A PSYCHOLINGUISTIC INVESTIGATION

OF THE VERBAL MORPHOLOGY OF MALTESE

by

Alina Evelyn Twist

A Dissertation Submitted to the Faculty of the

DEPARTMENT OF LINGUISTICS

In Partial Fulfillment of the Requirements
For the Degree of

DOCTOR OF PHILOSOPHY

In the Graduate College

THE UNIVERSITY OF ARIZONA

2006

THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE

As members of the Dissertation Committee, we certify that we have read the dissertation

prepared by Alina E. Twist

entitled A psycholinguistic investigation of the verbal morphology of Maltese

and recommend that it be accepted as fulfilling the dissertation requirement for the

Degree of Doctor of Philosophy

_____ Date: August 18, 2006
Adam Ussishkin

_____ Date: August 18, 2006
Natasha Warner

_____ Date: August 18, 2006
Ken Forster

_____ Date: August 18, 2006
Samira Farwaneh

_____ Date: August 18, 2006
Jane Hill

Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copies of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

_____ Date: September 15, 2006

Dissertation Director: Adam Ussishkin

STATEMENT BY AUTHOR

This dissertation has been submitted in partial fulfillment of requirements for an advanced degree at the University of Arizona and is deposited in the University Library to be made available to borrowers under rules of the Library.

SIGNED: Alina Evelyn Twist

ACKNOWLEDGEMENTS

I am indebted to each member of my committee for their encouragment and criticism. I am especially grateful to my advisor, Adam Ussishkin, for his speed reading, insightful feedback, and tireless cheerleading. Natasha Warner provided invaluable criticism of the statistical portions of the text, as well as feedback on the experimental designs. Ken Forster was instrumental in fostering my understanding of masked priming, as well as introducing me to the issues behind lexical access. Samira Farwaneh provided thoughtful comparisons of Maltese to other dialects of Arabic. Jane Hill offered advice on interpreting some of the sociolinguistic factors discussed here.

This work could not have been begun, much less completed, without the support of the entire faculty of the Institute of Linguistics at the University of Malta. Marie Azzopardi-Alexander, Albert Borġ, Antoinette Camilleri, and Manwel Mifsud provided invaluable commentary on structural considerations for stimuli and experimental design. I am indebted to Ray Fabri not only for his linguistic insight, but also for his friendship and logistical support during my fieldtrips to Malta. Anna Zammit likewise deserves credit for both her interest in my project and her hospitality. And I am grateful to Noah Fabri for making me feel at home at l-Arka.

Also instrumental to the project were Edwina Gouder, Nicolann Grech, Michael Spagnol, and Pauline Vassallo. Without their language and transcription expertise, none of the experiments could have been conducted. Finally, I thank the participants in each of the experiments for giving so generously of their time.

Writing a dissertation affects more than just the author. I am grateful to all my colleagues and friends who stuck by me through the process. I am thankful for the linguists, most notably Cathy Hicks Kennard, for showing me the ropes and sharing the zaniness; Erin Good, for Nepali food, commie otters, and dissertation yogurt; Naomi Ogasawara, for giving me someone to worry about; and Diane Ohala for chocolate and commiseration. I also managed to keep a few non-academic friends over the years in graduate school. Thanks to Deb, for mojitos, hikes, and patience; to John, for North Dakota; to Kelly and Abbey for making a house a home; to Moose, Becky, Kylie and Collin, just for being there; to Keith, for doing the best he could; and to Melanie, for roller coasters, Get Fuzzy, napkins, and Lucy and Ethel moments.

My parents and brother have never wavered in their encouragement. From weekly phone conversations to multi-month cat-sitting duty, their support has been invaluable. Thanks finally to Annie for being unflappable from the very beginning, and to Tajba for coming along just in time with her contagious enthusiasm.

Dedicated to the memory of the Becker sisters - Marie, Ev, and Doris

TABLE OF CONTENTS

TABLE OF CONTENTS - Continued

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES - Continued

LIST OF TABLES - Continued

ABSTRACT

This dissertation focuses on the unique aspects of Maltese morphology brought about by its genetic and geographic history. The experiments conducted and described here build on past research in Indo-European languages and new research in other Semitic languages to determine how different word formation systems function. Applying experimental techniques to the study of Maltese is crucial for two reasons. First, though Maltese is a Semitic language, recent extensive contact with English has greatly impacted its vocabulary and the structure of its verbs. Though the effects of persistent language contact is pervasive, clear and systematic differences may be observed between native Semitic verbs and those borrowed from English. Secondly, unlike other Semitic languages, the Maltese writing system uses the Roman alphabet. This allows for tests that require the reading of written stimuli to be performed in the same writing system as previous studies in Indo-European languages, eliminating a number of confounding factors.

A masked priming experiment asked Maltese speakers to judge whether or not test items were words of their language. The test items included real and nonce verbs of both Semitic and English origin. Accuracy rates and reaction time were recorded and compared across speakers. The results of this experiment support the psychological salience of the consonantal root as a unit of lexical organization.

An elicitation experiment asked native speakers of Maltese to provide a verb form that corresponded to a given noun or adjective. The test items were nouns of Semitic and English origin and non-words constructed to resemble such nouns. Responses were

broadly transcribed and analyzed for their similarity to the expected patterns. The results show that speakers are able to use two morphological strategies to form new words. The factors affecting the choice between morphological systems include linguistic structure and social variables.

Collectively, this pair of experiments indicate that the consonantal root is a viable morphological and psychological unit of lexical organization, supporting a search-based approach to lexical access. Furthermore, speakers are able to form new words on the basis of whole words, showing that this level of organization must also be present to facilitate lexical access.

CHAPTER 1: MALTESE AND MORPHOLOGICAL SYSTEMS[1]

This dissertation focuses on the unique aspects of Maltese morphology brought about by its genetic and geographic history. After an introduction to the history of Maltese, the remainder of this chapter introduces the features of morphological systems that are relevant to the experiments described in later chapters. First, a description of different morphological systems is given in Section 1.2, with special attention to the verbal morphology of Maltese in Section 1.3. Section 1.4 explores theoretical explanations for nonconcatenative morphology, and Section 1.5 includes an review of models of lexical processing. An overview of the dissertation concludes this chapter in Section 1.6.

1.1 Introduction to Maltese

Maltese is spoken primarily on Malta, an island archipelago nation in the Mediterranean Sea. Malta's population is approximately 400,000, most of which is concentrated on two of the three islands. Just over 370,000 people live on the main island of Malta, while approximately 31,000 inhabit Gozo. A third island, Comino, is home to only a handful of permanent residents. Mifsud (1995) describes the profound influence of Malta's geography on its language. Malta lies in the middle of many major trade routes, making it economically desirable. In addition, its position between Europe and the African continent has, for centuries, placed it in the middle of two opposite

[1] This material is based upon work supported by National Science Foundation Doctoral Dissertation Improvement Grant #0449757. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

political and cultural powers, most recently Islam and Christianity. The small size of the islands facilitates drastic and widespread changes based on outside influences.

1.1.1 Historical roots

When North African Arabs arrived in Malta around 870 A.D., they brought with them both classical and colloquial varieties of Arabic. Mirroring current diglossia in most Arabic speaking areas, classical, or literary, Arabic was written in Arabic script, while colloquial varieties were not written at all. Present day Maltese is a direct descendant of the imported colloquial dialect, not the classical variety (Hayes 2001; Wettenger 1993). According to Wettenger, this North African Arabic dialect came out of Tunisia via Muslim Sicily, whence the Arab occupation of Malta was staged. Some Romance features were already in evidence in this dialect, and it appears that even at this early stage Greek vocabulary related to religion may have been present.

From this point in history, Borġ (1978) provides a brief timeline of language contact that affected the development of Maltese. In 1090, the archipelago was annexed to the Kingdom of Sicily after capture by the Normans. The rulers of Sicily used the islands as a site of exile for rebels. They also encouraged the expulsion of Muslims from Malta, though tax assessments indicate that Muslims remained for at least 150 years after the Sicilian government took charge. During this time, Italian and various southern Italian dialects came into persistent contact with Maltese. However, literary Arabic continued to be the predominant written language well into the period of Norman rule (Wettenger, 1993). As Christianity spread throughout the islands, the use of Latin grew, but it never

became widespread. Vocabulary associated with Christian ceremonies indicates that even church services were conducted in a variety of Arabic.

By the late 15th century, the expulsion or conversion of Muslims was complete. Although the Arabic language remained, the official and literary uses of the language were defunct, having been replaced by Italian. This resulted in the disuse of Arabic script in the Maltese islands. At this critical juncture in the history of the Maltese language, the Latin alphabet was utilized to document Maltese, making it the only colloquial dialect of Arabic to ever attain a full-fledged literary register (Wettenger, 1993). The earliest known written Maltese is Peter Caxaro's *Cantilena,* written in the middle of the 15th century. Cassar (2001) points out that the form of Caxaro's *Cantilena* is that of an orally transmitted poem, and its documentation may not have been part of a standard written tradition. Since few written records of any kind from this period survive on Malta, it is difficult to ascertain the extent of literary practice (Wettenger, 1993). At the least, *Cantilena* shows that the Latin alphabet was utilized to write Maltese as early as the 1400s, and no evidence exists that Arabic script was ever used for this purpose.

In 1530, Holy Roman Emperor Charles V of Aragon gave Malta in fiefdom to the Knights of the Order of St. John (Borġ, 1978). The organization was founded in Jerusalem in the 12th century to provide medical and hospitality services to Christian pilgrims, though it soon took on a military role as well (Cassar, 2000). During their rule, the Knights preserved Italian linguistic and cultural influences on Malta. This close connection to the continent was generally well received by the Maltese, as the Knights provided protection from Muslim incursion (Cassar, 2001). Wettenger (1993) notes that

by this time the Maltese people had aligned themselves more with Europe than Africa and the Arab world, instilling a sense of ignorance and distaste for anything Arab.

The Knights decreed Italian as the official administrative language, but they made no attempt to eliminate Maltese as a mode of communication. Courts were required to translate proceedings into Maltese, and some derogatory references to the language were preserved, but by and large the rulers were accepting of the local dialect (Wettenger, 1993).

The Knights had become somewhat antiquated by the end of the 18th century, and Napoleon capitalized on their lost influence by peacefully ousting them from Malta in 1798 (Borġ, 1978; Hayes, 2001). The period of French rule was short but linguistically tumultuous. During this time, Mikiel Anton Vassalli, a Maltese freemason, instigated a Nationalist movement that was inspired by the Jacobite association of national unity with the existence of a national language (Mitchell, 2002).

One outcome of the Nationalist movement was the removal of the French by Malta's newfound British allies in 1800 (Borġ, 1978; Hayes, 2001). Malta was subsequently colonized by Great Britain in 1813. According to Cassar (2001), the originally congenial nature of British rule became increasingly autocratic and oppressive as Malta's strategic importance was magnified by changing world politics. Malta was at the crossroads between Great Britain and her largest colony, India. In addition, the opening of the Suez Canal in 1869 and the unification of Germany and Italy in 1870-71 boosted the value of a Mediterranean holding.

British rule brought with it English as the predominant language in government, though Italian remained the exclusive language of the court system, and Maltese continued to be spoken prominently. Due to this acceptance, Maltese was associated with the increasingly aggressive Anglicization and Protestantization of the island colony (Mitchell, 2002). The Nationalist movement that had started in the late 1700s continued to contribute to the language struggle throughout the 1800s. The Nationalists believed that Italian, being closely associated with the Catholic Church, therefore opposing the Church of England, was the most preferable choice for a national language.

The three-way struggle between English, Italian, and Maltese continued into the 20th century. Growing interest in a national language exclusive to Malta prompted the founding in 1920 of the Akkademija tal-Malti (Academy of Maltese), whose purpose is to defend the integrity of the Maltese language (Mitchell, 2002). However, it was not until 1934 that Maltese was added to the list of official languages along with English and Italian (Borġ, 1978). At this time, the orthography was standardized to its present-day form, though there are periodic calls to make spelling even more phonetic and less etymological in nature (Davidson, 1996; Hayes, 2001). The hostile actions of Mussolini's Italy against Malta in World War II brought a dramatic decrease in the support of the Italian language and a related boost in the status of Maltese (Davidson).

1.1.2 Writing system

As mentioned above, Maltese is the only variety of Arabic to utilize the Roman alphabet. Since this distinction figures prominently in the design of the experiments to follow, an overview of Maltese orthography is in order. The Maltese writing system uses

most of the same Roman letters that are found in English with a few adjustments. The writing system is phonetically predictable, and each symbol maps on to only one sound, for the most part. Borġ and Azzopardi-Alexander (1997) describe the system as having 22 consonantal phonemes represented by an equal number of letters. The sound to letter correspondences are illustrated below.

Table 1.1 Correspondences between letters and consonantal phonemes

Maltese orthography	**IPA**
p	p
b	b
m	m
t	t
d	d
n	n
k	k
g	g
q	ʔ
f	f
v	v
s	s
ż	z
x	ʃ
ħ	h
ċ	t͡ʃ
ġ	d͡ʒ
z	t͡s[2]
j	j
w	w
l	l
r	r

[2] The letter z is sometimes pronounced as the voiced affricate [dz]. Some researchers consider this a phonetic alternation. Borġ and Azzopardi-Alexander (1997) note that though [ts] and [dz] never occur in opposition, their placement is not entirely phonetically predictable. Therefore it may be appropriate to consider the two sounds separate phonemes represented by the same letter.

In addition to consonants, there are five symbols used to represent 11 phonetically distinct vowels, as shown below. Each of five letters may represent short or long realizations of their respective vowels, and a digraph is used to represent a long, very tense, high, front vowel that has no short counterpart.

Table 1.2 Correspondences between letters and vocalic phonemes

Maltese orthography	**IPA**
a	a, aː
e	ɛ, ɛː
i	ɪ, ɪː
o	ɔ, ɔː
u	ʊ, ʊː
ie	iː

The only two letters that overlap in pronunciation are *għ* and *h*. In word-final position or when they occur in succession (*għh*), these segments are pronounced as [h]. In other positions, *għ* is realized as a lengthening of the preceding vowel, and *h* is silent. In the selection of items for the experiments described in later chapters, items using these segments were avoided.

1.2 Concatenative vs. nonconcatenative morphology

Semitic languages like Maltese are characterized in part by their non-concatenative morphology. In this type of morphology, words are not formed by attaching morphemes to each other end-to-end, as in the concatenative morphologies of Indo-European languages. Instead, prosodic shape and vowel quality contribute significantly to the

semantic content of words. The prosodic shape of verbs is particularly constrained in Semitic languages, as described below.

Concatenative languages like Italian and English contain continuous verb stems, to which derivational and inflectional affixes are added to produce verbs with different tenses, aspects, and person and number agreement. Maltese, like other Semitic languages, makes use of inflectional affixes to show person and number agreement, but the basic forms of the verbs are derived by interleaving vowels with root consonants in predetermined patterns, not adding affixal material to one end of the verb. Examples of the differences between the two types of morphology are shown in Table 1.3. In the Maltese examples, numbers refer to consonant positions in the word and *v* indicates a vowel.

Table 1.3 Comparison of morphological types (Mifsud, 1995)

Morphological type	**Non-concatenative**	**Concatenative**	
Language	**Maltese**	**Italian**	**English**
Base lexeme	Discontinuous root base *<k s r>* 'break'	Continuous stem-base *cant-* 'sing'	Continuous stem-base *sing-*
Derivation	Verbal themes *Theme II* 1v22v3 *Theme VII* n1v2v3 *kisser* 'to smash' *nkisser* 'to be broken'	Verbal affixes *saltellare* 'to skip' *saltare* 'to leap'	Verbal prefixes *reread*
Inflection	Inflectional affixes *kissert* - 3sg., 'he smashes' *nkissru* - 1pl., 'we are broken'	Inflectional suffixes *cantate* 'you sing'	Inflectional suffixes *sings*

1.3 Verbal morphology in Maltese

Although morphological structure is a component of all lexical categories in a language, the morphology of verbs is of particular interest in Semitic languages. One reason to pay special attention to verb formation is that, as in other Semitic languages, the number of available derived verbal patterns, referred to as *themes*, is much less than the number of nominal patterns. Maltese, for instance, contains 102 nominal patterns, but only 11 verbal themes (Aquilina, 1959). Additionally, since verbal patterns predictably affect the semantic component of a verb, e.g. reflexive verbs tend to share the same

pattern, there is reason to suspect that the patterns themselves may be salient morphemes though the experimental evidence on this point has thus far been inconclusive, as is described in the following chapter. Nominal patterns, however, do not all consistently contribute a predictable meaning, so may be less likely to be psychologically analyzed as a separate component of a noun.

Another reason that verbs are of particular interest in Maltese is the productive borrowing of verbs from non-Semitic languages. Among Semitic languages, Maltese is the only one to exhibit this trait. The heavy borrowing present in Maltese makes it practical to distinguish between Semitic Maltese (SM) and non-Semitic Maltese (NSM). NSM may be further broken down into Romance Maltese (RM) and English Maltese (EM). According to Mifsud (1995), RM includes words and features borrowed mostly from southern Italian and Sicilian dialects, while constituents of English Maltese originated from various dialects of English. SM verbs conform to non-concatenative morphological strategies, while NSM verbs are subject to a different set of restrictions and formation processes (Aquilina, 1959; Borġ & Azzopardi-Alexander, 1997; Fabri, 2001; Mifsud, 1995).

