# Code Switching in Digital Communication

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## Abstract

This research examines Codeswitching (CS) from Hebrew into Arabic as used by Arabs from Iksal and Um Al-Fahm, in Israel, in the context of Arabic used in Digital communication (WhatsApp and Viber), specifically the written colloquial rural Palestinian Arabic dialect of Arabs in Israel. The study focuses on topics that motivate uses of code switching, the syntactic characteristics of these code switches, phonological aspects, Categories of CS. The expectations were that switches by bilinguals are largely limited to greeting phrases and are restricted to clause boundaries with one-word switching into Hebrew. Moreover, there is an adaptation of L2 to L1 phonology. The results show that the most frequent topics evolve around education and employment. Moreover, code switches can still be code switches even if they have been adapted to Arabic phonology. The results also reinforce previous findings, such as Paolillo (2011) and Lee (2007), on how synchronicity affects the usage of CS.

## Keywords

Codeswitching, Arabic, Hebrew, Digital Communication, Synchronicity

## 1. Introduction

This study investigates code switching (CS) in data drawn from written digital communication. The data was collected from WhatsApp (138 messages) and Viber chats (347 messages) from 24 people who live in Iksal in the lower Galilee and Um Al-Fahm in the Triangle region in Israel after obtaining their consent. Data were collected between September 2015 and the end of July 2016. Thirteen of the participants are women and eleven are men. The participants were aged between 19 and 35 at the time the study was conducted. This study was approved by the Indiana University Institutional Review Board[1]. The objective of the study is to investigate the use of code switching in Arabic spoken in Israel, where

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[1]This is part of my PhD dissertation conducted at Indiana University, Bloomington 2019.

Arabs frequently codeswitch with Hebrew. Moreover, to gain a thorough insight and understanding of the complex dynamics of multilingual communications and the constructions of identities in digital settings, it is therefore crucial to study how multilingual speakers utilize codeswitching on social media.

## 2. Literature Review

Myers-Scotton provided a definition of codeswitching as the act of bilingual or multilingual individuals choosing forms from an embedded language within the same conversation's utterances of a matrix language. According to Myers-Scotton's Matrix Language Frame Model, the Matrix language offers functional morphemes (such as tense) in a switched utterance. Myers-Scotton also introduced the Matrix Language Frame model (MLF) in 1992, 1993a, and 1997, which suggests that the matrix language (ML) and the embedded language (EL) have an asymmetrical relationship.

Not only are forms of CS found in speech, but also "easily find their way into communication via digital media" (Androutsopoulos, 2015: p. 659), which is pervasive nowadays. Indeed, CS, while originally a spoken-language phenomenon, has often been observed in written (typed) form in textual CMC[2] (Androutsopoulos, 2013; Danet & Herring, 2007; Dorleijn & Nortier, 2009).

The frequency of CS in digital writing is influenced by factors such as synchronicity, formality, and intimacy. Paolillo (2011) studied English and Punjabi/Hindi language use in Internet Relay Chat (IRC) and Usenet. He concluded that "conversational" CS was found more in the synchronous mode (IRC) than the asynchronous one (Usenet). Other studies have supported this finding, such as Lee (2007), who found that CS was more commonly used in ICQ,[3] which is synchronous and informal, than in asynchronous emails by the same users, which were usually more formal. About intimacy and the way it affects CS in digital writing (CMC), Androutsopoulos (2015) writes that:

> [T]he limitation of language mixing to wall dialogues [on Facebook] among "best friends" suggests that bilingual talk might be recontextualised as an index of intimacy in network language practices. (p. 17)

Facebook users in general tend to use CS less in asynchronous timeline dialogues, which can be read by all the users' friends (Abu Elhija, 2017). In keeping with the observations of Paolillo (2011), Lee (2007), and Androutsopoulos (2015), we might expect more CS in the semi-synchronous Viber and WhatsApp, as well as in Facebook chat messages when two close friends are interacting, than in their interactions on FB timelines. This seems to be true of borrowings on FB timelines in the context of Arabic spoken in Israel as well, because in this context, instead of borrowing from Hebrew, speakers tend to use a higher register of Arabic, MSA (Abu Elhija, 2017).

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[2]Referred to in this study as digital or digital writing. CMC is short for Computer-mediated communication.

[3]ICQ is an instant messaging program developed by the Israeli company Mirabilis.

The fact that synchronous digital media encourages the use of short turns in exchanges with rapid transitions makes it more similar to spoken interaction. In contrast, asynchronous digital media differs from prototypical spoken interaction in taking longer in terms of individual contributions and having transition gaps between each contribution. These observations support the assumption that digital synchronous modes are closer to spoken language than asynchronous ones (Dorleijn & Nortier, 2009).

