, which is not statistically significant (0.095), but again group A of those students who spent less time studying English in formal educational environment speak more in favor of their mother tongue. Statement 10 has the lowest rate of agreement (average 2.96) and the highest discrepancy between the groups which is statistically significant (0.002). To sum up, the students find English necessary for their communication, but they do not discard Croatian terms completely nor do they perceive Croatian as a language which lacks potential to develop its terminology.

4. Discussion

Standard language and its registers, especially scientific, need loanwords. Borrowings are necessary, especially in the expanding ICT field. Language should remain open to foreign influences if Croatian computer science is to keep abreast with current ICT developments; therefore, any language conservatism and purism would be detrimental. However, in accordance with the norms of the standard Croatian language y, it is advisable that scientific register be free of unadapted foreign language elements whereas adapted and integrated forms are acceptable if no domestic equivalent has been invented (Barić et al. 1999: 108). Borrowings should be as much as possible adapted to the orthographic, phonological, morphological and syntactic rules of the Croatian standard and thus integrated. Unadapted foreign language expressions may be used in Croatian texts to explain a Croatian equivalent which has not been widely accepted yet and these expressions are usually in parentheses (Hudeček and Mihaljević 2012). On the other hand, we have to be aware of the globalization processes, not only as an economic, but also as a sociolinguistic phenomenon, and rapid expansion of ICT, which cannot wait for Croatian terminologists and ICT experts to come up with new equivalents in their joint effort. However, a considerable number of English ICT terms have had their equivalents in dictionaries for some time (e.g. Kiš 2000), so students and ICT experts should be introduced to them and prompted to use them as well as other tools in order to create a habit of choosing Croatian terms or well-adapted Anglicisms, if possible.

This research showed that the scientific register of the university materials we studied is not always up to these recommendations, nor is the Croatian standard always used in situations where it is quite naturally expected, e.g. at various levels

of education or generally in public discourse. Moreover, written texts aimed at wider audiences in public discourse are not exemplary and leave much to be desired with respect to the level of literacy (Udier 2013: 58). However, it was not our intention to either prescribe what is to be used, to ban some expressions altogether and impose some others, but to describe the current state of affairs and indicate certain tendencies and practices a) in scientific textbooks and b) in the students' attitudes toward their mother tongue and toward English in their studies.

Some of the studied textbooks were proofread and edited, some were not, and they still testify to the lack of awareness in authors and language editors what scientific register is and what their mother tongue is. The authors of the textbooks we studied are not linguists, and they resort to English expressions at hand, combine them with Croatian elements and the final result of is hybridization sometimes close to jargon, the phenomenon which supports the view that boundaries of various registers have become blurred (Kryžan-Stanojević 2013: 196–197), as an aspect of discourse democratization. Nevertheless, it is the unsystematic and inconsistent approach to borrowings in scientific register, be they adapted to a certain extent or not, that solidifies the opinion that "anything goes, as long as we understand each other", though scientific register and university textbooks are part of public, not private, discourse. As we already pointed out, some terms surpass the limits of their strictly professional use and enter public discourse; therefore, standardization is important to all prospective users.

English classes in formal educational system have long ago ceased to be the only source of linguistic information for students, as they can obtain information, English ICT terminology included, through other formal, but more often informal channels (Sočanac 2010: 85). Slight and often statistically insignificant differences in answers between the two groups of students show that formal English (and Croatian) education, number of classes and time spent studying English have little to do with the degree of acceptability – English is the language of ICT, prestigious and welcome, preferably in its original form.

The participants in this research, graduate students of ICT, future engineers, find English expressions in Croatian mostly acceptable in their textbooks as they have been used to such a style they encounter in written media, which sometimes resembles code-switching due to the number of English expressions present. In future, these students may also be authors of magazine articles, journal papers, manuals or textbooks and terms they choose to use may enter public discourse. We do not promote censorship of any kind but we do hold that much more attention should be paid to the language of university textbooks which should be more thoroughly re-

viewed. Norms of the standard language do not always match norms of actual use, but more effort should be invested into reducing this gap between the two, at least when scientific register of university textbooks is concerned. In other words, "There may be a zero sum effect where one is developing literacy in another language and not developing literacy in the mother tongue" (Wright 2004: 154).