1.3.1 Semitic Maltese

SM verb roots are usually biradical or triradical (containing two or three consonants, respectively), and occasionally quadriradical. SM roots may not contain two instances of the same consonant. For instance <*k s k*>, with two [k] consonants, is an illicit root in Maltese. Thus, when multiple instances of the same consonant surface in a verb form, only one can belong to the root. The other(s) must be affixal material or a copy of the

root segment.[3] For example, biradical roots are able to fulfill quadriliteral patterns by copying both of their root segments. Thus the root <f r> yields [farfar] 'he dusted' and <z ʔ> is realized as [zaʔzaʔ] 'he creaked'.

Semitic roots can be strong or weak, as distinguished by the quality of the consonants of the root. Traditionally, weak roots have been distinguished by the inclusion of /j/ or /w/, glides that may not appear in all verb forms (Borġ & Azzopardi-Alexander, 1997)[4]. Examples of strong and weak verbs are given below. All root segments appear in both Theme 1 and Theme 2 forms of strong verbs. In the weak verbs, the glides do not surface in one or both of these themes. Medials glides, as seen in (c), disappear in Theme 1, but surface as geminates in Theme 2. Word-final glides, as in (d), do not appear in either theme.

---

[3] Borġ (1978) cites a verbal class in which the second and third radicals are identical, e.g. <h s s>, but no further examples or explanation is given, and it is likely that these forms are better represented by biradical roots, e.g. <h s>, in which the second radical spreads or is copied (see Bat El, 1989; Gafos, 1998, 2002; McCarthy, 1981; Rose, 2000; Ussishkin, 1999).

[4] Borġ and Azzopardi-Alexander (1997) also consider roots with final orthographic għ as weak. Verbs formed from these roots replace the weak segment with an unpronounced apostrophe when it occurs word-finally. However, the għ reappears in the presence of suffixes. Since the għ digraph represents an abstract segment, these cases are not of primary consideration here, and verbs of this type were avoided when selecting experimental items.

Table 1.4 Examples of strong and weak verbs in Theme 1 and Theme 2

	Root	Theme 1	Theme 2
Strong	b d l	bɪdɛl 'to change/convert'	bɪddɛl 'to change, exchange'
	t b ʔ	tɛbaʔ 'to shut airtight'	tɛbbaʔ 'to bisect'
Weak	f w r	far 'to overflow, boil over'	fawwar 'to cause to overflow'
	t n j	tɛna 'to fold'	tɛnna 'to repeat'

SM verbs are derived by interleaving one of 11 possible themes (analogous to Arabic measures and Hebrew binyanim) with a consonantal root. Each theme specifies a prosodic shape and vocalic melody. Themes contain space in their prosodic shape for three or four radical consonants and are thus referred to as triliteral or quadriliteral. Some themes include set affixes in addition to slots for root consonants and vocalic melody segments. No root interleaves with all possible themes, some of which are semantically redundant, with the average number of productive forms being three to four per root (Mifsud, 1995). Verbal themes and example forms are listed in Table 1.4, where numbers refer to consonant slots and *v* references a vowel. Vocalic segments may follow one of several patterns for each theme; in other words, the theme itself does not dictate vowel quality.

Table 1.5 Examples of verb forms in Maltese[5] (from Mifsud, 1995, p. 36 and Borġ, 1978, p. 212)

Theme	Pattern	Meaning	Example	
I	1v2v3	Basic active (transitive or intransitive)	k s r	kɪsɛr 'he broke'
II	1v22v3	Intensive or transitive of I	k s r	kɪssɛr 'he smashed'
III	1vv2v3	Transitive of I	b r k	bi:rɛk ‘he blessed’
V	t1v22v3	Passive and/or reflexive of II	k s r	tkɪssɛr 'it got smashed'
VI	t1vv2v3	Passive and/or reflexive of III	k t b	tkiitɛb ‘he corresponded’
VII	in1v2v3	Passive and/or reflexive of I	k s r	ɪnkɪsɛr 'it got broken'
VIII	1tv2v3	Passive and/or reflexive of I	f k r	ftakar 'he remembered'
IX	12vv3	Inchoative, acquisition of a quality	h m r	hmaar 'he blushed'
X	stv12v3	Originally inchoative	n b h	stɛnbah 'he awoke'
QI	1v23v4	Basic active meaning	h r b t	harbat ‘he ruined’
QII	t1v23v4	Passive and/or reflexive of QI	h r b t	tharbat ‘he was ruined’

1.3.2 Borrowing

Since the non-concatenative word formation processes described above are quite different from the concatenative processes of non-Semitic languages, most Semitic languages refrain from borrowing vocabulary extensively from unrelated languages. However, Malta’s persistent and extensive contact with European languages has resulted

[5] Theme IV is unattested in Maltese, which is consistent with many Maghrebine varieties of Arabic (Borġ, 1978).

in a high rate of loan words from Indo-European languages with concatenative morphological systems (Gerlach, 2003; Mifsud, 1995). Experimental evidence regarding and theoretical implications of borrowing are discussed at length in Chapter 3.

1.4 Theoretical models of nonconcatenative morphology

There are two main theoretical approaches to non-concatenative morphology. First, there is the view that words in this type of morphological system are composed of a combination of discontinuous morphemes, including consonantal roots. This will be referred to subsequently as the root-based approach. An alternative view is that the processes of word formation in non-concatenative morphology are essentially the same as in concatenative systems, but factors such as prosodic shape restrictions mask the parallels on the surface. This will be termed the stem-based approach in the following discussion.

Most researchers claim that consonantal roots are discontinuous morphemes that define a basic semantic area (e.g. McCarthy, 1979, 1981; McCarthy and Prince, 1986; Mifsud, 1995 among others). Verb stems, containing inflectional and derivational information, are formed by the application of a verbal pattern to the root, resulting in a predetermined word shape. The verbal pattern is made up of the vocalic melody along with the prosodic shape of the surface word.

An example of non-concatenative verbal morphology in Classical Arabic is given below. Each root can be combined with a number of verbal patterns, called *binyanim* (singular form, *binyan*) to form uninflected verb stems. The root supplies the basic meaning. In this example, the root <k t b> carries the meaning of ‘write’. The binyanim

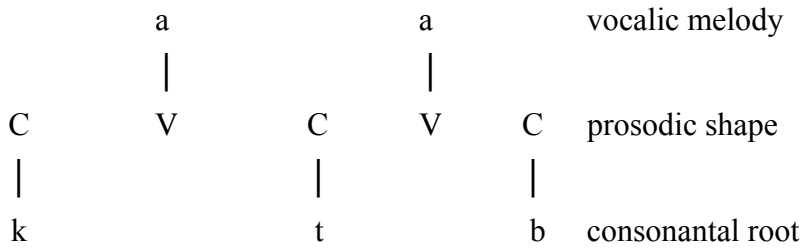
subcategorize this basic meaning into passive, causative, reciprocal, etc. versions according to predictable patterns. For instance, verbs in binyan II are typically causative in nature, while verbs in binyan VI are generally reciprocal.

Table 1.6 Illustration of non-concatenative morphology in Classical Arabic (McCarthy, 1979)

Binyan	**Root**	**Vocalic melody**	**Prosodic Shape**	**Verb**	**Gloss**
I	k t b	a a	CVCVC	katab	write
II	k t b	a a	CVCCVC	kattab	cause to write
III	k t b	a a	CVVCVC	kaatab	correspond
IV	k t b	a a	ʔVCCVC	ʔaktab	cause to write
VI	k t b	a a	tVCVVCVC	takaatab	write to each other
VII	k t b	a a	nCVCVC	nkatab	subscribe
VIII	k t b	a a	CtVCVC	ktatab	write, be registered
X	k t b	a a	stVCCVC	staktab	write, make write

A root-based approach, following McCarthy (1979), requires the root, the vocalic melody, and the prosodic shape to be on separate morphological tiers, as illustrated below.

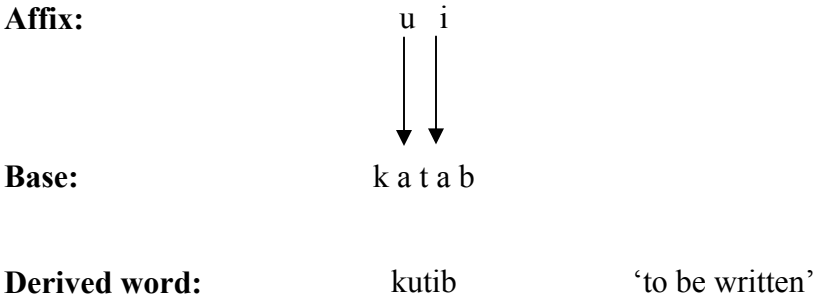
Figure 1.1 Representation of root-based approach



katab 'to write'

Not all researchers agree that the consonantal root should be considered a morphological constituent. Another theoretical direction points to the derivation of words directly from other words. Various types of stem-based analyses have been proposed (e.g., Bat-El, 1994, 2003; Benmamoun, 1999; McCarthy, 1993; Ussishkin, 1999, 2005). Under these approaches, the role of the consonantal root is diminished or eliminated entirely. For the example [katab], stem-based approaches consider this form to be morphologically simplex. Related verb forms ([kaatab], [nkatab], etc.) are derived from it via melodic overwriting, as shown below.

Figure 1.2 Melodic overwriting in Semitic morphology



Bat-El (2003) argues that verbal patterns are applied to whole word stems, not just roots. Ussishkin (1999, 2005, to appear) uses a similar argument working within a constraint-based approach to phonology. This approach relies on phonological processes to encapsulate structural relations between some stem and its derived forms. In an example from Hebrew, [gidel] 'raised' is derived from [gadal] 'grew' by vowel alternation alone, akin to the relationship between English [mit] and [mɛt]. In the case of more complicated derivations, limitations on prosodic structure then impose a predictable word shape.

Consider the case in Hebrew below using Optimality Theory (OT: Prince & Smolensky, 1993) deriving [hugdal] 'he was raised' from [higdil] 'he raised. Ussishkin's (2005) account assumes that the vowels form an affix that must be realized in the output. Faithfulness to affixal material is valued above faithfulness to the input[6], and prosodic restrictions dictate that the output be bisyllabic. This combination of constraints results in an output that is identical to the input in prosodic shape, but in which the vowels have been replaced.

[6] This constraint ranking is in direct opposition to McCarthy and Prince's (1994) Root-Affix Faithfulness Metaconstraint (RAFM). See Inkelas and Zoll (1999), Spaelti (1997), Twist (2004b), Ussishkin (2003), Ussishkin and Wedel (2002) for additional evidence in contradiction to the RAFM.

Table 1.7 OT account of a stem-based approach to nonconcatenative morphology (Ussishkin, 1999)

FAITH-AFFIX: The output must contain all affixal material present in the input.
σ-ALIGN: Every syllable must be aligned to the edge of a prosodic word containing it.
FAITH: Material in the output must be identical to material in the input.

higdil - u a	Faith-Affix	σ-Align	Faith
higudal		*!	i
higadil	u!		
☞hugdal			ii

In the tableau above, candidate (c) emerges as optimal even though it does not preserve the original vowel quality of the input. Candidate (a) fails due to misalignment of syllables to the prosodic word, despite the full realization of the affixal vowels. Candidate (b) is suboptimal because is does not include all affixal material.

Theoretical models of any sort should be supported by empirical evidence. The debate between root and word based approaches to Semitic morphology is hotly contested in part due to conflicting experimental evidence regarding how speakers form words. The following section provides an overview of the models of lexical processing available to interpret this experimental evidence.

1.5 Models of lexical processing

Word recognition is the process by which speakers use various characteristics to identify words that they know. By studying which factors speakers use to recognize words, it is possible to draw conclusions about how they process lexical items. Not all

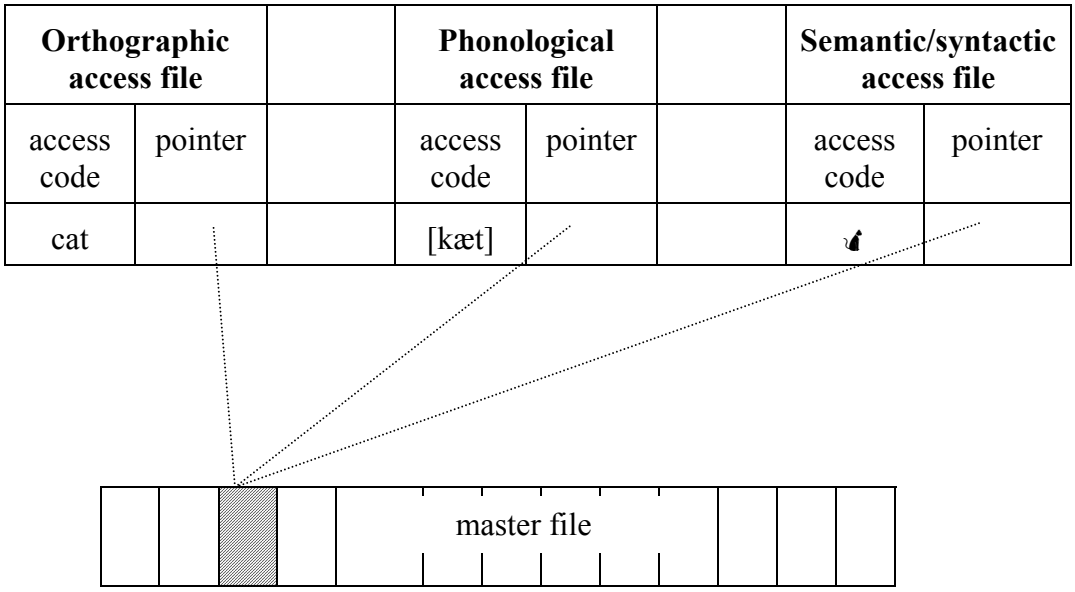
researchers agree on the theoretical consequences of experimental evidence, and the interpretation of experimental results depends largely on the framework assumed to govern the cognitive processes of word recognition in general. Three competing types of frameworks are search-based, parallel activation, and connectionist models (Seidenberg, 1995). Within each of these frameworks there are multiple models, but an overview of the differences between the general schemata will suffice as backdrop for the experiment described in the next chapter. Therefore, the following sections describe briefly the differences between search-based, parallel activation, and connectionist models and their bearing on the experiment described later.

1.5.1 Search-based models

Search-based models of lexical access (e.g. Allport & Funnell, 1981; Forster, 1976; Glushko, 1979; Loftus & Cole, 1974; Rubenstein et al., 1970) assume that words in the mental lexicon are organized into searchable groups based on distinct features, such as orthographic, phonological, and semantic characteristics. In order to find a particular word in the lexicon, a search is executed until all the available characteristics of an input are matched to a word. As an example of the basic structure of a search-based model, the framework of Forster's (1976) bin model is shown below.

In this simplified schematic, each word has an entry in a master file, plus several peripheral files that contain only specific features of each word. In the orthographic file, for instance, each word is listed by its orthographic features. These features make up the word's access code in this file. Each entry in a peripheral file also contains a pointer to the corresponding entry in the master file.

Figure 1.3 Schematic of Forster's (1976) bin model: Words are located in a master file by pointers originating in peripheral files.



According to this model, within each file words are organized into smaller groups, called bins. Word recognition is achieved by searching the bins, either serially or in parallel, and matching characteristics. When a match is found, the pointer selects the corresponding word from the master file.

Since the appearance of the first search-based models in the 1970s, many variations have emerged. Though the basic assumption of dictionary-like organization has remained, the search mechanisms and organizational parameters have been adjusted to account for the ever expanding body of experimental findings regarding lexical processing. Though search-based models come in a variety of forms, the basic premise of a diachronic search through a rigorously organized lexicon is paramount. Seidenberg (1995) points out two primary questions that follow from the assumption of a search-based model that can be addressed by a priming study. First, how is the lexicon

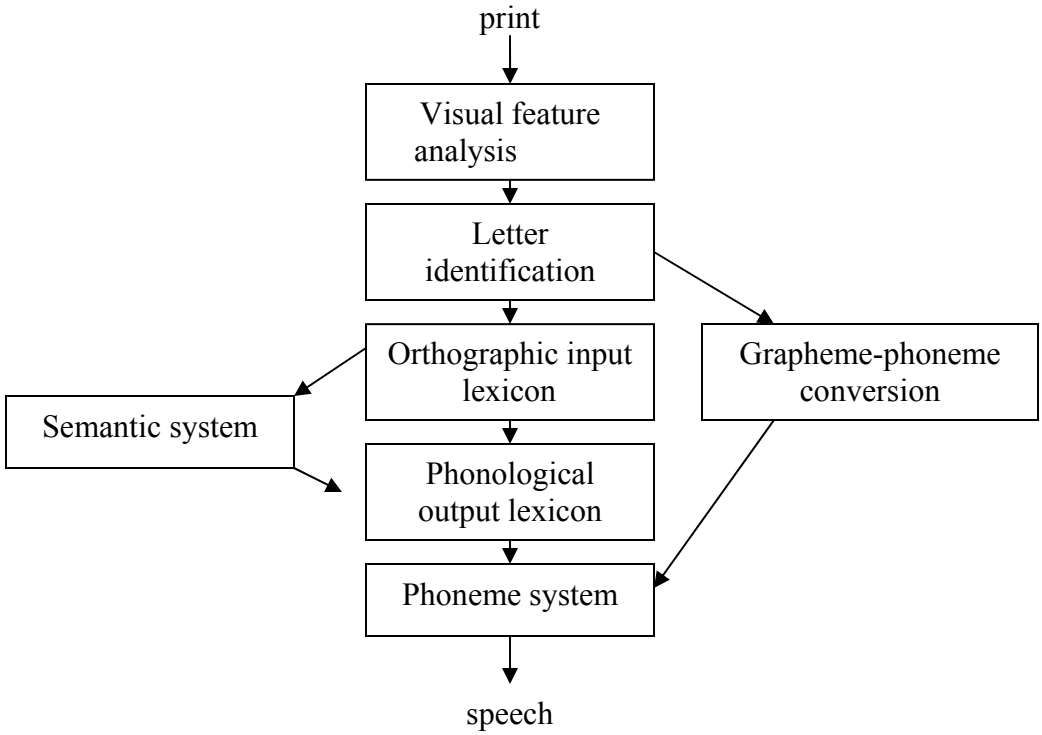
organized? Second, what factors influence the amount of time needed to execute a search?