Moreover, the literature indicates that CS online abides by the stylistic and social conversational norms of offline communication (Al-Khatib & Sabbah, 2008; Bianchi, 2013; Mimouna, 2012; Palfreyman & al Khalil, 2003; Salia, 2011; Warschauer, El Said, & Zohry, 2002). Research has explored CS between Arabic and English or French. Warschauer et al. (2002) studied emails and the instant messages (IMs) of 43 young educated Egyptians. Focusing on the CS strategies used, the authors concluded that users switched mainly between English and colloquial Arabic written in Roman script. However, Romanized Arabic was used more in informal contexts to express personal content, religion, and cultural themes, while English was used for technical terms. Similarly, Al-Khatib and Sabbah (2008) investigated the frequency and functions of CS in text messages written by Jordanian university students, finding, similar to Warschauer and his associates (2002), that Romanized Arabic was used in informal written contexts and English in formal contexts. Another study conducted by Alfaifi (2013) on intra-sentential CS in Facebook comments written by 10 Saudi Arabic-English bilinguals found that intrasentential CS was used with gossip and humor, English was used for academic and technical terms, and Arabic was used for religious topics. Mimouna (2012) discovered that either French or English was used instead of Arabic in emails to express certain concepts such as technological terms.

CS is apparent in the way Internet users write. Thus, even if a user chooses to write in Arabic, CS occurs when they alternate between Arabic and other writing systems (e.g., English or Hebrew in the case of Arabs in Israel[4].

## 3. Data Collection

The data for the study corpus were collected from Viber and WhatsApp. Chat logs were collected from 24 Arabic-Hebrew bilingual participants after their consent was obtained by email. Each received a letter explaining that the research would examine the language without mentioning borrowing or code switching. Participants who agreed to take part were asked to provide some of their text messages in WhatsApp or Viber after deleting all information about themselves and their interlocutors. They were allowed to provide only their messages, without those of their interlocutors, unless the interlocutors were also participating in the research. An instruction sheet was emailed to them that included information on how to download and send WhatsApp and Viber mes-

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[4]The term "Arabs in Israel" refers to Palestinian Arabs who hold Israeli citizenship. There is disagreement and controversy surrounding what to call this group and their variety of Arabic, and I am using this term only for the purpose of clarity.

sages to their emails so that they could delete all extraneous and private information before forwarding the messages to the researcher. The data collected from the 24 participants were as follows: 16 supplied WhatsApp chat logs, while 9 gave Viber chats. One allowed me to see chat logs from both his Viber and WhatsApp accounts and thus was counted in more than one category. The data were collected from their personal chat log histories between September 2015 and July 2016. Of the participants 13 are female and 11 are male. They were between 19 and 35 years old at the time of the study, and they were university students and graduates who were from different areas in the Galilee and the Triangle. From these subjects 138 WhatsApp messages and 347 Viber messages were collected, mostly written in Arabic, in Hebrew script, or in a combination of Arabic and Hebrew; only a few of the collected messages were written in Latin script. The data were manually coded in an Excel spreadsheet for code switches per user, and the medium of communication was noted to facilitate observation and comparison.

An instance where a word or a phrase appears once in Hebrew and another time in Arabic was considered code switching. An example would be the Arabic word *daʃː rak* "do not bother" and the Hebrew *ʔazov otxa* "do not bother" appearing together in the data for the same user. Arabic tokens that appear all the time in Hebrew are regarded as borrowed. Cases, if found, where a Hebrew word appears many times and only once in Arabic are considered an indication that the Hebrew word is becoming more of a borrowed word than a switch.

Moreover, examples where a borrowed word from Hebrew appeared and was preceded or followed by one or more words in Hebrew, it was considered a CS and not a case of borrowing. For instance, this sentence appeared in the corpus: ? הכול בסדר عضولا وش *ʃu il wadiʕ hakul biseder* "How are you? (Arabic) Is everything ok? (Hebrew)." In this example there is an intersentential CS where the first part is in Arabic and the second is in Hebrew. The word *biseder* "okay" is very common and can be considered a borrowing; however, in this case it is used as a CS.

## 4. Methods of Analysis

The texts from the digital media were entered into an Excel spreadsheet and coded for code switches for every speaker. A Python dictionary script was built to calculate the counts of each unique entry.

The technique known as the Grounded Theory Approach, developed by Strauss and Corbin (1994), was utilized to categorize the different areas where code-switching took place. In this analysis, the entire switched sentence was examined as a unit of analysis, with attention given to the context of the conversation. Although there were a few instances where determining context was difficult or where data did not fit into existing categories, no significant issues arose during the coding process. These exceptional examples were grouped together under a general category labeled "other." The information collected was analyzed by categorizing the data into different categories such as extra sentential,

intersentential, intrasentential, intra word, and mixed, as well as L1/L2 - L2/L1 adaptation and switching boundary. Additionally, the topic of the conversation was taken into account to determine which topics led to more instances of code switching, with topic categories emerging from the data.

The research questions for the study of code switching are:

RQ1: What are the topics that lead to instances of code switching?

RQ2: What are the syntactic characteristics of code switches in which Hebrew is incorporated into the language use of the participants?

RQ3: Are the phonologies of the two languages kept separate in code switching, and if so, what features are involved?

RQ4: What are the different categories of code switching (extra/intersentential, intrasentential, intra word) that occur when switching from Arabic to Hebrew?