5. Conclusion

Every language needs new borrowings especially to meet the requirements of a very demanding and rapidly growing communication in science and technology. It is up to language planning and policymakers to at least direct this phenomenon, because language planning, based on a consensus, will be successful only if supported by those that are to carry it out (Granić 2011: 264).

International expressions may facilitate scientific communication; however, from the examples collected from university educational materials which we have provided it is clear that these are not international expressions but purely English. The materials are not meant for a foreign market but for Croatian students. The results of our research showed the students' attitude toward the use of English in the scientific register of these educational materials and toward their native language. We concluded that expressions which kept the English form were perceived as more acceptable than those which were adapted. We also found out that the acceptability of the hybrid English-Croatian structure as a syntactic and a lexical pattern was also high as well as the acceptability of juxtaposed language elements following the English syntax pattern according to which a head noun may be premodified by another noun, in our cases a Croatian noun, a numeric expression, an abbreviation or an acronym. As to the comprehensibility of the English element at the sentential level, the results were lower than those of the acceptability, which could mean that they accepted some expressions even though they did not know what the expressions actually signify. However, the students find English necessary for their communication, but they do not discard Croatian terms completely nor do they perceive Croatian as a language which lacks potential to develop its terminology. Finally, we can say that regardless of different amount of time and effort which the examined students invested in formal education and courses of English during their secondary education, most of their answers converge toward overall acceptance of English in Croatian as a non-foreign element.

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DIPLOMSKI STUDENTI RAČUNARSTVA I NJIHOVA PERCEPCIJA ENGLESKOGA ELEMENTA U ZNANSTVENOME FUNKCIONALNOM STILU HRVATSKIH OBRAZOVNIH MATERIJALA IZ PODRUČJA INFORMACIJSKIH I KOMUNIKACIJSKIH TEHNOLOGIJA

U ovome se radu bavimo rezultatima upitnika kojim smo ispitali 54 studenata druge godine diplomskog studija računarstva na jednome hrvatskom sveučilištu. Studenti su pohađali *Engleski jezik u računarstvu* kao obvezni kolegij na prvoj godini preddiplomskog studija i od tada su engleskome jeziku uglavnom izloženi u manje formalnom okruženju i situacijama. Upitnik, koji je bio pripremljen kao test prosudbe prihvatljivosti, sadržavao je pitanja o engleskome elementu, tj. o anglizmima na različitim razinama prilagođenosti hrvatskome jeziku i neprilagođenim izrazima koje smo prikupili iz hrvatskih sveučilišnih udžbenika i obrazovnih materijala o informacijskim i komunikacijskim tehnologijama, a koji su bili preporučeni u preddiplomskome i diplomskome programu studija. Osnovni cilj istraživanja bio je ustanoviti smatraju li ispitani studenti, prema njihovoj jezičnoj intuiciji, engleski element prihvatljivim u znanstvenome funkcionalnom stilu standardnoga hrvatskog jezika. Upitnik je također trebao ispitati smatraju li studenti primjere rečenica s engleskim elementom razumljivima i u kojoj se mjeri studenti slažu s određenim izjavama u vezi terminologije na hrvatskome i engleskome jeziku. Podaci su obrađeni računalnim programom za statističku analizu SPSS. Rezultati su pokazali da su ispitani studenti engleski element u znanstvenome funkcionalnom stilu udžbenika i obrazovnih materijala iz područja informacijskih i komunikacijskih tehnologija u pravilu smatrali prihvatljivim te ga nisu osjećali stranim elementom, dok su hrvatski oblici i prilagodbe, odnosno anglizmi, obično smatrani manje prihvatljivim.

Ključne riječi: studenti računarstva; engleski element; znanstveni funkcionalni stil; prihvatljivost; sveučilišni obrazovni materijali.