1.5.2 Parallel activation models

In parallel activation models, the input to a system activates units on a number of levels that correspond to word attributes, such as orthographic representation, phonology, and semantics. The links between these levels may be either facilitatory or inhibitory in nature, increasing or decreasing the activation of particular words accordingly. Examples of parallel activation models are the Dual Route Cascaded (DRC) model (Coltheart, Curtis, Atkins, & Haller, 1993) for written word recognition, and Trace (McClelland & Elman, 1986) and Shortlist (Norris, 1994) for spoken word recognition.

While some models attempt to describe the organizational structure of the lexicon and specific processing mechanisms in great detail, others have a broader scope without the precision. These more generalized systems lend themselves well to computer modeling. For example, Coltheart (2006) uses computational modeling to adapt the Dual Route Cascaded (DRC) model (Coltheart et al., 1993; Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001) to account for dyslexic reading. In the full model, illustrated by the flowchart below, words must be recognized at several representational levels to be translated effectively from print into speech. By making adjustments to the grapheme-phoneme conversion module, dyslexia can be simulated without disrupting the other layers of the model.

Figure 1.4 A schematic of the DRC model of visual word recognition (from Coltheart 2006): Visual input activates units in multiple featural levels of processing.



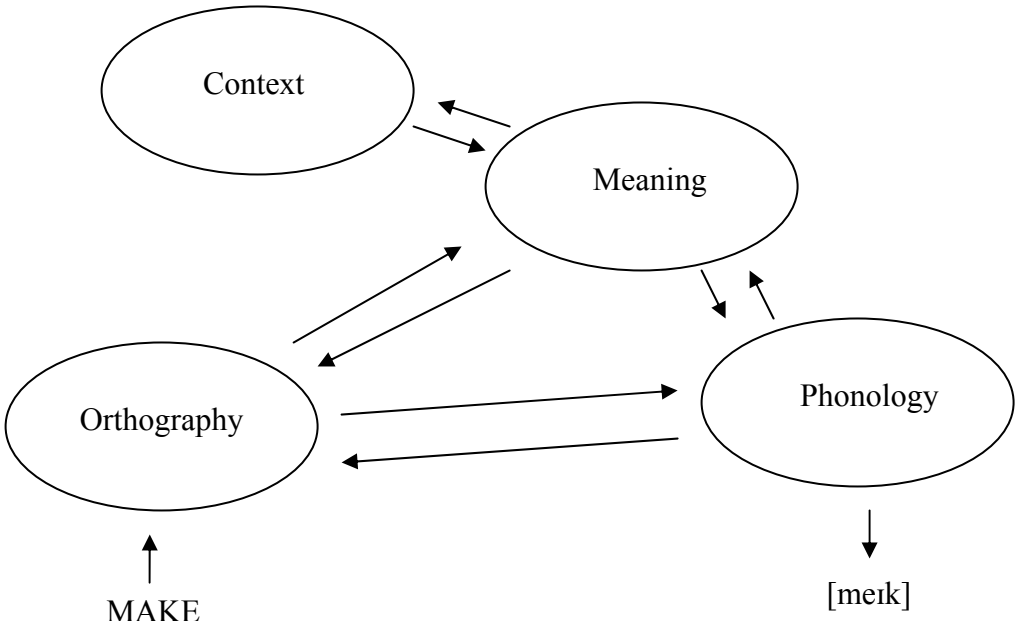
1.5.3 Connectionist models

In connectionist models, the processes that drive word recognition derive from broader frameworks that govern additional cognitive properties. In contrast to search-based models, connectionist frameworks (e.g. McClelland & Rumelhart, 1981; Plaut, McClelland, Seidenberg, & Patterson, 1996; Seidenberg & McClelland, 1989) rely on successive activation of featural units to culminate in the recognition of the target word. The matching patterns are computed over time instead of being stored as in search-based models. Unlike parallel activation models, connectionist systems do not assume any

serial organization to the featural units. Instead, any unit may interact with any other unit in the framework and feedback may flow bidirectionally. As with parallel activation models, some connectionist models have been proposed to describe spoken word recognition instead of written word recognition. For example, Gaskell and Marslen-Wilson's (1997) distributed cohort model (DCM) focuses on auditory input.

To illustrate a connectionist model, a simplified version of Seidenberg and McClelland's (1989) framework is reproduced below. Each attribute of a word, e.g. orthography, phonology, semantics, is connected to other attributes of that word by a series of feedback loops. The input to the model is assessed by simultaneous activation of multiple units associated with each attribute of the input. As more feedback is fed through the loops, activation is increased in words that are most similar to the input, eventually leading to the selection of the maximally activated word as a match.

Figure 1.5 Simplified schematic of Seidenberg and McClelland's (1989) connectionist framework: Interaction of featural attributes contributes to a word's overall activation level.



Regardless of the framework adopted, certain effects have been observed experimentally that must be accounted for by any model. Some crucial effects that can be measured by priming studies, such as frequency, neighborhood density, and morphological family size, are outlined below.

1.5.4 Frequency

Rubenstein et al. (1970), Forster and Bednall (1976), and Scarborough, Cortese, and Scarborough (1977), among others, showed that frequently occurring words are recognized more quickly than less frequent words. All the models described above account for this effect of word frequency on the time needed to recognize a word. In the

case of a search-based system, the word recognition process requires a search of all lexical entries. It seems plausible that the organization of lexical items would include frequency as a factor, so that a search would begin with the most frequent items. This would result in words with a higher frequency of occurrence being recognized more quickly than words that are not as common (Forster, 1976).

Forster (1989, 1992) notes that the reaction times to non-words are on average about 80 ms to 100 ms slower than those to words and just a bit slower than the lowest frequency words. A search-based approach also accounts for this difference. In order to classify an item as a non-word, the search mechanism would have to look through all the words in the lexicon in order to determine that an item is not present. This strategy results in a longer search than if the target item were located at any time during the search.

Parallel activation and connectionist models account for the effect of word frequency in quite a different way. In these models, the identification of a word is achieved by the activation of a series of features attached to it. This activation is assumed to be cumulative over time, so that very frequent lexical entries have a higher ambient activation than lower frequency items. Therefore, when additional activation is provided by a stimulus, the high frequency items need less time to reach the threshold of recognition. Slower reaction to non-words is expected since these items never reach the recognition threshold.

1.5.5 Phonology

Another issue that must be addressed in any study of word recognition, even one involving visual stimuli, is the role of phonology. A number of studies have been carried out to discern if phonology mediates lexical access. If word recognition is assisted by phonological cues, lexical access to words that sound the same (e.g. homophones like *hair/hare*) should be related. If there is no phonological component to word recognition, the fact that two words sound alike should have no bearing on lexical access.

Glushko (1979) tested word naming reaction times (RTs) to words that varied in their phonological consistency as compared to similarly spelled words. The study classified test items as consistent, inconsistent, or exceptions. The consistent words, like HUNT, belong to a group of words that share some of the same letters that are pronounced in the same way across the entire group (BRUNT, BUNT, PUNT). Inconsistent words and exceptions both belong to groups of words that share similar spelling but have at least one group member that does not rhyme with the rest (PINT, MINT, HINT, GLINT). The non-rhyming word (PINT) is the exception, and any of the remaining rhyming words are in the inconsistent category. The results showed that participants were faster to name consistent words than either inconsistent or exception words. Inconsistent and exception words did not elicit a difference in RTs. However, participants made more errors in response to exception words than to inconsistent words. This study suggested that phonology plays a part in word recognition, as inconsistent phonological content slows down the recognition process and makes it more error prone. However, Taraban and McClelland (1987) were unable to replicate this effect. Instead,

they found that only exception words produced a processing delay, suggesting that phonological regularity is more important than consistency.

Regardless of the specific effect, both of these studies show some mediating effect of phonology on word recognition. It is important to note that this research was carried out in English, a language in which phonology is not consistently orthographically encoded. Shen and Forster (1999) show that phonology shows no priming effect in Chinese, in which phonology and orthography are even less related. However, phonological similarity does facilitate naming. In conducting research with visual stimuli, it is therefore important to consider the additional factor of orthography on lexical access.

1.5.6 Orthography

Katz and Frost (1992) (also Frost, Katz & Bentin, 1987; Katz & Feldman, 1982) addressed the effect of orthography on word recognition by way of the Orthographic Depth Hypothesis (ODH). The two premises of this hypothesis are that phonology is more accessible in languages with shallow orthographies, those in which the relationship between phonemes and their graphemic representations are consistent. The second part of the hypothesis states that the easier it is to access phonological information early in the word recognition process, the more that information will be exploited for lexical access.

Research in Serbo-Croatian[7], a language with shallow orthography, has supported the connection between orthographic depth and lexical access. Lukatela, Popadic,

[7] Since the dissolution of Yugoslavia in the 1990s, the term Serbo-Croatian is not widely used, and the distinction between Serbian and Croatian is made partially through the use of different

Ognjenovic, and Turvey (1980) made use of ambiguity between the Cyrillic and Roman alphabets, both of which were used to write Serbo-Croatian. When confronted with items that contain letters that could be interpreted in either orthography, e.g. *betap*, where the *b* and the *p* could be the Cyrillic equivalents of *v* and *r*, readers took more time to make lexical decisions. These findings seem to support the phonological mediation of lexical access in Serbo-Croatian, as anticipated by the ODH. However, the previously mentioned research on English and Chinese (Taraban & McClelland, 1987) and Chinese (Shen & Forster, 1999) acknowledged some effect of phonology even in deep orthographies.

1.5.7 Neighborhood density and frequency

In addition to effects that involve the phonology-orthography interface, there is evidence that orthography provides an independent influence on lexical access by way of neighborhood effects. A word's neighborhood density increases with the number of words that share orthographic similarities. A word like *heal* comes from a dense neighborhood (containing *head*, *hear*, *meal*, *deal*, etc.), while *coax* belongs to a sparse neighborhood. Conflicting results have emerged from experiments designed to determine the effects of neighborhood density.

According to Coltheart, Davelaar, Jonasson, and Besner (1977) and Grainger, O'Regan, Jacobs, and Segui (1989), neighborhood density had no effect on lexical decision times. However, Andrews (1989) reported faster lexical decisions to low

---

orthographic systems. Serbian is written in the Cyrillic alphabet and Croatian uses a Latin system. The study is described here in relation to the timeframe in which it was conducted.

frequency words with dense neighborhoods. Grainger (1992) speculated that the discrepancy in these results could be attributed to the fact that the manipulation of neighborhood density levels masked the true source of neighborhood effects. He argued that what really matters is not the density of the neighborhood, but the number of higher frequency neighbors. This approach predicted no effect on high frequency words, since the number of neighbors with higher frequency would be negligible, while low frequency words would always have more frequent neighbors. In the case of low frequency words, then, a greater number of high frequency neighbors would facilitate lexical access relative to a small number of frequent neighbors.

1.5.8 Morphological family size

Since orthographic overlap is frequently associated with morphological overlap, the issue of morphological family size must also be taken into consideration. Morphological family size has been shown to have differing effects on lexical decision depending on the modality of presentation. For visual word recognition, larger morphological families provide a facilitatory effect, but for auditorily presented words, large morphological family size is inhibitory. De Jong, Schreuder, and Baayen (2000), following Marslen-Wilson, Zhou, and Ford (1997), Meunier and Segui (1999), and Zwitserlood (1989) supported the view that in an auditory presentation, the absence of information from a visual stimulus results in longer latency times. Using a parallel activation model approach, they argued that visual stimuli make entire words immediately available to the processing system, but stimuli that are presented only auditorily must be processed over time, as the auditory information is received. This gradual processing results in the

activation of multiple forms from multiple morphological families, negating any effect that size of the target's morphological family might have.

1.5.9 Morphological complexity

Another factor in lexical processing is the role of morphological complexity. Are morphologically complex words stored in the lexicon as whole words, or are they stored in pieces? Taft and Forster (1975) proposed that words are decomposed into their morphological constituents. A search of the lexicon by the central organizational unit provides access to all morphologically complex words that contain that unit. For instance, a search for the stem *bird* also accesses the plural *birds* and the compound *blackbird*. A central question for this theory is exactly what constitutes an organizational unit. In the case of Semitic languages, as previously discussed, much research has focused on the status of the consonantal root as such a unit.

Dual route search models allow for processing of morphologically complex words both by decomposition and by whole word storage. For instance, Marslen-Wilson, Tyler, Waksler, and Older (1994) posited that semantically transparent complex words such as *unlock* are stored as their constituent morphemes. Other complex words that are semantically opaque, like *untoward*, are represented in their framework as whole words. Similar models, e.g. Pinker (1994) differentiate between the storage of regular, rule-governed complexity as decomposed parts and irregular forms as whole words.

Parallel activation (e.g. Coltheart et al., 1993) and connectionist models (e.g. Seidenberg 1992) do not allow for word storage in the same way that search models do. Instead, the activation of featural properties by a single system accounts for accurate

processing of morphologically complex forms. According to Joanisse and Seidenberg (1999), regular English past tense forms ending in *-ed* are accessed through phonological similarity, while irregular past forms like *went* depend more upon semantic activation. In related work, Rueckl, Mikolinski, Raveh, Minder, and Mars (1997) found that reaction times to target items were facilitated more by morphologically related primes that shared a high degree of phonological and orthographic overlap (*agree-agreeable*) than those that had less of these features in common (*serene-serenity*).

1.6 Overview of dissertation

This chapter has provided an overview of the topics to be discussed in relation to a pair of experiments on Maltese. The first experiment, described in the following chapter, focuses on the structure and lexical processing of SM verbs. Chapter 3 describes an elicitation experiment designed to explore the interaction of two verb formation strategies available to speakers of Maltese. This is followed in Chapter 4 by a discussion of sociolinguistic factors that affect the morphological variation uncovered by the elicitation task. Finally, an overview of the results of both experiments is given, along with a discussion of the direction of future research.

CHAPTER 2: MASKED PRIMING

This chapter describes the results of a masked priming experiment designed to measure how quickly Maltese speakers responded to verb stimuli based on their similarity to masked primes. The stimuli were manipulated to contain prime-target pairs with identical roots, verbal patterns, both, or neither. The relative speed of reaction to targets preceded by primes of differing levels of similarity showed which morphological elements are salient when accessing lexical entries. It was expected that word recognition would be facilitated by primes containing the same root consonants or the same verbal pattern, mirroring the verb recognition strategy of Hebrew speakers, as shown in Deutsch, Frost, and Forster (1998).

As discussed in Chapter 1, there are conflicting viewpoints as to what comprises a morphological unit in Semitic languages. Some researchers (e.g. Bat-El 1994, 2003; Ussishkin 1999, 2005) have argued that the consonantal root is not a viable unit in the lexicon. This approach views verbal patterns as affixes that are attached to whole stems, not just consonantal roots. Another theoretical perspective, taken by McCarthy (1979, 1981), McCarthy and Prince (1986), Prunet, Beland, and Idrissi (2000) and many others, considers consonantal roots to be central in the processing of Semitic words. This approach considers the consonantal root to be on a separate morphological tier from the verbal pattern.

Much experimental work has focused on determining the status of the consonantal root as a morphological unit in Semitic languages. The following sections discuss first the theoretical frameworks associated with research into lexical access, then the specifics

of masked priming methodology. Special attention is paid to the use of masked priming in Semitic languages, culminating in the Maltese study which is the primary focus of this chapter.

2.1 Masked priming

No matter which type of model of lexical access is assumed, the processes central to word recognition performance are not purely lexical in nature. The masked priming task (Forster & Davis, 1984) was developed as a strategy to isolate and measure the lexical effects of word recognition.

In a masked priming experiment, participants are exposed to a series of stimuli in rapid succession. The first presentation is a fixation point composed of neutral symbols, generally shown for a period of 500 ms. The fixation point camouflages the prime, making it imperceptible to the viewer. This stimulus also focuses the participant's vision on the area in which subsequent stimuli will be presented. Next, the prime is presented for a brief period, typically between 30 and 60 ms, that is out of the range of conscious perception. The prime is followed immediately by the target, to which some response is required.

Priming effects were originally shown through the use of repetition of identical prime-target pairs. Though visibly perceptible primes induced some effect (e.g. Scarborough et al., 1977), it is not clear what the priming mechanism was. Forster and Davis (1984) pointed out that the facilitatory effect of repetition is due to two independent sources, episodic memory and lexical processing. Repetition facilitates word recognition by increasing awareness of a particular item in episodic and lexical

records. The effect of repetition is weaker for more frequent words, suggesting a long term consequence of repeated impressions. The lexical component of the repetition effect, in contrast, is short-term and insensitive to frequency.

The masked priming procedure, by making the prime so short in duration that it is unrecognizable, is able to remove the memory component of the repetition effect. Since the prime is not fully perceived, there is no chance for it to make an impression in memory. Therefore any priming effects observed must be the result of lexical processing. The masked priming technique has been exploited to investigate which lexical components are important in the retrieval of words from the lexicon. Section 2.2 reviews the use of masked priming to study the structure of morphology in Semitic languages.

2.2 Morphological priming in Semitic languages

One persistent question that dominates much research on Semitic morphology concerns the status of the consonantal root. Theoretical approaches have treated the root variously as a central unit of organization (e.g. McCarthy, 1979, 1981; McCarthy & Prince, 1986) or an artificial result of affixation in prosodically restricted environments (e.g. Bat-El, 2003; Ussishkin, 1999, 2005). Experimental studies, especially priming methodologies, have added evidence to this debate, mostly in favor of some representation of the consonantal root. These studies have also added to the interpretation of the importance of word patterns in Semitic morphologies.