I anticipate that bilingual speakers will mostly use code switching in greeting phrases, and that it will be limited to clause boundaries, with only one-word switches into Hebrew. This is based on the understanding that the Arabic language is a critical aspect of Arab identity, and as a result, the participants will likely aim to preserve the purity of their language (including MSA and dialectal varieties) to the best of their ability. Furthermore, from my personal observations, I have noticed that there is an adaptation of L2 to L1 phonology, although this can vary depending on the region. The amount of contact between languages can also lead to adaptation from L1 to L2, as discussed in Horesh (2015).

## 5. Results

The dataset for digital code switching (CS) consists of 1776 sentences, of which 315 (17.7%) contain code switches. Of the code switches, 25% (79 sentences) are from WhatsApp, and 74.7% (236 sentences) are from Viber. The language in which a sentence starts is considered the matrix language for this analysis, and in most cases, the matrix language for the sentences in the corpus is Arabic (86%), while only 14% are in Hebrew. For this analysis, the focus is primarily on switches where the matrix language is Arabic, as there were not enough data for switches governed by Hebrew as the matrix language. Table 1 displays the percentage and number of sentences from each mode, and it indicates that the Viber corpus has a higher frequency of CS than the WhatsApp corpus.

1) Four categories of CS were evident in thedigital data: Extra sentential: This category of code switching refers to a tag insertion for instance, where a tag from

**Table 1.** Data breakdown for the digital CS corpus.

|  | Total # of sentences | # of sentences with CS | % of sentences with CS |
|---|---|---|---|
| WhatsApp | 725 | 79 | 10.9% |
| Viber | 1051 | 236 | 22.5% |
| Total | 1776 | 315 | 17.7% |

one language is added to an utterance from another language. An example from the corpus is: 3varta mo3ed 2lef, la? ʕavɑ: rta mo3ed 2lef, la:? "You've passed the first exam period, right?" (Arabic is underlined, the rest is Hebrew throughout all the examples). It is worth noting that although the focus of the analysis is on Arabic as the matrix language (Myers-Scotton, 1992, 1993, 1997), there are cases where Hebrew serves as the matrix language, as seen in this example. What makes this example even more interesting is that it is written in Latin script, which was more commonly used before 2012 (Abu Elhija, 2012), and has since diminished in use. While this example appeared in the data, the majority of sentences in the corpus are written in either Arabic or Hebrew script.

2) Intersentential: One clause is in one language, and the next is in another. For example: **المشوار كان حلو كتير. היינו במלון מהטובים שם.** *il-miʃwa: r ka: n ħilu kti: r. hajinu ba-malon m-ihatov-i: m ʃam* "The trip was very nice. We stayed in one of the best hotels there." Note that each sentence is written in a different script.

3) Intrasentential: The switch occurs either within the clause or at a sentence boundary. For instance: **יעני מתלן אנא מתכנן בס יפתח ארוח מרה** *jaʕni matalan ʔana mıtaxne: n bas jeftaħ ʔaru: ħ mar: a* "so for example, I am planning to go there one time when it opens."

4) Intra word: Switches occur within a word boundary. An example: ال דירה اللي الها *ildira: il i ilha* "the apartment that is hers." This sentence includes an intra word and an intrasentential switch. That is, the Arabic definite article *ildira* constitutes an intra word, while the word *dira* "apartment" is an intrasentential switch within the clause. The script was also switched from Arabic to Hebrew.

5) Some entries mix two of these categories. For instance: **اذا جاي عالهرتساه,** **ارجعلي دحوف** *ʔiða dʒa: j ʕal*hartsaʔah, *ʔirdʒaʕli* daħo: f "if you are coming to the lecture, get back to me urgently." The word ʕal*hartsaʔah* includes an Arabic preposition and a definite article connected to the Hebrew word hartsaʔah "lecture". This is an intra word switch. Moreover, the second part of the sentence has an intrasentensial switch ʔirdʒaʕli daħo: f, from Arabic into Hebrew.

The categories of CS that were discussed above are: 1) extra sentential, 2) intersentential, 3) intrasentential, 4) Intra word, and 5) mixed categories. Table 2 presents the frequencies for each category.

Table 2. CS categories in the corpus.

| Categories | WhatsApp | Viber | Total |
|---|---|---|---|
| Extra sentential | 2 2.5% | 0 0% | 2 0.6% |
| Intersentential | 5 6.3% | 66 28.0% | 71 22.5% |
| Intrasentential | 42 53.2% | 145 61.4% | 187 59.0% |
| Intra word | 26 32.9% | 9 3.8% | 35 11.1% |
| Mixed | 4 5.1% | 16 6.8% | 20 6.3% |
| Total | 79 100% | 236 100% | 315 100% |

Table 1 and Table 2 present notable differences between the use of code switching in the WhatsApp and Viber corpora. According to Table 2, the most common category of code switching in the corpus is intrasentential, followed by intersentential code switching in Viber, and intra-word code switching in WhatsApp. Extra sentential code switching is the least common category observed in the digital data. The analysis of intrasentential code switching entries included an examination of the part of speech (POS) of the switched words. The findings reveal that nouns and noun phrases are the most frequent POS for code switching, followed by adjectives, verbs, and verb phrases. Discourse markers, coordination phrases, and determinative phrases are the least frequent. Table 3 presents the frequencies of these POS categories in the intrasentential code switching data.