2.2.1 Nouns

Frost, Forster and Deutsch (1997) used the masked priming technique to show that some morphologically related primes facilitate both lexical decision and naming of nouns in Hebrew. Prime-target pairs that share a consonantal root exhibited facilitatory priming. For example, the consonantal root indicating words related to singing, <z m r>, facilitated responses to the noun [tizmoret] 'orchestra' relative to an unrelated root, <t m r> 'date'[1]. In contrast, primes that contained the same pattern as targets showed no priming effects at all. One pattern used in this experiment was ta__i_, indicating a masculine noun that is the result of an action. Responses to [targil] 'exercise' were similar when primed by [taldit] 'record', which shares the verbal pattern, or [tadhema] 'amazement', which has a different pattern. Also, roots that were related semantically but not morphologically showed no priming effects. As mentioned above, [tizmoret] 'orchestra' was primed by the semantically and morphologically similar <z m r>, having to do with singing. However, it was not primed by <n g n>, conveying the meaning of instrument playing, a morphologically unrelated root that was semantically linked to the target. The experimenters concluded that consonantal roots are psychologically accessible morphological components of Hebrew words.

2.2.2 Verbs

Further masked priming experiments in Hebrew (Deutsch et al., 1998) showed that both roots and patterns facilitate priming in verbs. This suggests that verbal patterns are

---

[1] The noun *tizmoret* includes the prefix *ti-* that contains a consonant that is not part of the root.

more salient than nominal patterns. Since Hebrew contains 7 verbal patterns and greater than 100 nominal patterns, the researchers concluded that verbal patterns contain more transparent morphological information than nominal patterns.

One criticism of masked priming studies in Hebrew centers on the orthography, which, like Arabic script, does not encode all vowels. This type of orthography might be expected to emphasize the salience of consonantal segments that make up the root while placing less stress on the vocalic segments present in the patterns. Some research has addressed the issue of the orthographic confound by using experimental methodologies that use auditory rather than visual stimuli. Using a cross-modal priming methodology, in which participants must process both auditory and visual information, Boudelaa and Marslen-Wilson (2000) confirmed that verbs and nouns in Modern Standard Arabic behave differently according to the same patterns as in Hebrew. Their test materials included prime-target pairs of primitive nouns ([qamarun]-[maraqun], 'moon'-'sauce'), deverbal nouns ([xudˤuuɬun]-[ħudutˤun], 'submission'-'happening'), and verbs. Though consonantal roots facilitated priming in all grammatical categories, only verbs and deverbal nouns showed priming associated with patterns. Furthermore, this study was able to contrast prime-target pairs that shared patterns that were related both semantically and in form with prime-target pairs that shared patterns related only in form. Deverbal nouns failed to exhibit priming when shared patterns were related only by form ([sujuunun]-[ħuduutˤun] 'prisons'-'happening'). Verbs that shared patterns produced priming effects whether the patterns were related by form and meaning or by form alone.

Further experimentation (Boudelaa & Marslen-Wilson, 2004) separated the influence of vocalic melodies and prosodic shape, the two components of patterns. In Modern Standard Arabic, prime-target pairs that shared only prosodic shape exhibit as much facilitatory priming as those that shared both aspects of the pattern. Those pairs that shared only the vocalic melody did not produce priming effects. These effects were found using visual masked priming, cross-modal priming, and auditory-auditory priming. These findings suggested that not only do verbal patterns prime, but it is specifically the prosodic shape dictated by the pattern, and not the vocalic melody, that is salient.

2.2.3 Weak Verbs

Recent priming studies in Hebrew have investigated the behavior of weak verbs as well as strong verbs. Frost, Deustch and Forster (2000) tested the priming effects of weak verbs, in which one root consonant is deleted on the surface. They found that although root priming was facilitated in weak verbs, patterns did not prime at all. However, substituting a random consonant into the prosodic shape of the verb where the weak consonant was deleted reestablished the pattern priming effect. The researchers argued that this strengthens the support of the verbal pattern as a salient morphological unit, since disrupting the pattern was disastrous to priming effects. They also concluded that the role of the root in lexical access is not as strong, since the priming effects of roots into which arbitrary consonants have been inserted are just as strong as the effects of existing strong roots.

Building on the effects of weak root priming, Sumner (2003) studied different classes of weak verbs in Hebrew. The weak verbs were classified as either /j/ or /ʔ/ final.

Sumner separates these groups because the processes governing the consonant loss may be different. Glottal stops are prohibited in word final position, which is the position the final root consonant occupies in many verbal patterns. In fact, the glottal stop only appears in verbal patterns in which it may occupy an onset position. Even so, the production of the glottal stop in any position appears to have been declining over time. Meanwhile, the loss of /j/ in final position is not phonologically motivated. In verbs that contain a root with /j/ as the third consonant, this segment never appears. The results of an auditory priming task showed that weak verbs of either type did not facilitate pattern priming. In fact, for older adults (mean age 49.5), /ʔ/-final verbs demonstrated an inhibitory effect, making speakers slower to respond to an item with the same pattern. Sumner hypothesized that the phonotactically predictable behavior of the glottal stop suggests that it is an underlying segment of the root, whereas final /j/ may not actually be present at all in any form. She also suggested the possibility of a morphological neighborhood effect, which will be discussed as part of the next section. Whatever the reason for the contrasting behavior of the two types of weak verbs, Sumner's experiments showed that verbal patterns may have some effect on lexical access, even for weak verbs.

2.2.4 Morphological priming in Maltese

Two factors make Maltese a particularly suitable Semitic language in which to test for word formation strategies. First, most of this type of research done to date has focused on Indo-European languages that use the Roman alphabet. Recent studies in other Semitic languages using visual stimuli may be difficult to compare because of the

disparate orthographic systems. Both Hebrew and Modern Standard Arabic are written in scripts that lack representation for most vowels. Maltese is the only relative of Arabic whose writing system uses the Roman alphabet instead of Arabic script. Therefore, a study in Maltese can be compared to previous research in Indo-European languages without the confounds of orthographic ambiguity and dissimilarity. The data below shows a few cognates that illustrate the difference between Maltese orthography and Arabic script.

Table 2.1 Illustration of the difference in orthographic systems of Maltese and Modern Standard Arabic

Maltese	**MSA**	**Transliterated MSA**	**Pronunciation**	**Gloss**
dewwaq	ذوق	th w q	dɛwwaʔ/ðɛwwaʔ	to make someone taste something
feraħ	فرح	f r ħ	fɛrah	to be glad
wited	وتد	w t d	wɪtɛd/watad	wooden nail, stake

Most of the population of Malta is bilingual in Maltese and English, and many also speak a third language (Davidson, 1996; Ellul, 1978). Compulsory schooling is conducted in both English and Maltese, but the extent to which each language is used varies greatly within the population. Factors such as region (city versus village), type of school attended (state, private, or church-sponsored), and occupation strongly influence daily language choice (Camilleri, 1996). Chapter 4 discusses bilingualism in Malta in more detail.

Within Maltese, Borġ (1978) noted that some systematic variation in speech can be observed in extremely rural settings, especially on the minor islands of Gozo and Comino. These variations in speech are limited to alternative pronunciations of a few sound segments and some regional vocabulary. For instance, the [ʔ] of standard Maltese may be realized in some dialects as [k] or [q], and final [a] is raised to [e] in some rural speech patterns. Camilleri and Vanhove (1994) provided a detailed account of the dialect of Mġarr, a town in the northwest of the main island of Malta. Although their research pointed out that dialect variation in Maltese is largely disregarded as minor, it is important to note that the differences are present only in oral language. The writing system was standardized in the 1930s (Davidson, 1996; Hayes, 2001), so literacy requires proficiency in the standard variety of the language. Furthermore, none of the dialect variations affect processes of word formation, so speaker dialect was not a factor under consideration in the experiments described here.

2.3 Hypotheses

The primary hypotheses concern the effect of morphological similarity on reaction times (RTs) to common Maltese verbs. In a series of masked priming experiments, Deutsch et al. (1998) illustrated that RTs to written Hebrew verbs were facilitated by primes with the same root consonants. For instance, [hitlabeʃ]-[hilbiʃ] 'he got dressed'-'he dressed' share the same root, <h l ʃ> and exhibit facilitatory priming. Also pairs of verbs with the same verbal pattern, as in [huklat]-[hugdar] 'was recorded'-'was defined', exhibit facilitatory priming. These results suggest that Hebrew speakers use both the

morphological information supplied by consonantal roots and the word form information supplied by patterns to recognize verbs. This finding contrasts with earlier work on Hebrew nouns that showed that identical roots facilitate priming but patterns do not (Frost et al., 1997). The fact that nouns and verbs might be accessed differently is predicted by both cross-linguistic evidence and factors specific to Semitic morphology.

Smith (1997) argued for the salience of the noun as a linguistic category, using crosslinguistic evidence. In Japanese, for instance, accent placement is predictable, and therefore non-contrastive, for verbs and adjectives, but not for nouns. A number of studies on aphasic patients in Italian (Miceli, Silveri, Villa, & Caramazza, 1984), English (Williams & Canter, 1987, Zingeser & Berndt, 1990), and Chinese (Bates, Chen, Tzeng, Li, and Opie, 1991) also supported the salience of nouns. Miceli et al. (1984) and Zingeser and Berndt (1990) reported that aphasics were impeded to a different extent in their production of verbs and nouns depending on the syndrome with which they were affected. Broca's aphasics had more trouble producing verbs, while Wernicke's aphasics found it more difficult to produce nouns. One criticism of this study is that Italian verbs are more morphologically complex than nouns, a fact that may independently influence production. However, Bates et al. were able to replicate these findings in Chinese, an isolating language in which complex morphology is not an issue. In a study on English speaking aphasics, Williams and Canter found that both Broca's and Wernicke's aphasics had more difficulty producing verbs than nouns. However, they noted that patients with Broca's aphasia were better at the confrontation-naming task than picture description. The pattern for Wernicke's aphasics was the opposite. There were no clear differences

between tasks relating to verb production for either group. The researchers suggested that the overall difficulty of processing verbs eliminated any task effect, while the fact that nouns are easier to process made it possible to observe subtle differences in response to different tasks. Although this series of studies was far from conclusive in terms of determining the factors that influence the recognition and production of different lexical categories, this research strongly anticipates that nouns and verbs are processed differently.

Another reason Semitic nouns and verbs in particular may be expected to behave differently is connected to the availability of discrete morphemic units. Assuming a root-based approach, verbs are constructed by interleaving consonantal roots with verbal patterns, themselves made up of vocalic melodies and prosodic shape requirements[2]. Considering only roots with three radical consonants, the number of possible roots in Maltese is somewhat less than 12,000 (assuming each of 23 consonants is available for any radical position, minus phonotactically disallowable combinations). However, the number of available patterns is only 77, the number of acceptable prosodic shapes (11) multiplied by the number of licit vocalic sequences (7). Nouns also require that a consonantal root be paired with a pattern, but the number of patterns available to nouns is 102, making the shape of nouns much less predictable than that of verbs (Aquilina, 1959). Deutsch et al. (1998) described a similar distribution of nominal and verbal

---

[2] McCarthy (1981) and other root-based approaches consider the vocalic melody and the prosodic shape to be separate morphological entities. However, vocalic melodies are not as variable in Maltese as in other Arabic dialects, so the analyses presented here conflate vocalic melody with prosodic shape into a single morphological unit referred to as the verbal pattern.

patterns in Hebrew. For this reason, it is reasonable to expect that verbal patterns, by virtue of their relative stability across the grammatical class, play some role in lexical access.

Nominal patterns, on the other hand, may be too variable to provide any facilitation in the search of the lexicon. This does not mean that nominal patterns could not be separate morphological units, as verbal patterns have been shown to be. Instead, it could be that any expected facilitation of processing is cancelled out by the unpredictable nature of nominal patterns.

In addition to morphological overlap priming, the organization of the test items allows for the investigation of the effects of two other variables on overall RTs. Items in the study were balanced between weak and strong verbs, and Theme 1 and Theme 2 verbs.

2.3.1 Verb strength effect

Chapter 1 provided an introduction to the difference between strong verbs, which are pronounced using all of their root radicals, and weak verbs, which lose a radical on the surface. In the experimental items, all weak verbs were missing the final consonant. Strong verbs were expected to elicit faster RTs than weak verbs. This prediction is based on the effect of overall word frequency on reaction times. Since there is no working corpus of Maltese from which to gain frequency statistics, speaker intuition is the best available estimate of frequency. Based on this measure, weak verbs have been shown to be less frequent on average than strong verbs (Twist, 2004a). For that reason, RTs are expected to be slower for weak verbs.

2.3.2 Verbal pattern effect

Theme 1 verbs were expected to elicit faster RTs than Theme 2 verbs due most likely to morphological family size effects. As with weak and strong verbs, lack of corpus materials makes it impossible to calculate accurate family size information. However, assuming that the distribution of Maltese verbal patterns mirrors other Arabic dialects, Theme 1 verbs are expected to have larger morphological families than Theme 2 verbs. In other words, all verbs that share a particular pattern are part of the same morphological family, and Theme 1 verbs are more common than Theme 2 verbs. Thus, verbs in Theme 1 should induce faster RTs to visually presented stimuli.

This hypothesis is supported by previous work in Maltese and Hebrew. Using auditory lexical decision tasks, Ussishkin and Twist (2006) found that a difference in verbal pattern affected recognition verbs in both languages. In the Maltese study, the difference in mean RTs for Theme 1 and Theme 2 verbs was inconclusive due to confounds caused by the auditory methodology. Originally, RTs were measured from the onset of the auditory stimuli. However, since Theme 2 verbal patterns differ from their Theme 1 counterparts by gemination of the medial consonant ($C_1VC_2C_2VC_3$ versus $C_1VC_2VC_3$), the difference in RTs between the two groups included the difference in stimulus length. For instance, the Theme 1 stimulus *dilek* had a length of 492ms, while its Theme 2 counterpart *dellek* was 571ms long. So any RTs measured from the stimulus onsets included both the difference in reaction to the stimuli and the 79ms difference in stimulus length. To eliminate this confound, RTs were also measured from the offset of

the stimuli. When measured this way, no difference was found in RT to the two types of stimuli.

In the related experiment on Hebrew, word length was not an issue, as the different verbal patterns are encoded by the vocalic segments used, not consonant gemination. Thus items from the pa'al binyan (analogous to Maltese Theme 1) like *gadal* were of comparable length with their pi'el binyan (analogous to Maltese Theme 2) counterparts, like *gidel*. In this experiment, RTs were faster in response to verbs in the pi'el binyan. Note that this is exactly the opposite of the effect that is predicted for Maltese. The discrepancy arises from the different presentation mode. Although larger morphological family size is predicted to be facilitatory for visual stimuli (de Jong et al., 2000; Moscoso del Prado Martin et al., 2005) show that the same factor is inhibitory for stimuli presented auditorily. It was expected that the shift to visual presentation of stimuli would show more clearly the effects of theme on RT than the auditory presentation.

2.3.3 Morphological overlap priming

On the basis of previous masked priming studies in Hebrew, it was expected that Maltese prime-target pairs with overlapping roots would induce facilitatory RTs with respect to the control condition of unrelated prime-target pairs. It was also anticipated that verbal patterns would facilitate RTs. No effect of priming was anticipated in non-words, as priming is related to lexical processes that act only on known words (Forster & Davis, 1984).

2.4 Methodology

2.4.1 Participants

Participants for the current study were recruited on the University of Malta campus and were mostly undergraduate students. Participants were pre-screened using a two-part instrument to measure their language competence and patterns of use (see Appendix A). The first part was an extensive language background survey to measure participants' patterns of language acquisition and daily use. The results of this survey provided information about which participants spoke languages in addition to English, including non-standard dialects of Maltese. It also asked speakers to estimate their use of Maltese relative to other languages. Since the lexical decision task described in this chapter is based on responses to written words, which are standard throughout the islands, participants were not excluded on the basis of dialect. The elicitation task outlined in Chapter 3 required spoken responses, and the language background information will figure into the analysis in that section.

The second part of the prescreening test was a short language proficiency instrument, including word selection and sentence completion tasks in addition to a short answer question designed to test participants' ability to write freely in standard Maltese. The participants all performed perfectly or nearly perfectly on this test, demonstrating their competence in comprehending and responding in standard Maltese.

Participants were 89 native Maltese speakers between the ages of 18 and 37 recruited on the University of Malta campus at Msida. Like most Maltese, all participants were English speakers, and two were native speakers of Italian as well. Two participants were

also fluent in the Gozitan dialect of Maltese. Three additional participants indicated that they were raised on and currently lived on Gozo, suggesting that they were Gozitan speakers, but they did not specifically indicate the variety of Maltese they usually speak. Participants received monetary compensation for their participation.

No exclusions were made based on the variety of Maltese or additional languages spoken by participants. All participants were familiar with reading in standard Maltese, and every effort was made to keep them focused on using Maltese throughout their participation in the experiment in order to avoid cross-language contamination. Verbal and written instructions for the experiment, as well as feedback for each response, were provided in Maltese.

2.4.2 Items

All test items conformed to regular verbal patterns of Maltese, as shown in Table 2.2. The basis of the test items were of two types: regular and weak verbs from the Semitic vocabulary stratum. Test items included four types of prime-target pair applied to each type, as illustrated below.

Table 2.2 Test item types for masked priming task

Verb type		**Identity**	**Root**	**Pattern**	**Unrelated**
Regular	***Prime:***	kiser 'to break'	nkisser 'to smash'	dilek 'to lick'	ftakar 'to remember'
	Target:	KISER	KISER	KISER	KISER
Weak	***Prime:***	beka 'to weep'	bekka 'to make cry'	lewa 'to bend'	nqara 'to be read'
	Target:	BEKA	BEKA	BEKA	BEKA

Items in the identity prime condition included identical prime-target pairs. Items in the root prime condition included primes and targets that contain identical roots and different patterns, while prime-target pairs in the pattern prime condition exhibited identical patterns and different roots. Unrelated pairs shared neither roots nor patterns. Whenever possible, the prime for the unrelated pair was formed using the root from the pattern prime condition and the pattern from the root prime condition. This strategy resulted in pairs with similar orthographic overlap across prime-target conditions. A complete list of experimental stimuli is provided in Appendix B.

Verbal patterns were matched on prosodic shape, not on vocalic melody. For instance, libbes~FARRAD was a prime-target pair matched on verbal pattern. The prosodic shape of CVCCVC was preserved between the prime and the target even though the identity of the vowels differs within the pair.

Target items had a mean length of five letters, with a standard deviation of 0.7. Since these items were all verbs of either Theme 1 or Theme 2, all weak verbs were either four or five letters in length, and all strong verbs were either five or six letters in length. Each orthographic symbol corresponds directly to one phoneme, so the mean number of phonemes in all targets was also five[3]. Prime items had an average length of 5.2 letters (5.4 for the root and unrelated prime conditions and 5.0 for the pattern prime condition), with a standard deviation of 0.8 (0.8 for the root and unrelated prime conditions and 0.7 for the pattern condition).

---

[3] The one exception to this one to one matching of letter to phoneme is the target item *nieda*, in which the *ie* digraph corresponds to a single phoneme /i:/.

In order to conform to the prime conditions listed, some items contained primes and targets of slightly different lengths. However, De Moor and Brysbaert (2000) showed that a one letter difference in length between primes and targets had no significant effect on priming in Dutch. Since Maltese uses an orthographic system similar to that of Dutch, it seems reasonable that this result would hold true for Maltese as well. When primes and targets of the same length could not be used, the items were constructed with a one letter difference between target and prime, with some items containing a longer prime and some a longer target, as illustrated below in Table 2.3[4].

Table 2.3 Length differences within prime-target pairs[5]

	Example	**Number of items (words/non-words)**
Same length	sewwa~TENNA	222 (126/96)
Prime one letter longer	tbatta~BATTA	202 (122/80)
Target one letter longer	raqad~RAQQAD	94 (35/59)

Each participant responded to a total of 176 items. Half of the prime-target pairs consisted of real word primes and real word targets, while the remaining 88 pairs were nonsense primes and targets. The nonsense items were composed of possible but nonexistent verbal roots and existing verbal patterns.

[4] A total of 8 prime-target non-word pairs were unavoidably mismatched in length by two letters. In all cases, the primes were two letters longer than the targets.

[5] This chart excludes prime-target pairs in the identity condition, as these pairs were by definition of identical length.

2.4.3 Task

The stimuli were presented on a computer screen in standard Maltese orthography using E-Prime software (Schneider, Eschman, & Zuccolotto, 2002). A forward mask of hash marks (####) was presented for 500 ms, immediately followed by the lower case prime. The prime was presented for 42 ms, after which it was replaced by the target in upper case. The purpose of the forward mask is to conceal the prime from the viewer's field of vision. It has the added effect of focusing the attention and vision of the participant on the area of the screen in which the stimuli will be presented. The prime duration of 42 ms was chosen to replicate the priming conditions presented in Deutsch et al. (1998). Furthermore, Boudelaa and Marslen-Wilson (2004) showed that primes with durations of 48 and 64 ms were more successful at uncovering morphological priming than those with durations of 32 or 80 ms. Specifically, priming patterns in verbs were best detected with a prime duration of 48 ms.

Participants indicated whether or not the target was a real word by pressing either a YES or NO button on a button box labeled in Maltese (IVA or LE, respectively). They were instructed to respond to the items as quickly as possible while maintaining accuracy. To assist in this process, participants were given immediate feedback on each item on the computer screen including their accuracy and response time in milliseconds. If participants failed to respond within in 2 seconds of the onset of the target, a "too slow" message appeared on screen in Maltese and the test jumped to the next item.

Native Maltese speaking researchers were employed to monitor the experiment. All instructions, task clarification, and feedback were provided in Maltese[6]. Items were sorted into four lists counterbalanced by prime condition, so that each participant responded to every target only once. Each list was arranged into 8 randomized blocks of twenty items, with an optional short break between blocks to allow the participant to relax before continuing. Each study began with a training block of 6 practice items that conformed to the test criteria but were not statistically evaluated. Each participant had an opportunity to ask for clarification about the task following completion of the practice block.

2.5 Statistical results

2.5.1 Data included in analysis

RT and accuracy were collected for each response and averaged across items for the by-subjects analyses and across participants for the by-items analyses. Of the 89 participants, 67 responded accurately to at least 80% of the items. Only these participants were included in the analysis. The accurate participants were split almost evenly between the four counterbalanced lists, with 17 participants each on three lists and only 16 participants on the last list.

In addition to excluding inaccurate participants, items which did not meet an accuracy threshold were also excluded. Targets that were responded to accurately 60%

---

[6] Eight participants received instructions and task clarification in English due to the temporary unavailability of Maltese speaking research assistants. On-screen feedback was provided in Maltese. The responses of these eight participants did not differ statistically from the responses of other participants.

of the time or better across all lists and that also had a 60% or better accuracy rate on each list were included in analysis. This criterion reduced the number of analyzed items from 160 to 132. The excluded targets were distributed randomly among target types - weak/strong, Theme I/Theme 2, and word/non-word.

Finally, RT outliers were excluded by the following method. For each participant, the mean and standard deviation of RTs were calculated. All RTs outside of two standard deviations of the mean were removed from analysis. This resulted in the exclusion of 3.9% of the data, leaving 8,504 responses to be analyzed.

2.5.2 Results

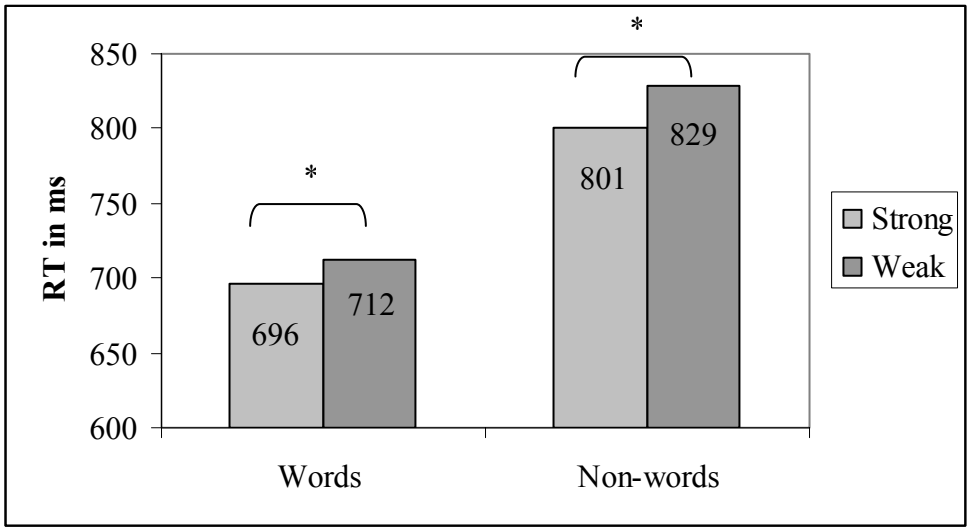
A series of analyses of variance (ANOVAs) was conducted on the RT and error data, including both by-subjects and by-items analyses. The 2-level factors of verb strength (strong/weak) and verbal theme (Theme 1/Theme 2) were within-subjects factors for all analyses. Prime condition was a 4-level factor (identity/root/pattern/unrelated) evaluated as a within-subjects factor in the by-subjects analyses and a between-items factor in the by-items analyses.

Counterbalanced list, a 4-level factor, was used as a between-subjects factor in the by-subjects analyses. However, the effects of the list variable are not reported below, as it was included only to ensure that the order of stimuli did not have an effect on responses. Since the task required participants to make a decision about each item's lexical status, it was expected that word and non-word items would elicit different behavior. Therefore, responses to the word and non-word items were analyzed

separately. A summary of important main effects and interactions is provided below. For a series of graphs depicting all data, refer to Appendix C.

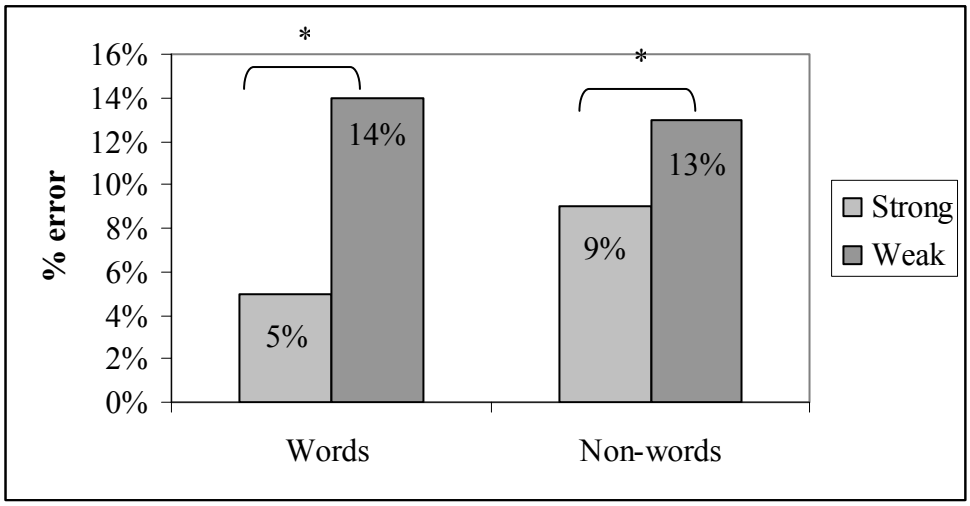
The main effect of verb strength was significant for word items in the by-subjects analysis ($F_1(1, 63) = 8.12$, $p < .01$) but not in the by-items analysis ($F_2(1, 74) = 2.36$, $p > .05$). However, for the non-word items, both analyses yielded significant results ($F_1(1, 63) = 21.34$, $p < .01$; $F_2(1, 68) = 4.51$, $p < .05$).

Table 2.4 Main effect of verb strength for words and non-words: Strong verbs elicited faster reaction times than weak verbs in both words and non-words. The * indicates a statistically significant difference.



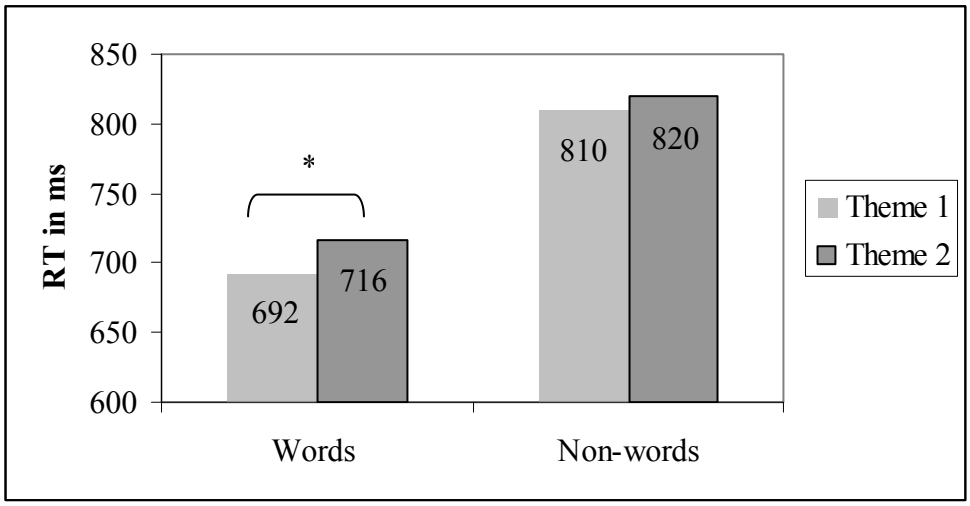
The main effect of verb strength on errors was significant for word items ($F_1(1, 63) = 57.37$, $p < .01$; $F_2(1, 74) = 11.61$, $p < .01$) and for non-word items in the by-subjects analysis ($F_1(1, 63) = 8.40$, $p < .01$) but not by-items ($F_2(1, 68) = 2.82$, $p > .05$).

Table 2.5 Main effect of verb strength on errors for words and non-words: Strong verbs elicited fewer errors than weak verbs in words and non-words. The * indicates a statistically significant difference.



The effect of verbal theme was significant for words in the by-subjects analysis ($F_1(1, 63) = 19.81$, $p < .01$) but not in the by-items analysis ($F_2(1, 74) = 3.25$, $p > .05$). For non-word items, neither the by-subjects or by-items analyses yielded a significant result ($F_1(1, 63) = 3.29$, $p > .05$); $F_2 < 1$). Error rates did not show a significant effect of verbal theme in words ($F_1 < 1$; $F_2(1, 74) = 1.65$, $p > .05$) or in non-words ($F_1 < 1$; $F_2 < 1$).

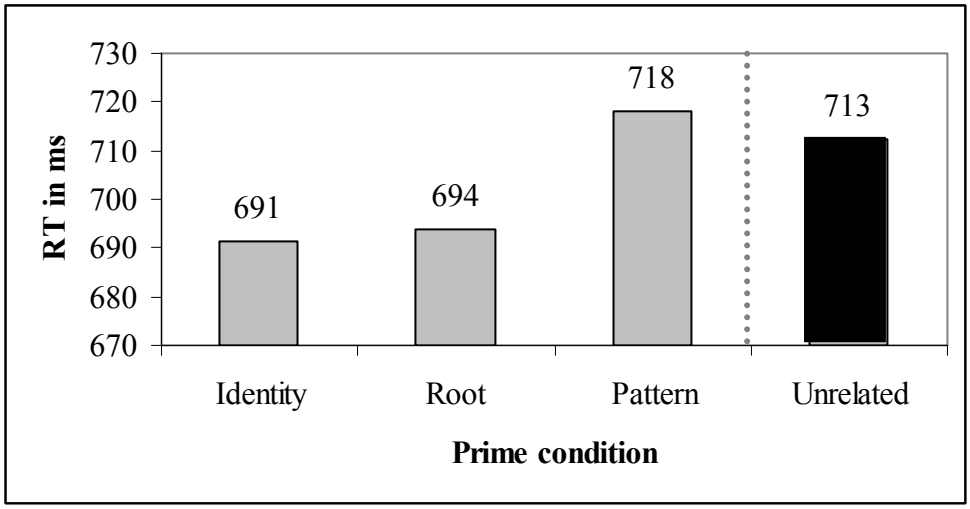
Table 2.6 Main effect of verbal theme on RTs for words and non-words: RTs were faster for Theme 1 verbs in words and non-words. The * indicates a statistically significant difference.



The main effect of prime condition was, as anticipated, significant for word items ($F_1(3, 189) = 6.00$, $p < .05$; $F_2(3, 222) = 6.07$, $p < .01$). For non-word items, also as expected, prime condition was not a significant factor ($F_1(3, 189) = 2.01$, $p > .05$; $F_2 < 1$). No main effect of prime condition on error rates was shown for words ($F_1 < 1$; $F_2 < 1$) or non-words ($F_1(3, 189)$ 1.42, $p > .05$; $F_2(3, 204) = 1.52$, $p > .05$).

As anticipated and shown below, the factor of prime condition affected RTs to real word stimuli. Planned comparisons contrasted RTs for words averaged across verb strength and verbal theme. RTs in the identity, root, and pattern conditions were compared to those in the unrelated control condition.

Table 2.7 Priming results: Words in the identity and root prime conditions showed a facilitatory effect relative to the control unrelated prime condition. Responses to words in the pattern prime condition were not statistically different from those in the control condition.



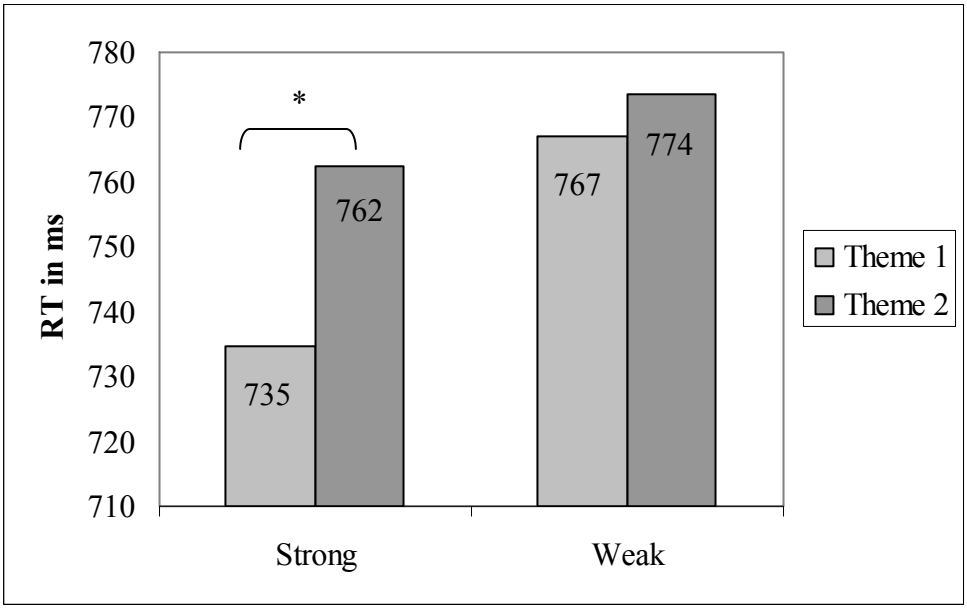
Compared to the control condition of unrelated primes, identity primes showed a facilitatory effect of 22 ms by-subjects ($F_1(1,66) = 7.84$, $p < .01$) and 26 ms in the by-items analysis ($F_2(1, 77) = 6.60$, $p < .05$). Additionally, root primes facilitated RTs by 19 ms in the by-subjects analysis ($F_1(1,66) = 4.67$, $p < .05$) and a similar difference in means (25 ms) was significant in the by-items analysis ($F_2(1, 77) = 7.79$, $p < .01$). Pattern primes did not provide any significant priming effects in either the by-subject or by-items analyses ($F_1 < 1$; $F_2 < 1$). In addition, the identity prime condition was compared to the root prime condition. The difference in RTs between these conditions was not statistically significant ($F_1 < 1$; $F_2 < 1$).