The corpus contains instances of code switching that happen at different levels of syntactic structure, such as the highest categories like noun phrases (NP) and verb phrases (VP), and the smallest ones like individual nouns (N) and verbs (V). Switching can occur both at word boundaries and within clauses. Example 1) below shows an extra-sentential switch from Arabic to Hebrew where the writer switches scripts. It's worth noting that the Hebrew and Arabic text are written right-to-left, while the English translation is written left-to-right.[5]

1)

<u>هاد الفستان اللّي شريتي</u>، יפה[6]!!

<u>ha: d il - fusta: n il: i ʃareti:, jafe</u>

<u>this def.- dress that you bought it</u>, nice

"This is the dress that you've bought, nice!!"

Table 3. POS of intra sentential entries.

| POS | Tokens | Percentage |
|---|---|---|
| N | 53 | 28.3% |
| V | 18 | 9.6% |
| ADJ | 23 | 12.3% |
| ADV | 9 | 4.8% |
| ADVP | 6 | 3.2% |
| VP | 16 | 8.6% |
| NP | 48 | 25.7% |
| PP | 11 | 5.9% |
| DM | 1 | 0.5% |
| COORDP | 2 | 1.1% |
| DETVEP | 0 | 0% |
| TOTAL | 187 | 100% |

[5]The examples are written from right to left, followed by a left-to-right transcription with the gloss and English transcription under it.
[6]Arabic is underlined.

The word "nice" in this sentence is a tag in Hebrew inserted into an Arabic sentence. There are very few examples of Arabic-Hebrew extra sentential switches in the data, and they are all single-word switches of this type.

Below are some examples of intersentential switches.

2)

المشوار كان حلو كتير. היינו במלון מהטובים שם.

[il-miʃwa: r ka: n ħilu ktir. hajinuba-malon m-ihatov-i: mʃam]

def.-trip was nice very. we were in- hotel of -good –plural there

"The trip was very nice. We stayed in one of the best hotels there."

Example 2) includes two sentences or main clauses, each one in a different language and written in the writing system of that language.

3)

בס מש פאהם איך יצא ללא הסכם ?[7]

[bas miʃ fa: him ʔɛx jatsa liluhiskem]

but neg. understand how withdrew without agreement

"But I do not understand how he withdrew (*from the partnership*) without an agreement."

In this sentence above, the interrogative complement, "how he withdrew without an agreement," appears in Hebrew. The first part of the sentence, "but I do not understand," is in Arabic.

Intrasentential CS constitutes the majority in the data. These switches were found between diverse types of phrases, such as NP, VP, PP, and AdvP, as well as within these phrases. Some examples follow.

After a conditional:

4)

مع انو بعرف انو معلوماتك قليله جدا. بس بتحداك اذا תוכל להצביע עלא דבר אחד.

[maʕ ino baʕrif ino maʕluma: t- ak qalili dʒidan. bas batħad-a: k ʔiða tuxal-li-hatsbiəʕ ʕaladavar ʔiħad]

despite that I-know that information-your little very. but I-challenge-you if you-can to-indicate on thing one.

"Although I know that your knowledge is very little *on this topic*, but I still challenge whether you are able to point to one thing…"

This example has code switching in two levels, a language switch and a writing system switch. The concessive clause, the coordinator (*but*), the verb, and the conditional marker (*if*) are all in Arabic. The Hebrew switch appears after the conditional "if". That is, the *if*-clause is in Hebrew, except for the conditional "if" itself. This is a switch within the clause.

A sentential complement with a null complementizer:

5)

انا بقول תמיד זה תלוי במיקום ובניהול ורמת הסיכון גבוה

[ʔana baqu: l tamidzɛ taluj ba-mekum w-ba-nihul ve-ramat ha-siku: n gvuh-a]

I say always this depending on-location and-on- management and-level def.-risk high-fem.

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[7]The Arabic part as well as its translation are underlined.

"I say (that) it always depends on the location and on management, the level of risk is very high as well."

In the example, "I say" is in Arabic, but there is no complement (that), and the whole sentential complement is in Hebrew.

A switch within a VP and a PP:

6)

قال اشترى أراضي במליונים

[kal ʔiʃtaraʔaradˤi bi-miljon-im]

said he bought lands prep.-million.- pl

"It is said that he bought lands in millions (i.e., he paid millions for the lands)."

The switch here is within the, at the PP boundary.[8]

Within a VP:

7)

فائدة شخصية...بتوخذ توأر

[faʔidiʃaxsij: j... btuxid toʔar]

benefit personal …you'll get degree

A personal benefit… you'll get a degree.

The switch in example 7 is within the VP "you'll get a degree", where the part "you'll get" is in Arabic and "a degree" is in Hebrew.