The 3-way interaction of verb strength, verbal theme, and prime condition was not significant in by-subjects or by-items analyses for word items ($F_1(3, 189 = 1.19$, $p < .05$; $F_2(3, 222) = 1.17$, $p > .05$) or non-word items ($F_1 < 1$; $F_2(3, 204) = 1.55$, $p > .05$).

Analyses of errors also revealed no three way interaction for either words ($F_1(3, 189) = 1.86$, $p > .05$; $F_2 < 1$) or non-words ($F_1(3, 189) = 2.71$, $p = .05$; $F_2 < 1$), though the by-subjects results are marginal.

The 2-way interaction between verb strength and verbal theme was significant for word items in the by-subjects analysis ($F_1(1, 63) = 21.32$, $p < .01$) but not in the by-items analysis ($F_2(1, 74) = 1.69$, $p > .05$). There was no significant interaction of these factors for non-words ($F_1 < 1$; $F_2 < 1$). A graph of the interaction between verb strength and verbal theme for words, collapsed across prime conditions, is shown below.

Table 2.8 Interaction of verb strength and verbal theme for words collapsed across prime conditions: RTs to Theme 1 verbs were slightly faster than RTs to Theme 2 verbs in both strong and weak conditions, though the difference is larger for strong verbs. The * indicates a statistically significant difference.



It appears that Theme 1 verbs elicited shorter RTs than Theme 2 verbs in both strong and weak verbs. However, the graph indicates that the difference between themes was

larger for strong verbs. Using verbal theme as the only independent variable, by-subjects ANOVAs were conducted on both strong and weak verbs, averaging RTs across conditions. There was a significant difference between RTs to verbs of different themes for strong verbs ($F_1(1, 132) = 4.97$, $p < .05$) but not for weak verbs ($F_1 < 1$). There was no significant interaction of verb strength and verbal theme with regard to errors for either words ($F_1 < 1$; $F_2 < 1$) or non-words ($F_1 < 1$; $F_2 < 1$).

The 2-way interaction between verb strength and prime condition was not significant for words ($F_1 < 1$; $F_2 < 1$) or non-words ($F_1(3, 189) = 1.21$, $p > .05$; $F_2(3, 204) = 1.36$, $p > .05$). Error rates did not significantly differ for words ($F_1 < 1$; $F_2 < 1$) or non-words ($F_1 < 1$; $F_2 < 1$) either.

The 2-way interaction between verbal theme and prime condition was not significant for word items ($F_1 < 1$; $F_2 < 1$). There was also no significant interaction of these factors for non-words ($F_1 < 1$; $F_2 < 1$). Finally, there was no interaction of verbal theme and prime condition with respect to errors for words ($F_1(3, 189) = 1.55$, $p > .05$; $F_2(3, 222) = 1.47$, $p > .05$) or for non-words ($F_1(3, 189) = 1.30$, $p > .05$; $F_2 < 1$).

2.6 Discussion

The results from this experiment largely supported the initial hypotheses, which anticipated that prime-target pairs that shared consonantal roots would exhibit facilitatory priming. Verbal patterns were also expected to show a priming effect. Although the main focus of the study was on priming effects, differences were detected in overall RTs to different themes and verb strength categories. RTs were faster for strong verbs as

opposed to weak verbs, and strong verbs also elicited fewer errors. RTs were faster for Theme 1 verbs, which are more frequently occurring than Theme 2 verbs.

The main effects of both verb strength and verbal theme on RTs were consistent for word and non-word items, suggesting that something about the structure of strong verbs and Theme 1 verbs makes them easier to process than weak or Theme 2 verbs, respectively. Although Frost et al. (2000) and Sumner (2003) reported differences in the priming behavior of strong and weak verbs, there are no published experiments that compare RTs to these categories absent the effects of priming. However, Frost et al. reported that the insertion of random consonants into the missing consonant slot of weak verbs made those verbs more susceptible to priming effects. They conclude that restoring the prosodic shape of the word made the verbal pattern more readily available for processing. If verb processing is facilitated by adherence to expected word shape, it may be that CVCVC is the most anticipated form. Any deviation from this shape, such as deleting a consonant in weak verbs (CVCV) or adding a consonant in Theme 2 verbs (CVCCVC) would hinder lexical decision.

Concerning morphological overlap priming, responses to target verbs were facilitated by primes that shared only the consonantal root, as expected. This suggests that the consonantal root bears psychological salience, as predicted by previous studies on languages with similar morphologies. In fact, root primes facilitated RTs just as much as identity primes, indicating a strong effect.

However, responses to verbal pattern primes were not any faster than those to the control condition. This result contradicted the expectation of a facilitatory effect of

pattern primes. Since the difference in mean RTs between the pattern prime condition and the control was only 5ms and this result was not statistically significant, no firm conclusions can be drawn about the inhibitory effect of patterns on priming. On the other hand, these results clearly do not indicate any facilititory effect of verbal patterns either.

The fact that consonantal roots show a priming effect bolsters earlier findings in Arabic and Hebrew that have shown similar effects. Prunet et al. (2000) provided evidence for the status of the consonantal root in the errors of an aphasic bilingual speaker of Arabic and French. They observe that the patient makes metathesis errors 25 times more often in Arabic than in French. In addition, the Arabic errors affect only root consonants, not affixal consonants. Examples of metathesis errors from the study are given below.

Table 2.9 Examples of metathesis errors in Arabic involving only root consonants (Prunet et al., 2000)

Target	**Output**	**Target gloss**
fuqaṛ-aaʔ	fuṛaq-aaʔ	poor people
ta-waqquf	ta-qawwuf	stopping
lawħ-a	waħl-a	picture, painting
ma-sbaħ	ma-ħbas	swimming pool

It is important to note that the patient produced the same type of metathesis errors in a variety of tasks, including those that required spoken responses instead of written output.

A variety of experimental tasks have provided evidence for the consonantal root in Hebrew. In addition to the numerous priming studies discussed in Section 2.3, Berent and Shimron (1997) demonstrate that Hebrew speakers attend to root consonants when judging the acceptability of non-words. Non-words formed with root-initial gemination are substantially dispreferred over those with root-final gemination, which is allowed in the structure of Hebrew. Non-words formed with no gemination in the root consonants are the most preferred type. Speaker preferences for root type were consistent regardless of the placement of the root within the non-word. In other words, the addition of affixes to move the root consonants from the edge of the non-word had no effect on speakers' attitudes towards gemination. Frisch and Zawaydeh (2001) showed compatible results in Jordanian Arabic.

An advantage of performing the same type of visual masked priming study in Maltese as has been carried out in Hebrew is the replication of results in a language that uses a different orthography. Hebrew script is a consonant-based system that does not typically encode vowels. Readers must use their knowledge of vocabulary and context to disambiguate words written with the same characters. This leaves open the possibility that readers attend more to the characters that are written, i.e. the consonants, than the hidden vowel segments. Maltese, however, uses the Roman alphabet spelled in a phonetically consistent manner, so readers have equal visual input for each segment. Furthermore, this study utilized lower case letters for primes and upper case letters for target stimuli, thus eliminating any physical overlap between the two. In Hebrew there is no case distinction, so primes and targets always overlap in form.

Based on priming studies in Hebrew and Modern Standard Arabic, it was hypothesized that prime-target pairs that shared only a verbal pattern would exhibit facilitatory priming in Maltese. However, this was not the case. Responses to items in the pattern prime condition were similar to responses to those in the control condition. The premise that consonantal roots function as units that are central to lexical access suggests that morphological decomposition is taking place. If this is the case, it would be reasonable to expect word patterns to act as independent units of lexical organization. The lack of verbal pattern priming effects contradicts this expectation. A similar lack of priming was reported in Frost et al. (1997) for nouns in Hebrew. Their conclusion was that nominal patterns, though morphologically significant, do not play a role in the organization of the lexicon, or at least not a large enough role to be detectable in experiments.

One possible reason for the discrepancy in the behavior of pattern priming is the construction of stimuli. In the present study, target items were either of the Theme 1 or Theme 2 pattern. In both the Hebrew and MSA studies, a wider range of patterns was used in the target stimuli. For instance, Deutsch et al. (1998) used five different verbal patterns in their stimuli, and Boudelaa and Marslen-Wilson (2004) used eight. Furthermore, because the target item patterns were restricted, the patterns of the primes were also restricted in order to keep the word length of prime-target pairs as similar as possible. Participants may have been conditioned to expect one of only two similar patterns in the stimuli, making the effect of this factor negligible. In Semitic languages other than Maltese, the writing system may unduly favor consonants, but word length is

easier to control. Maltese orthography weights consonants and vowels the same, but the trade-off is that verbal patterns affect the length of written words more substantially.

Though the interpretation of the lack of effect of verbal pattern is difficult, consonantal roots show a distinct priming effect, giving more weight to an analysis of Semitic languages that includes the consonantal root as a psychological and morphological unit that influences lexical processing. This result bolsters claims about the status of the consonantal root made on the basis of research in related languages. Importantly, the Maltese case provides evidence for the consonantal root that is not biased by a consonantal writing system. Chapter 3 describes an experiment that expands on the nature of the structure of Maltese verbs.

CHAPTER 3: ELICITATION OF NOVEL VERBS

This chapter describes the results of an elicitation experiment designed to measure the relative productivity of two verb formation strategies in Maltese. Maltese generally exhibits non-concatenative root and pattern morphology in its verbal system. However, many verbs borrowed from other languages are incorporated into the language using a concatenative suffix. In this experiment, participants were asked to create novel verbs based on noun-like nonce stimuli. The forms of the novel verbs were analyzed to determine which word formation strategy is favored.

3.1 Loan verb formation in Semitic languages

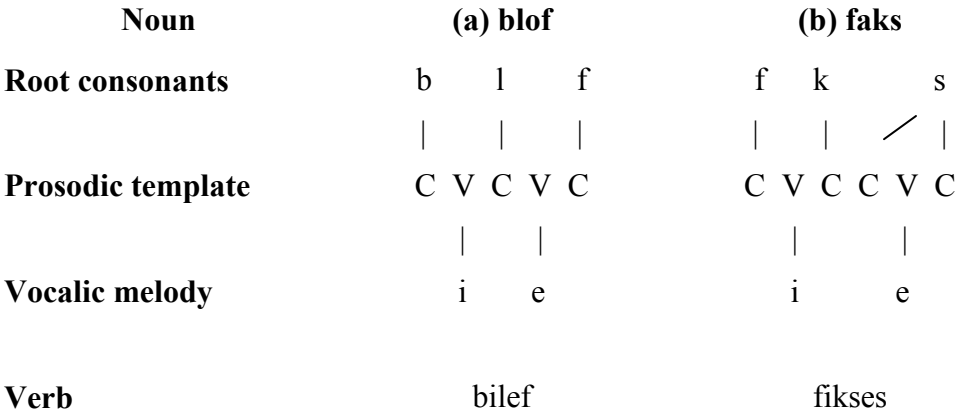
As discussed in Chapter 1, Semitic languages are generally resistant to borrowing from non-Semitic languages because the disparate morphological systems are difficult to reconcile. Maltese is unique among its relatives in its facility for borrowing verbs from non-Semitic languages. Most Semitic languages allow the borrowing of verbs only through intermediate forms of nouns or, less commonly, adjectives. In other words, verbs may not be borrowed directly from other languages but may be formed from previously borrowed nouns. From these forms, denominal verbs are formed using standard verbal patterns. This process is illustrated below in examples from Modern Hebrew.

Table 3.1 Denominal verb formation in Modern Hebrew (from Bat-El, 1994 and Ussishkin, 1999)

Source Word	Noun	Denominal verb	Gloss
a) bluff	blof	bilef	to bluff
b) facsimile	faks	fikses	to send a fax
c) flirt	flirt	flirtet	to flirt
d) nostalgia	nostalgia	nistelg	to be nostalgic
e) transfer	transfer	trinsfer	to transfer
f) striptease	streptiz	striptez	to perform a striptease

In examples (a) and (b), the root consonants of the nominal forms fit neatly into the regular verbal templates of CiCeC and CiCCeC, both of which are in the pi'el verbal class. These examples, therefore, can be accounted for by Root to Template Association (McCarthy, 1981). Under this approach, the consonantal root of the noun form is extracted and mapped onto an existing verbal template that includes both vocalic identity and prosodic shape tiers. Finally, the contents of the separate tiers are collapsed into a single linear string by way of Tier Conflation (McCarthy, 1986; Younes, 1983). The entire process is illustrated below.

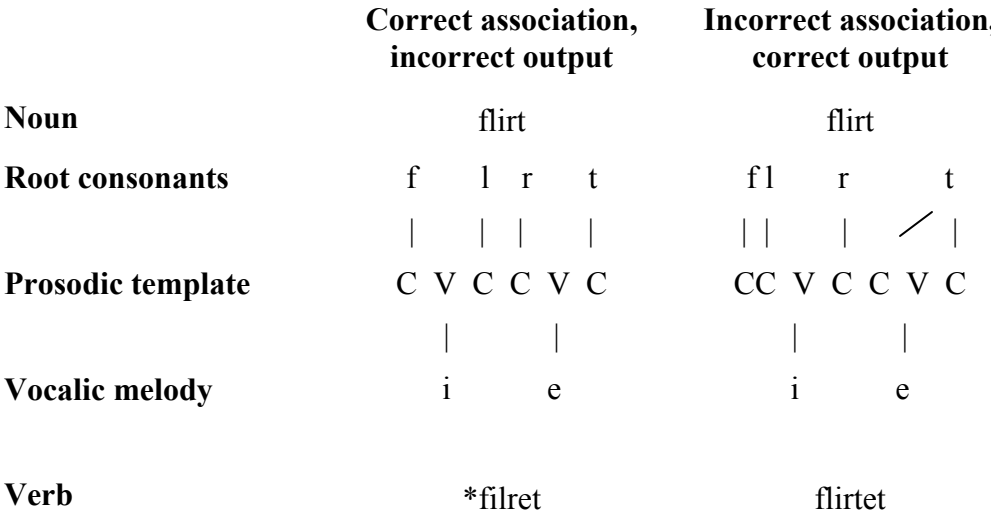
Figure 3.1 Illustration of root extraction in Hebrew



The first example, [blof] → [bilef], shows the dissolution of a consonant cluster in order to fulfill the prosodic template. The example of [fikses], however, preserves the medial consonant cluster in favor of spreading the final consonant to fill two positions in the template. According to McCarthy (1981), the phonological segments are mapped to the prosodic template from left to right in a one-to-one correspondence. If elements of the prosodic template are left unfilled once the correspondence is complete, spreading will occur. Bat-El (1994) argues that cluster preservation is the norm and edge-in syllabification accounts for the dissolution of some word-initial clusters.

Examples (c) through (f) above all exhibit unexpected consonant clusters that are carried over into the verbal forms, disrupting the verbal template. Nevertheless, the vocalic pattern remains constant and bisyllabicity is maintained in all the verbal forms. These words pose a problem for the Root to Template Association approach, as the retention of the consonant clusters defies one-to-one correspondence, as shown below.

Figure 3.2 Illustration of cluster retention in Hebrew



If the root consonants were inserted into the prosodic template one at a time, the result would be *[filret]. Under this approach, in order for the correct output to surface, a different template must be assumed. However, assuming different templates for each possible combination of retained consonant clusters undermines the efficiency and predictability of the root and pattern approach. Also, the fact that all the borrowed forms shown above fall into the same verbal class supports a more unified approach. As discussed in Chapter 1, Bat-El (1994, 2003) and Ussishkin (1999) have challenged the root and pattern approach to denominal verb formation based on verbs like those shown above that retain consonant clusters. They favor an approach to verbal morphology that does not rely on a consonantal root, but on the adaptation of a contiguous stem to a bisyllabic template. The prosodic shape of the output, i.e. whether or not it allows for clusters, is a product of the stem, not of any specific binyan.

3.2 Loan verbs in Maltese

Under either the root extraction or stem modification approach, the examples from Hebrew illustrate the use of non-concatenative morphology to incorporate loan verbs into the native system. While Maltese allows for this type of borrowing, it also provides a different strategy. Specifically, Maltese facilitates the borrowing process by allowing verbs to take on a particular suffix and subsequent declension pattern instead of forcing them to conform to regular verbal patterns. Although loan verbs of both types, root-extracted and suffixed, occur in Maltese, the way in which foreign verbs have been integrated into Maltese has shifted over time. The origin of loan verbs in each group reflects the changing contact situation in Malta. The archipelago's proximity to Italy, coupled with heavy political and economic ties from the 1500s through the 1800s, resulted in many verbs being borrowed from Italian and Sicilian dialects. As the political climate on Malta shifted during the 1800s and 1900s, more and more linguistic influence was felt from English. At some time during this era, loan verbs formed with suffixes started to surface. Suffixed forms are considered the most productive current loan verb integration strategy.