Within an equational sentence with a predicative adjective:

8)

واللي بفوز هو צודק

[w-il: i bi-fu: z hu: tsodek]

and- demonstrative future-win he right

"And the person who will win is right."

In this sentence, the switch is the predicative adjective, which appears in Hebrew and is written in Hebrew script, unlike the previous part of the sentence, which is in Arabic and is written in Arabic. Note that the pronoun *hu:* in the example above is the same in Arabic and Hebrew for "he", which could create ambiguity; but since this is taken from online written data and the pronoun is written in Arabic, it is clear for the reader that *hu:* is Arabic and not Hebrew.

An object of a preposition (NP within PP):

9)

قبل شوي روحت من סיור

[qabl ʃwaj rawaħ-it mɪnsiju: r

before a little while came back- I from. tour

"I came back from a tour a little while ago."

The Hebrew switch in the example happened right after the preposition "from", i.e., in the noun "a tour".

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[8]This one-word switch is considered a switch and not borrowing, because borrowing in this study refers only to words that are widely used by all speakers or subjects in preference to another "native" word. Words that were sometimes used in Arabic and other times in Hebrew are considered code switches.

Between VP and AdvP:

10)

انقذني بمحرمة دخوف

[ʔinqið-ni b-maħrami daxuf]

save-me with-tissue urgently

"Save me with a tissue urgently (I need a tissue urgently)."

The word "urgently" is an adverb in Hebrew and written in Arabic, but it maintains Hebrew phonology, being written with /x/ instead of /ħ/. The word *daxuf* "urgent" or "urgently" is written with < ח > ħ in Hebrew but pronounced *daxuf*. Since the user here in this example used [x], this indicates Hebrew phonology.

Between a determiner and a noun:

11)

כל מוסד אקדמי מדווח על הסטודנטים שלו לביטוח לאומי

[kul musa:d ʔakademe midaveaħ ʕa:l ha-student-em ʃelo la-bituaħ liʔumi]

every institution academic.report on def.-student-pl. possessive.to-security national

"Every academic institution reports on its students to the social security."

The switch happens here after the determiner; that is, the determiner is in Arabic and the rest of the sentence is in Hebrew.

Between a noun and an attributive adjective:

12)

انسخي كل شي على كوبيتس جديد

[ʔinsax-i kulʔiʃi ʕala kuvits d͡ʒdi: d]

copy-you.FEM. all thing on.document new

"Copy everything in a new document."

The word "file" is a one-word switch in this sentence, followed by an adjective in Arabic. The whole sentence is written in Arabic.

Between a verb and an object:

13)

لا هيك صايبتني סערת רגשות

[la hek sˤajibt-ni. saʕarat rigaʃo: t]

no like this hit-me agitated emotions

"No, I am having agitated emotions."

The verb "having" is in Arabic, and the object is in Hebrew.

Between the possessed and the possessor:

14)

يلا احجز هاد الاوتيل המלצת ابوي

[jal: a ħd͡ʒiz ha: d il-ote: lhamlatsa: -t ʔabo-j]

come on book this.def.- hotel recommendation- poss. dad-my

"go ahead and book this hotel; it is my dad's recommendation."

In this example, the word *hamlatsa: t* is in Hebrew ("recommendation", possessor), and the word *ʔaboj* ("my dad") is in Arabic. It is also interesting that the Arabic *Idafa* and Hebrew *Smixu: t* (genitive case, possessive construction) is

shared between the two languages; that is, the /t/ at the end of the word *hamlat-sa: t* "recommendation" is the indicator of genitive case in both languages. This shared structure may trigger code switching within the possessive construction.

Between a complementizer and the clause it introduces:

15)

אתסלו בדקטור אנו מעכב תיק סתם

[ʔit: asal-u b-i-daktor ʔin: -o miʕakev tikstam]

called-they prep.-def.-doctor that-he delay file purposelessly

"They called the doctor to tell him that he is purposelessly delaying the file."

This example is written in Hebrew, including the Arabic part of it. It starts with Arabic and the Hebrew switch happens right after the complementizer "that-he".

For the case of intra word CS, there are some examples that show switches within word boundaries. Most of the examples in the corpus reflect a switch between a determiner, which is a bound morpheme, and a noun:

Within a determiner and a noun (very frequent in the data):

16)

مال المشترى معبيه البلد؟

[ma: l il-miʃtaramʕabj-iil-balad]

why def.- police filling-FEM. def.- town

"why are the police everywhere in the town?"

The term "police" used in the sentence is in Hebrew but is written in Arabic script and is preceded by the Arabic definite article instead of the Hebrew definite article. This use of Hebrew in Arabic script with the Arabic definite article could be considered a borrowing in some dialects of Arabic in Israel, depending on the region and the extent of language contact. The figure provided below illustrates the various domains or topics where code switching was observed in the corpus. The occurrence of code switching was influenced not only by the topics being discussed but also by the participants involved. The main participants in the Viber chat, who were highly educated and had more exposure to Hebrew due to their professions, used code switching more frequently. The data showed that CS was used in many domains, including education, employment, technology, and politics. Figure 1 displays the percentage of CS used in each topic out of all the sentences in the corpus.

The main finding of Figure 1 is that education is the domain where CS is most commonly used in WhatsApp, while employment is the most common domain in Viber. This trend may be explained by the fact that many participants in the WhatsApp group are either teachers or college students, and therefore the topics of discussion often revolve around education. On the other hand, in Viber, the participants may be more likely to discuss topics related to their employment due to their professions. Additionally, the figure shows that the topics of money and politics are more commonly discussed in Viber than in WhatsApp. The results of the study indicate that code-switched utterances that are written entirely in Arabic orthography tend to use first-language (L1) phonology

(Arabic) the most. Specifically, the data shows that 96% of the Hebrew words that appear in CS sentences are affected by L1 (Arabic) phonology, while only 4% of the Hebrew words (4 tokens) are affected by L2 (Hebrew) phonology. For example, the word كوبيتس *kobits* "file" in Hebrew is pronounced [kovits]—the Hebrew [v] is written as [b] in Arabic, since Arabic has no [v] in its language repertoire. Hence, this Hebrew word is adapted to both Arabic script and Arabic phonology.

Moreover, the study found that most of the written code switching involved a switch in orthographic system within the same sentence, meaning that the Arabic and Hebrew parts of the sentence appeared in their respective scripts. As a result, it was difficult to determine the specifics of the pronunciation of each language, other than the fact that the Arabic part typically used Arabic phonology and the Hebrew part used Hebrew phonology. Out of the 315 analyzed sentences, 241 were excluded from the phonological analysis because the two languages appeared in different writing systems and provided no information about phonological adaptation. Examples 13 and 14 from the study were given as illustrations of this type of code switching.

The following **Figure 2** shows the code switching that exclusively uses the Arabic writing system.
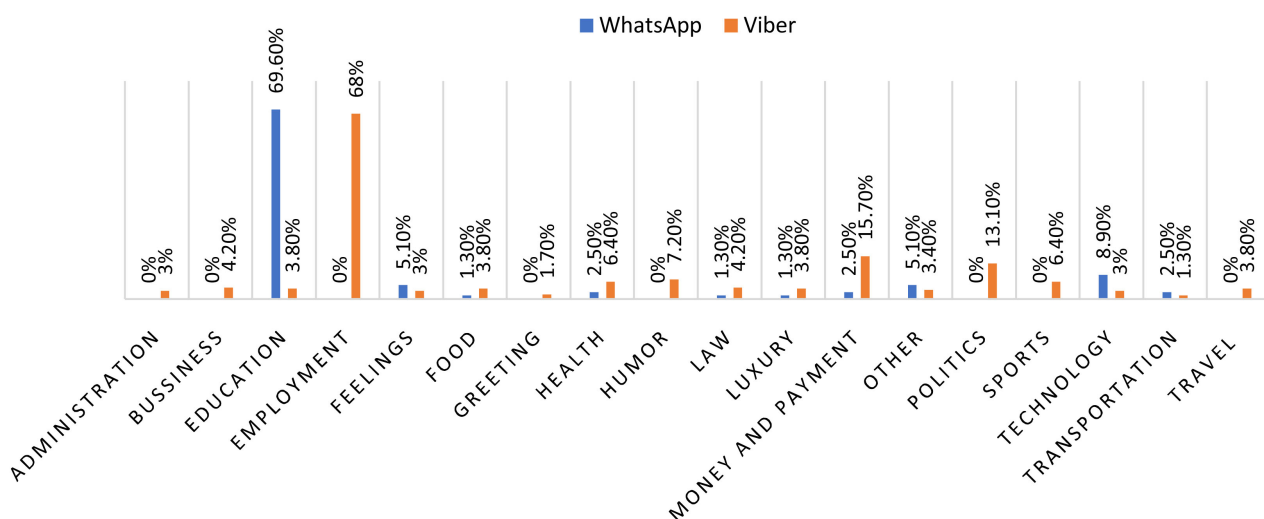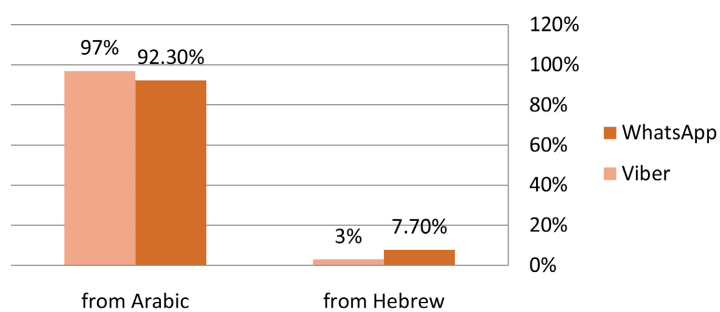


**Figure 1.** Topical domains of CS.



**Figure 2.** Phonological adaptation in CS.

## 6. Discussion

It is commonly observed that people tend to switch between languages and use colloquial language more freely with their close circle of friends. According to Androutsopoulos (2015), language mixing on Facebook Timeline posts is limited, and bilingual talk is an indicator of intimacy in network language practices. This explains why code switching is less common on Facebook, as Timeline posts are less private and are often addressed to all friends and contacts. In the corpus, the percentage of CS is 17.7% of all sentences, which is relatively low compared to what would be expected in spoken language. This suggests that the medium of communication plays a role in reducing the use of code switching.