Mifsud (1995) identified 4 groups of loan verbs, characterized by the language group from which they were borrowed and the timeframe of original borrowing. The table below describes these groups, organized from the oldest type of loans to the most recent.

Table 3.2 Loan verb types (Mifsud, 1995)

Group	Example	Origin
1: Romance verbs following strong verb patterns	pitter	Italian *pitt-ore* 'to paint'
2: Romance verbs following weak verb patterns	falla	Italian *fall-ire* 'to fail'
3: Romance verbs that take suffixes	(ip)pretenda	Italian *pretend-ere* 'to claim'
4: English verbs that take suffixes	(ip)parkja	English *park*

In Groups 1 and 2, there are loans that conform to Semitic patterns of non-concatenative morphology. Consonantal roots were extracted from the original Romance forms. Existing verbal patterns interleave with these roots, regularizing the use of the new verbs in non-concatenative morphology. The process of consonantal extraction seen in Groups 1 and 2 is typical of loan word behavior in other dialects of Arabic, including the preference for regularizing newly extracted roots using Theme 2, as in Algerian, Egyptian, and Saudi Arabic (Mifsud, 1995).

Group 1 follows the Theme 2 verbal pattern for strong verbs, which are those verbs that do not contain glides as part of the consonantal root. Theme 2 can be recognized by a medial geminate consonant. Note that in Group 1, consonants from the verb stem and affix are both incorporated into the borrowed verb. Group 2 exhibits the Theme 2 pattern that applies to weak verbs. As discussed in Chapter 1, native weak verbs in Maltese contain a glide in the root that disappears in the surface form. However, borrowings that

follow weak verb patterns do not necessarily contain any weak segments. Mifsud (1995) attributed the use of weak verb patterns to a gradual extension of syllabic pattern matching from the source language. For instance, in the example given above, the verb stem *fall-* was easily adapted to the weak verb pattern CvCCv without disruption to the contiguity of stem segments. This level of analysis would require a higher level of familiarity with the source language to determine which segments are part of the verb stem and which are affixal material, since the example for the Group 1 loan verbs could also have been analyzed this way.

The second two groups of loan verbs identified by Mifsud include verbs that were borrowed as intact verb stems from both Romance and English languages. Due to their varying shape, these verbs do not necessarily conform to typical verbal themes, and other strategies for derivation and inflection ensue, as discussed below. Although the formation of verbs from intact stems is not restricted to loan words with consonant clusters, it does allow loan words to maintain their clusters as they are nativized. Verbs borrowed from Romance languages, classified as Group 3, exhibit suffixation of *-a*. English origin loans found in Group 4 are suffixed with *-ja*, originally analogous to the Sicilian verb ending *-iare*. These suffixes result in a class of loan verbs that are all *-a* final. The following NSM verbs show the consistency of loan verb endings.

Table 3.3 Examples of *-a* and *-ja* NSM verb endings

Italian origin	
a) at͡ʃt͡ʃɛtt-a	'to accept'
b) obd-a	'to obey'
c) jɪzvɪlʊpp-a	'to develop'
English origin	
d) assɛss-ja	'to assess'
e) ɪppark-ja	'to park'
f) var-ja	'to diversify'

3.2.1 Inflectional endings

SM has *-a* final verbs, but the inflectional paradigms for SM *-a* final verbs and NSM *-a* final verbs differs slightly. SM Theme 1 *-a* final verbs all retain their *-a* endings in the singular masculine perfect, singular imperfective and singular imperative forms. Inflectional endings in all other cases are of two types, *-ejt* and *-ajt*, classified by the endings in the first person singular imperfective. Borġ (1978) attributes the paradigm split to the historical origin of the verbs. Those that can be traced to Old Arabic roots ending in a voiceless pharyngeal fricative [ħ], replaced by [h] or deleted in Maltese, take the *-ajt* series of endings. Those verbs that contained a final glide [w, j] or glottal stop [ʔ] use the *-ejt* series of endings[1]. The *-ejt* ending verbs are further split into two types

[1] Hoberman and Aronoff (2003) state that the verb endings are dependent on the quality of the non-final vowel, with back vowels triggering -ajt endings and verbs with high vowels taking -ejt endings. The data given here that seem to contradict this are from Borġ (1978).

depending on the endings appearing in the imperfect and imperative forms, the *-ejt/-i* paradigm or the *-ejt/-a* paradigm. The full paradigms for SM Theme 1 *-a* final verbs are shown below in Table 3.4.

Table 3.4 Examples of SM Theme 1 paradigms (from Borġ, 1978; Hoberman & Aronoff, 2003)

	qela 'to fry' -ejt/-i	nesa 'to forget' -ejt/-a	tefa 'to throw' -ajt
Perfect			
1st singular	qlejt	nsejt	tfajt
2nd singular	qlejt	nsejt	tfajt
3rd singular masc.	qela	nesa	tefa
3rd singular fem.	qliit	nsiet	tefat
1st plural	qejna	nsejna	tfajna
2nd plural	qlejtu	nsejtu	tfajtu
3rd plural	qleew	nsew	tefaw
Imperfect			
1st singular	naqli	ninsa	nitfa
2nd singular	taqli	tinsa	titfa
3rd singular masc.	jaqli	jinsa	jitfa
3rd singular fem.	taqli	tinsa	titfa
1st plural	naqlu	ninsew	nitfa
2nd plural	taqlu	tinsew	titfaw
3rd plural	jaqlu	jinsew	jitfaw
Imperative			
Singular	aqli	insa	itfa
Plural	aqlu	insew	itfaw

NSM verbs are limited in the paradigms they can display. RM verbs may belong to the *-ajt* or the *-ejt/-i* paradigm. All EM verbs belong to the *-ajt* paradigm. Examples of NSM verb paradigms are shown in Table 3.5.

Table 3.5 NSM verb Theme 1 paradigms follow SM patterns with restrictions (Borġ & Azzopardi-Alexander, 1997)

	Romance origin		English origin
	serva ‘to serve’ -ejt/-i	vinċa ‘to overcome’ -ejt/-a	ibbukja ‘to book’ -ajt
Perfect			
1st singular	servejt	vinċejt	ibbukjajt
2nd singular	servejt	vinċejt	ibbukjajt
3rd singular masc.	serva	vinċa	ibbukja
3rd singular fem.	serviet	vinċiet	ibbukjat
1st plural	servejna	vinċejna	ibbukjajna
2nd plural	servejtu	vinċejtu	ibbukjajtu
3rd plural	servew	vinċew	ibbukjajaw
Imperfect			
1st singular	inservi	invinċi	nibbukja
2nd singular	isservi	tvinċi	tibbukja
3rd singular masc.	iservi	ivinċi	jibbukja
3rd singular fem.	isservi	tvinċi	tibbukja
1st plural	inservu	invinċu	nibbukjaw
2nd plural	isservu	tvinċu	tibbukjaw
3rd plural	iservu	ivinċu	jibbukjaw
Imperative			
Singular	servi	vinċi	ibbukja
Plural	servu	vinċu	ibbukjaw

3.2.2 Initial gemination

In addition to predictable suffixation, NSM loan verbs beginning in a consonant display gemination of the initial consonant whenever phonotactically possible (Borġ, 1997; Hoberman & Aronoff, 2003; Mifsud, 1995). In the case that the borrowed verb has a single initial consonant, as in (a) below, that consonant is doubled in Maltese. If the borrowed verb begins with a consonant-sonorant cluster (b), the initial consonant is also

doubled. Consonants in sibilant-initial clusters (c) and complex clusters (d) do not exhibit gemination.

Table 3.6 Initial consonant gemination in verbs borrowed from English

Verb	Gloss
a) iffilmja	to film
b) iddrillja	to drill
c) storja	to store
d) skrinja	to screen

Borġ (1978) points out that initial consonant gemination is common among southern Italian and Sicilian dialects, whence many borrowed verbs entered Maltese. However, in those dialects, the doubled consonants are present in all word classes, while Maltese geminates initial consonants only in borrowed verbs. Some examples are given below of RM verbs that exhibit initial gemination while their noun or adjective counterparts do not.

Table 3.7 Examples of initial gemination in RM verbs and counterparts without gemination (Hoberman & Aronoff, 2003)

Noun or adjective		Verb	
a) dilettant	'amateur'	e) iddiletta	'to have a hobby'
b) differenti	'different'	f) iddifferixxa	'to differ'
c) divrenzja	'difference'	g) iddivrenzja	'to discriminate against'
d) sensja	'discharge from a job'	h) issensja	'to discharge from work'

Since initial gemination in loan words is confined to verbs, Hoberman and Aronoff (2003) argued that this feature operates as a general marker for loan verbs, much like suffixation. There is no reason to expect loans to be set apart from native vocabulary in any systematic way, but the fact that Maltese borrowed both gemination and suffixation from sources that exhibit both features resulted in these features being associated with loans by analogy. This view is supported by the fact that the process of initial gemination has been extended to verbs borrowed from source languages that do not show gemination at all, as shown by the following examples of verbs borrowed from English.

Table 3.8 Examples of initial gemination in EM verbs and counterparts without gemination (Aquilina, 1959)

Noun or adjective		**Verb**	
a) glejz	'glaze'	e) igglejzja	'to glaze'
b) lanċa	'launch, small boat'	f) illanċja	'to launch'
c) riskju	'risk'	g) irriskja	'to risk'
d) gass	'gas'	h) iggassja	'to gas'

3.3 Hypotheses about the productivity of borrowing strategies

The experiment described in this chapter was designed to determine the morphological productivity of the two possible verb formation strategies: root and pattern on the one hand, and suffixation on the other. In order to mimic the process of borrowing foreign words, speakers created novel words in response to nonce stimuli. If root and pattern morphology is not productive in Maltese, all novel verbs would be expected to be formed by way of *-ja* suffixation. If root and pattern morphology is a productive word

formation strategy in the language, it would be expected that responses to some significant portion of the non-word items would conform to the licit Semitic verbal patterns outlined in Chapter 1.

Morphological productivity is the combination of two related factors (Bauer, 2004). Availability determines whether or not a particular process can be used to form new words. Profitability refers to the extent to which the process is actively used. Baayen (1989, 1991, 1992) has proposed statistical calculations of productivity based on measuring profitability in corpora. Since there is no readily available corpus for Maltese, it is not yet possible to utilize this type of model. However, the suffixation strategy is so prevalent in modern Maltese that Hoberman and Aronoff (2003) were prompted to speculate that root and pattern morphology is no longer productive in Maltese. They argued that the lack of adherence to templatic constraints in borrowed verbs indicates that non-concatenative morphology is not actively functioning in Maltese, suggesting that the profitability of root and pattern morphology is low or non-existent.

A weaker position on the status of non-concatenative morphology was taken by Stolz (2003), who classified Maltese as a type of mixed language with two available morphological systems. This approach puts more weight on availability of production than profitability, so that the mere fact that it is possible to use a particular strategy contributes to its productivity, even if it is seldom used. Under this approach, the fact that Maltese exhibits little or no verb borrowing with root extraction is less important than whether or not this is a potential strategy available to native speakers. However, until now, lack of empirical data on the availability of verb formation strategies in

Maltese made it impossible to support or refute either the position that root and pattern morphology is unavailable or that it is unprofitable.

3.4 Methodology

3.4.1 Participants

Recruitment and screening procedures for this experiment were the same as for the masked priming experiment described in Section 2.5. Participants were 49 native Maltese speakers between the ages of 18 and 37 recruited on the University of Malta campus at Msida. Like most Maltese, all participants were native English speakers, and two were also native speakers of Italian. Two participants were fluent in the Gozitan dialect of Maltese. Three additional participants indicated that they were raised on and currently lived on Gozo, suggesting that they were Gozitan speakers as well, but they did not specifically indicate the variety of Maltese they usually speak. Participants received monetary compensation for their participation.

As in the masked priming experiment, no exclusions were made based on the variety of Maltese or additional languages spoken by participants. Bilingualism in Malta and the possible effects of dialectal variance are discussed at length in the following chapter. All participants were familiar with reading in standard Maltese, and every effort was made to keep them focused on using Maltese throughout their participation in the experiment in order to avoid cross-language contamination. Verbal and written instructions for the experiment were provided solely in Maltese.

3.4.2 Items

A total of 160 items were presented to participants, a complete list of which is provided in Appendix D. Half of the items were real nouns of Maltese, and half were possible but unattested nonce forms. The nonce forms were constructed as described below to resemble real nouns. Both the words and non-words were split into two groups, one representing words of Semitic origin, the other words of English origin. The term *origin* is applied to both words and non-words in this study, though technically the non-words have no origin at all. The classification of non-words was determined by a number of structural properties that influenced their construction, as outlined below.

Based on a random selection of real SM and EM nouns, prosodic templates were constructed. A list of 7,600 non-attested 3 consonant roots was generated, and each nonce form modeled on a SM noun was assigned one of these roots. For instance, the non-attested root <*x s n*> was mapped onto the prosodic template for the real word *toqba* 'a hole' to yield *xVsnV*. For the nonce forms modeled on EM nouns, consonant clusters were chosen to mirror the sonority sequencing of their real word counterparts. Single consonant positions were then filled randomly. A non-word modeled on the real word *drill* "drill", contained the consonant cluster *br* and a random consonant to fill out the prosodic shape, resulting in *brVff*. Vocalic sequences were then assigned to each nonce form in a random manner. From this initial list, adjustments were made to ensure that each item obeyed Maltese phonotactics. Examples of each stimulus type are shown below.

Table 3.9 Examples of test item categories

	Real Words	**Non-words**
Semitic origin	toqba "a hole" felliek "bad steering"	xesna paffien
English origin	spid "speed" drill "drill"	klid braff

Within each stimulus origin group, the items were divided equally into two sets: more acceptable and less acceptable. These divisions were based on the general prosodic structure and segmental inventory of each item and verified by native speakers. Prosodic structure was determined by the pattern of consonants and vowels as modeled by experimental stimuli. For instance, some Semitic origin stimuli had a shape of $C_1VC_2C_2VC_3$, a structure never encountered in English origin stimuli. English origin stimuli also contained some structures, including $C_1C_2VC_3C_3$, not present in the Semitic origin stimuli. Some structures were present in both types of stimuli. A list of prosodic shapes found in the stimuli, categorized by stimulus origin, is given below.

Table 3.10 Prosodic shapes of nonce stimuli

Semitic	**English**	**Both**
$C_1VC_2.C_2VC_3$	$C_1C_2VC_3C_3$	$C_1VC_2.C_3V$
$C_1C_2V.C_3V$	$C_1VC_2C_3$	$C_1C_2VC_3$
$tC_1VC_2.C_2VC_3$	$C_1VC_2C_2$	$C_1V.C_2VC_3$
$tVC_1.C_2VC_3$	$C_1C_2C_3VC_4$	
	$C_1VC_2.C_3VC_4$	

English origin words with prosodic shapes not found in Semitic origin stimuli were considered less acceptable as words of Maltese. Borġ and Azzopardi-Alexander's (1997) list of preferred syllable types in Maltese supports this distinction. Their classification states that Maltese favors symmetrical syllables, in which the number of consonantal segments in the onset is equal to that in the coda. If a syllable contains an uneven number of consonants, clusters are less preferred in coda position.[2] The following table outlines the rate of occurrence of each syllable type in the nonce stimuli.

Table 3.11 Number of occurrences of preferred syllable shapes in nonce stimuli

	Maltese stimuli	**Both**	**English stimuli**
CV	1	2	0
CVC	5	2	2
CCV	1	0	0
CCVC	1	1	0
CCVCC	0	0	1
CCCVCC	0	0	0
CVCC[3]	0	0	2
CCCVC[4]	0	0	1

Only the four most ideal syllable shapes are found in the nonce stimuli of Semitic origin. The English origin nonce stimuli contain less preferred syllable shapes, along

[2] Syllable initial clusters occur infrequently in Modern Standard and Cairene Arabic. However, Bahraini Arabic, along with other northern and eastern Arabian dialects, contains many instances of syllable initial clusters (Holes, 1995).

[3] This syllable pattern is not listed in Borġ and Azzopardi-Alexander, and is therefore placed at the bottom of the hierarchy as least preferred.

[4] See note 3 above.

with some preferred syllable shapes, as some of the nonce English origin forms shared the prosodic shape of nonce Semitic origin forms.

In addition to prosodic shape, the segmental inventory of nonce items was crucial in determining their relative acceptability. The voiceless labial segments [v] and [p] do not occur in any Maltese words of Semitic origin. Thus their appearance in unfamiliar words is a clear indication of foreign origin. The voiceless affricate [t͡ʃ] (ċ in Maltese orthography), also suggests foreign origin, though this segment does appear in some native words in which it corresponds to Arabic [d͡ʒ] or [ʃ] (Aquilina, 1959). The content of consonant clusters was another factor in determining the acceptability of nonce forms. As described in Section 3.4.4.1, Maltese obstruents exhibit word-final devoicing and regressive voicing assimilation word internally. Though Maltese is orthographically shallow, these voicing constraints are not always indicated through spelling. However, in reviewing nonce forms, native speaker consultants generally found medial consonant clusters more acceptable if they were spelled in a manner that explicitly indicated similar voicing status. That is, though the nonce forms *ladga* and *latga* would have the same pronunciation ([ladga]), the first spelling, which includes letters that correspond to two adjacent voiced segments, is judged to be more acceptable.

The acceptability of each stimulus was based on a combination of these factors. Though the stimuli fell on a continuum of highly acceptable to not very acceptable, the items were divided into only two groups for each stimulus origin type. Examples from each stimulus group are shown below.