The domains with the highest occurrences of code-switching were education, money, and politics, followed by employment. These domains were also the most frequently discussed in the corpus. Table 4 presents examples from the corpus, some written in Arabic, including Hebrew CS; some in Hebrew, including Arabic and Hebrew CS; and others in Arabic, with the Hebrew switch written in Hebrew. The examples are written from right to left, followed by a gloss in italics and an English translation.

These topics are contemporary and have strong links to Hebrew in Israel, as higher education in Israel is predominantly taught in Hebrew. Many Arabic speakers are employed by or work for Hebrew-speaking companies, and new technological devices have been introduced to the Arabic-speaking sector through Hebrew. The official language for practical and formal purposes in the

**Table 4.** Examples of CS used in different domains (bold indicates Hebrew).

| Education | Money | Politics | Employment |
|---|---|---|---|
| بتوخذ **توأر**<br>*btuxid to'ar*<br>"You will get a **degree**" | ?קאל מטבוש **במליונים**<br>*kal mat'bo: bamilyonim*<br>"Does he have debts **of millions?**" | מבלא. אטלעו ביאן אנו **לא עשה כלום**…<br>*'imbala. 'it'lao bayan ino… lo 'oseh klo: m*<br>"Yes. They published a declaration that says that he (the mayor) **does not do anything**" | **עובדים רק בא** א פחם. מלהנש **סניפים** ברא<br>*'ovdim rak b Umm Alfahm. malhini∫ snifi: m barra*<br>"**They work only in** Um Alfahm. They do not have **branches** anywhere else." |
| رح يعطلوك عالإقل سنتين **השלמות**<br>*rah yf't'o: k al 'aqal sinten ha∫lamot*<br>"They will ask you to add two years of **degree completion**." | **חוב בנק לאומי** בטלע…<br>*ħov bank li'omi bit'la ʕ…*<br>"**The debt for Leumi Bank** is about…" | למא בשאר אלאסד בדו יטייר וזיר ענדו או אי שכסייה **מסכנת עליו**…<br>*lam: a Ba∫: ar Alas: ad bido yt'aj: ir wazi: r ʕindo aw aj∫axsij: j mɪsakenɪt ʕalav*<br>"When Bashar Alassad wants to exile a minister in his government or any **person who endangers him**…" | פש **ניהול תקין**<br>*fi∫niho: l takin*<br>"There is no **proper management**" |
| الَكلكلاه بس حليت<br>*ħalet bas il**kalkalah***<br>"I only solved my **economics** homework." | בדפעש **מזונות**<br>*bidfaʕ i∫mizonot*<br>"He does not pay **alimony**" | **לו מדינה** בדהא תחסל . זמאן עמלת עליה **אמבוש תקשורתי**<br>*lu midenah bidha tiħasel… zama: n ʕimlat ʕaleh 'ambo∫ tak∫orti*<br>"**If the country** wants to scotch… it would have made a **media ambush** a long time ago." | كنو مشتغل **לילה**<br>*kinu mi∫ɣil lajla*<br>"It seems that he worked a **night shift**." |

country is Hebrew, and administration and politics are also conducted in Hebrew. The most commonly inserted elements in CS in this corpus are nouns and NPs, for instance: טאלעין **טייול** לחאלהן בדון אוולאד *tˤaʕin tˤijol laħalhɪn bidoːn liwlaːd* "they are going on **a trip** alone without their kids." The word "trip" in the example is a noun switch. Other examples are:

(17) **סערת רגשות** صايبتني هيك لا

*la hek sˤajibtni sɪˤarat rigaʃoːt*

"I am having **agitated emotion**"

In the last example, "agitated emotion" is an NP switch.

The higher occurrences of nouns than of other elements are supported in the CS literature. Nouns are frequently used because they are freer of syntactic constraints than other elements like verbs or VPs. Verbs and system morphemes carry more syntactic features and encode grammatical agreement via inflections and derivatives, which can affect the syntactic structure of an utterance (Alhazmi, 2016).

Myers-Scotton (2002: p. 76) claims that verbs are harder to fit into the recipient language, since they carry more "syntactic baggage." Forslund (2009) also believes that nouns are freer than other word classes when it comes to grammatical restrictions. Alrowais (2012, cited in Alhazmi, 2016) and Bowers (2006) found that nouns constituted the vast majority of switches in their collected data. Despite the fact that Arabic and Hebrew are typologically similar and share many grammatical features as well as some lexical roots, in this data, nouns and NPs are still the most frequent items in CS. It seems that nouns and NPs in the two languages share more common ground than verbs, particularly given that verbs have to be conjugated using certain templates, adding stress and gemination depending on the verb class.

In the data on CS, it was observed that the majority of the utterances were written using an orthography that reflects Arabic phonology more closely than standard spoken Hebrew (Ashkenazi dialect). This was because the writers either chose to imitate the Hebrew orthography or preferred to use the nonstandard (Mizrachi) Sephardi dialect, which is more similar to Arabic and closer to historical Hebrew, for example: في عنا **بوحن كلكلاه** يوم الخميس *fi ʕinna boħan kalkalah yom ɪl xamis* "we have an **economics quiz** on Thursday." The user here typed a pharyngeal [ħ] instead of following modern Hebrew phonology [x]. In contrast, some examples in the data have adapted Ashkenazi (standard) Hebrew phonology, such as **دخوف** انقذني بمحرمة *ʔanqiðni bmaħrami daxoːf* "I need a tissue, it is **urgent.**" Instead of *daħoːf*, the subject wrote it with [x], adapting it to Hebrew phonology, instead of [ħ]. The above examples suggest that phonological adaptation in the case of Hebrew and Arabic loanwords and code switching is not key to determining whether a lexical item or an utterance is a CS or a loanword, unlike the case for other languages. The reason for the similarity in orthography between Arabic and Hebrew in the CS data from the corpus is due to their typological similarity, which means that they share many phonological and morphological aspects. Additionally, the Hebrew orthography has remained unchanged

for a long time, while the pronunciation has evolved into two dialects—the standard Ashkenazi dialect and the nonstandard Mizrachi dialect, which is closer to historical Hebrew and Arabic. This Mizrachi dialect is mainly used by old Sephardim or Yeminites, and the dialect of Hebrew spoken by Israeli Arabs, which is similar to the Mizrachi dialect, needs further research. It is important to note that in some instances, code-switched (CS) sentences were written partly in Arabic and partly in Hebrew. In some cases, the Arabic part was written in Arabic script and the Hebrew part in Hebrew script. However, in some sentences, both the Arabic and Hebrew parts were written in Hebrew script, even though the grammatical patterns followed Arabic. It should be noted that these sentences do not necessarily make Hebrew the matrix language. Some sentences were not considered when analyzing phonology, such as those written in Hebrew script and those where the writers switched both the language and the script between Arabic and Hebrew, which is referred to as "double layer switching."The most frequently used type of code-switching found in the corpus was intrasentential switching. This type of switching requires a high level of proficiency in both languages and a strong knowledge of syntax in both languages. Poplack (1983) found that balanced bilinguals tend to use more intrasentential switches in their speech compared to bilinguals who are dominant in one language and less proficient in the other, who tend to use more intersentential switches. Intersentential switching requires less syntactic knowledge and is more commonly used by less fluent bilinguals (Kanakri & Ionescu, 2010).

## 7. Conclusion

The topics that appeared most frequently in the data of this study were education and employment, with technology and money also being common. The participants in the study were all educated, which may explain why these topics were discussed most often. Surprisingly, the domains of administration and construction were not as prominent as expected, despite typically having more Hebrew code switching. This could be attributed to the level of education and career of the participants. Additionally, code switches that have been adapted to Arabic phonology are still considered code switches, as the two languages share many aspects of phonology due to their typological similarity. In addition, the results of this study support previous research conducted by Paolillo (2011) and Lee (2007) on the differences in code-switching (CS) between different digital modes such as Facebook (FB) and messaging apps like Viber/WhatsApp, which vary in terms of synchronicity. The concept of synchronicity was identified as one possible factor contributing to the variations in the frequency of CS and borrowing observed between the corpus analyzed for this study and the Facebook corpus analyzed in a previous study by Abu Elhija (2017).

The study highlights synchronicity, a concept that could be used to explain differences in code-switching patterns between digital platforms. This insight could be used to inform future research into codeswitching patterns in digital contexts and help develop digital communication tools sensitive to cultural and

linguistic diversity. Synchronicity can also be related to intimacy; synchronous digital communication is more frequent with our closer network. Thus, the finding that CS is more frequently used in WhatsApp and Viber messages compared to Facebook Timeline (Androutsopoulos, 2015; Abu Elhija, 2017) demonstrates the importance of language for shaping social interactions and relationships. This suggests that people use different languages in different contexts to express their group membership or social status. In public settings such as work or academic settings people might use a standard or formal language variety to communicate professionalism or competence. However, in more intimate settings such as those with close family members or friends they may choose a vernacular or informal variety to communicate familiarity and intimacy.

Moreover, this suggests that language users and learners need to be fluent in multiple registers and varieties of language to be able to navigate social and professional situations effectively.

There are several limitations to this study; first, is the lack of variation in the social backgrounds and ages of the participants. All of the participants were students and teachers, and their ages ranged from 21 to 35 years old. This limits the generalizability of the results to other populations and age groups.

Second, this study only focused on CS between Hebrew and Arabic, while ignoring other possible language combinations used by the participants. This means that the results cannot be generalized to code switching involving other languages.

Finally, the data collected for this study were limited to digital writing, which may not accurately reflect the patterns of spoken language use. Future research could consider collecting data from spoken language as well, which could reveal different patterns of code switching and borrowing.

## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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