Table 3.12 Examples of more acceptable and less acceptable non-words

Origin	More acceptable	Less acceptable
Semitic	xesna tirqil	paffien leċda
English	qarr tamdi	relk frim

3.4.3 Task

Native Maltese-speaking researchers were employed to monitor the experiment. All instructions, task clarification, and feedback were provided to participants in Maltese. Items were arranged into eight randomized blocks of twenty items, with an optional short break between blocks to allow the participant to relax before continuing. Each study began with a training block of 6 practice items that conformed to the test criteria but were not statistically evaluated. Each participant had an opportunity to ask for clarification about the task following completion of the practice block.

Each item was presented on a computer screen in standard Maltese orthography using E-Prime software (Schneider et al., 2002). Participants were instructed to respond verbally to each item, naming a verb associated with the item. For the non-word items, participants were instructed to create a novel verb. An English translation of the Maltese on-screen instructions is provided below.

Figure 3.3 Instructions for elicitation experiment (English translation)

A word will be shown on the screen. Some of the words are nouns, and others are made up nouns. When you see a noun, say an associated verb. If it is a made up noun, make up a verb that matches.

The researcher repeated these instructions verbally and gave examples of stimulus-response pairs. Each participant heard the same four examples. The researcher gave two real word examples first, encouraging the participant to provide an appropriate answer. If the participant was not able to provide an answer, the researcher demonstrated the process. For example, for the noun *felliek* 'bad steering', an appropriate response would be [fɛllɛk*]*, meaning 'to steer the plough or rudder of a ship badly'. Since appropriate responses to non-words were also non-words, this was the most difficult part of the task to explain. Therefore, two non-word examples were also provided, and participants were prompted to respond with an appropriate nonsense verb. There were no restrictions placed on the form of the verb itself, either in terms of verbal theme or inflection for person or number. A detailed account of acceptable responses is given in the next section.

3.4.4 Data preparation

Participants' verbal responses were transcribed by two researchers, one a native Maltese speaker and the other the present author, a linguist familiar with the structure of the language. After all responses were transcribed by both researchers, differences were resolved by consensus. For instance, if the transcribers disagreed on the voicing status of an obstruent, they listened to the item again together in an attempt to resolve the discrepancy. In the event that the researchers could not reach a consensus, another native speaker of Maltese was asked to make a judgement. If the third researcher was unsure, the response was not considered for analysis. Successfully transcribed responses were then coded on a number of dimensions for analysis.

Responses were first coded for lexicality. Responses to real words were expected to be real words themselves, and responses to non-words were expected to be non-words. The real word responses were further divided into verb/non-verb categories. This distinction was necessary to ensure that participants performed the task correctly.

Each response was evaluated to determine how it differed from its corresponding stimulus. A response was considered valid if it contained the same consonants in the same order in which they appeared in the stimulus. Alteration, deletion, insertion, or metathesis of consonants was not considered admissible, except in the cases of voicing alternations, affix alteration, or gemination alternations. The acceptability of these deviations is explained below.

3.4.4.1 Voicing alternations

Voicing alternations were allowed without restriction. According to Aquilina (1959) and Borġ and Azzopardi-Alexander (1997), Maltese exhibits obligatory word final obstruent devoicing, shown in examples (a)-(e) below. Additionally, as in examples (f)-(g), regressive voicing assimilation of obstruents is observed within words.

Table 3.13 Word-final obstruent devoicing and medial voicing assimilation

Maltese orthography	Pronunciation	Gloss
a) kelb	kɛlp	dog (masc.)
b) ħobż	hops	bread
c) tond	tont	round
d) gdid	d͡ʒɪt	new
e) lablab	lablap	talkative
f) xibka	ʃɪpka	net
g) libsa	lɪpsa	dress

These phonotactic rules are not reflected in the otherwise transparent Maltese orthography, so allowances were made for the reinterpretation of the voicing status of obstruents. Since the stimuli were presented visually, many speakers devoiced final obstruents in their verbal responses, even though the segments were written as voiced letters. Additionally, some of the non-word stimuli contained adjacent graphemes that were mismatched in voicing, and speakers tended to correct the mismatch in their responses. These predictable phonological alternations have no effect on morphological structure and so were tolerated as acceptable. Examples of both word-final devoicing and word-internal voicing assimilation are shown below.

Table 3.14 Examples of responses with voicing alternations

	Stimulus (Maltese orthography)	**Stimulus (IPA)**	**Response (IPA)**	**Gloss**
Words	a) gidba	gɪdba	gɪdɛp	to lie, tell an untruth
	b) tidrib	tɪdrɪp	tɪdrɪp	to strike, hit with a weapon
Non-words	c) fondi	fondi	fannat	
	d) leċda	lɛt͡ʃda	ɪllɛd͡ʒda	

In examples (a) through (c), the responses all reflect final devoicing of a segment that is written with a letter that typically represents a voiced segment. In example (b), this segment would be pronounced voiceless even in the stimulus, since it occurs at the end of the word. In example (a), however, the *b* in *gidba* is read as voiced, but when the corresponding verb [gɪdɛp] is produced, the final obstruent must be devoiced. The same alternation occurs in example (c). Example (d) shows a case of word internal voicing agreement. In both the stimulus and the response, the segments in the medial cluster must match in voicing. The regressive nature of voicing assimilation in Maltese dictates that the voicing status of the cluster will match that of the final consonant, not the initial one.

Participants were not restricted as to the conjugation, aspect, or verbal theme of their verbal responses. Therefore some responses contained prefixes and/or suffixes apart from the verb stem. Responses were not penalized for extra consonantal material in these affixed positions. Examples of common verbal prefixes are listed below.

Table 3.15 Common verbal prefixes

Prefix	Present in verbal patterns	Example
t-	V, VI, QII	tkisser 'it got smashed'
in-	VII	inkiser 'it got broken'
st-	X	stenbah 'he awoke'

For real words, affixes attached to responses had to result in the formation of a real word. Since only a few of the 11 verbal themes are available to each verb root, there was a limited set of prefixes available to each item. For instance, in response to the noun *gidba*, related verbs are available in Themes I, II, IV, V and VI. Thus responses with the prefixes *t-* or *in-* were acceptable, but a response prefixed with the Theme X prefix *st-* would result in a non-word, which would not be acceptable.

3.4.4.2 Affix alterations

Some of the stimulus items, both words and non-words alike, began with letters that some speakers analyzed as affixal material. Aquilina (1959) lists 15 participial patterns that are prefixed with *m-*. Borġ and Azzopardi-Alexander (1997) list *m-* prefixation as a sign of three types of meaning, including the name of a place where an activity is carried out or a tool with which the activity is accomplished and abstract nouns. They also list another nominal prefix *t-*, which occurs in the nominal forms of integrated loans formed from verbs. Examples of each of these patterns are listed below.

Table 3.16 Prefixed nominal forms (from Borġ and Azzopardi-Alexander 1997)

Prefix	Noun	Gloss	Related verb	Gloss
m-	maħżen	store	ħażen	he stored
m-	moqdief	oar	qadef	he rowed
m-	maħfra	forgiveness	ħafer	he forgave
t-	tisrip	zigzagging	serrep	he zigzagged
t-	tbandil	swinging	bandal	he swung

Since verbs related to nouns with these prefixes are not themselves prefixed, these sequences were sometimes stripped, resulting in the deletion of a consonantal segment. Though these changes affected the shape of the responses, the processes at work were morphologically predictable, and these responses were considered acceptable with or without the initial segment. Examples of acceptable responses are shown below. There were no responses to non-word stimuli beginning with *m-* that were otherwise acceptably formed, so no examples are given in this category.

Table 3.17 Acceptable responses with stripped nominal prefixes

	Stimulus (Maltese orthography)	**Stimulus (IPA)**	**Response (IPA)**	**Gloss**
Words	mqata	mˤʔata	ʔata maʔʔat	to cut to treat someone harshly
	tgerrim	dgɛrrɪm	gɛrrɛm dgɛrrɛm	to gnaw, to gnaw away to gnaw, to gnaw away
Non-words	tirqil	tɪrʔɪl	rɛʔɛl tɛrʔɛl	
	tilgen	tɪlgɛn	ligɛn tɛlgɛn	

Maltese verbs are inflected for person, number, and aspect by way of concatenative affixes. Since participants were not restricted in regard to the inflection of their responses, allowances were made to accommodate inflectional affixes as well. A sample inflectional paradigm is shown below for a real word of Maltese.

Table 3.18 Inflectional affixes allowed in elicitation responses

	żelaq **he slipped**	**Affix(es)**
Perfect		
1st singular	żlaqt	-t
2nd singular	żlaqt	-t
3rd singular masc.	żelaq	Ø
3rd singular fem.	żelqet	-t
1st plural	żlaqna	-na
2nd plural	żlaqtu	-tu
3rd plural	żelqu	-u
Imperfect		
1st singular	niżloq	ni-
2nd singular	tiżloq	ti-
3rd singular masc.	jiżloq	ji-
3rd singular fem.	tiżloq	ti-
1st plural	niżolqu	ni-u
2nd plural	tiżolqu	ti-u
3rd plural	jiżolqu	ji-u
Imperative		
Singular	iżloq	i-
Plural	iżolqu	i-u

Any well-formed inflectional affix or combination of multiple affixes was allowable in response to both real words and non-word stimuli. Some examples of acceptable responses including inflectional affixes are given below.

Table 3.19 Examples of responses with affixal alterations

	Stimulus (Maltese orthography)	Stimulus (IPA)	Response (IPA)	Gloss
Words	a) fellus	fɛllus	infɛllɛs	to insert a wedge
	b) rokna	rokna	rɛkkɛn	to pile up, amass
	c) blaff	blaff	ibblaffjajna	to bluff
	d) ċans	t͡ʃans	nit͡ʃt͡ʃansja	to take a chance
Non-words	e) barm	barm	barmjajt	
	f) rdis	rdɪs	jordos	
	g) britt	brɪtt	brittjajt	
	h) skrit	skrɪt	tɪskrɪtja	

3.4.4.3 Gemination alternations

Gemination and degemination were also acceptable processes. In order to conform to some verbal templates, certain segments are lengthened or shortened. As long as the resulting response contained at least one occurrence of each consonantal segment in the correct order, gemination and degemination were not penalized. Some acceptable responses exhibiting gemination and degemination are shown below.

Table 3.20 Examples of responses with gemination alternation

	Stimulus (Maltese orthography)	Stimulus (IPA)	Response (IPA)	Gloss
Words	a) mqata	mˌʔata	maʔʔat	to treat someone harshly
	b) ħaddiem	hadim	hadɛm	to work, to exert oneself
Non-words	c) mirx	mɪrʃ	mɛrrɛʃ	
	d) draxx	draʃʃ	daraʃ	

Consonant gemination at the beginning of a response was coded separately and not cause for exclusion from analysis. These cases are discussed in a later section.

3.5 Statistical results

The responses to words and non-words in the elicitation experiment were analyzed separately. Responding to words required participants to retrieve existing words from the lexicon. Responding to non-words, on the other hand, entailed building entirely new lexical items using novel stimuli as input. Since these two tasks required different cognitive and linguistic processes and result in distinct classes of responses (words and non-words), any comparison between the two groups would be difficult to interpret.

Analyses of variance were conducted to determine the effect of verb origin and item acceptability on the dependent variable of *-ja* suffixation. Verb origin was a 2-level within-subjects factor for by-subjects analyses and a between-items factor for by-items analyses. Analyses of non-word responses included an additional 2-level factor of item

acceptability. This factor was also a within-subjects factor for by-subjects analyses and a between-items factor for by-items analyses. Further analysis was conducted on responses to non-words to capture the relationship between initial gemination and *-ja* suffixation. The following sections review the results of the elicitation experiment, examining first responses to words, then responses to non-word stimuli.

3.5.1 Data included in analysis

The verbal responses of each participant were recorded and coded for *-ja* suffixation and initial gemination as previously described. Of the 49 participants recorded, 36 of them responded accurately to at least 50 (62.5%) real word stimuli. The responses of the remaining 13 participants were not used in the analyses.

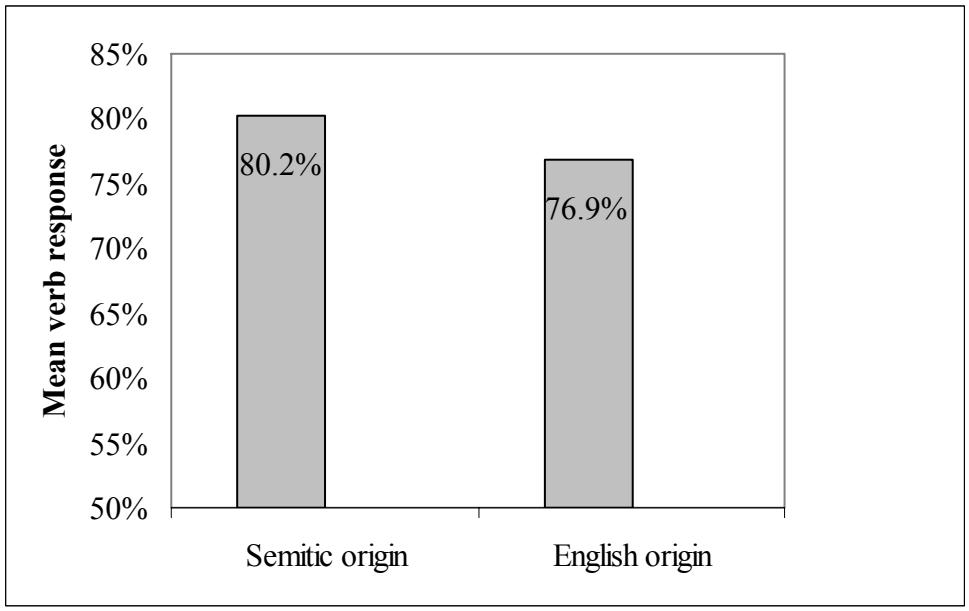
Additionally, some items in each group failed to elicit enough appropriate responses to analyze. Items for which less than 30 of the responses were valid based on the criteria outlined in the previous section were discarded. This left a total of 37 items in each word condition and the English non-word condition and 23 items in the Semitic non-word condition.

3.5.2 Results of -ja suffixation

Due to the complicated nature of the task, the first step in data analysis was to establish that participants were able to perform the task accurately with real word stimuli. Therefore, an ANOVA was conducted on responses to real words only to determine if participants were as accurate for Semitic verbs as for English verbs. The dependent factor in this analysis was real verb responses, and the single independent factor was verb

origin, either Semitic or English. The results show that there was no significant difference in the number of acceptable responses to stimuli of different origins in either by-subjects or by-items analyses ($F_1 < 1$; $F_2 < 1$). These results show that participants were able to understand and perform the task with precision.

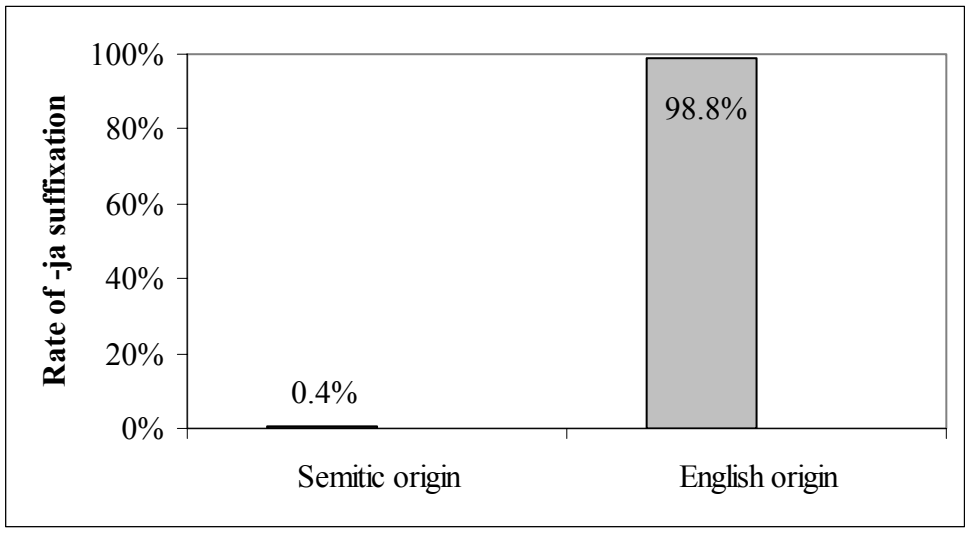
Table 3.21 Mean verb response to real words by stimulus origin: Participants responded accurately to words of Semitic and English origin at similar rates.



The next step was to determine the extent to which *-ja* suffixing was used in response to real words of both Semitic and English origin. An ANOVA was conducted on real words with *-ja* suffixing as the dependent factor, and verb origin as the sole independent factor. There was a significant difference in the use of the *-ja* suffix in the

by-items analysis ($F_2(1, 65)=318.83$, $p<.01$)[5]. These results indicate that nouns of Semitic origin prompted regularly formed Semitic verbs, and English origin nouns prompted suffixed verbs, as shown below.

Table 3.22 Use of *-ja* suffixation in response to real words by stimulus origin: Participants responded to Semitic origin nouns with unsuffixed verbs and to English origin nouns with suffixed verbs.



Almost all Semitic origin words elicited verbs without the *-ja* suffix. The few that contained the suffix could be attributed to participant error. Likewise, a few responses to English origin words did not make use of the *-ja* suffix. While some of this may be attributed to participant error, data organization might have also had an effect on this category of stimuli. One source of non-suffixed responses to English origin verbs came from responses that fit all coding criteria without being related to the original stimulus. For instance, valid responses to the English origin word [garraʃ] 'garage' include

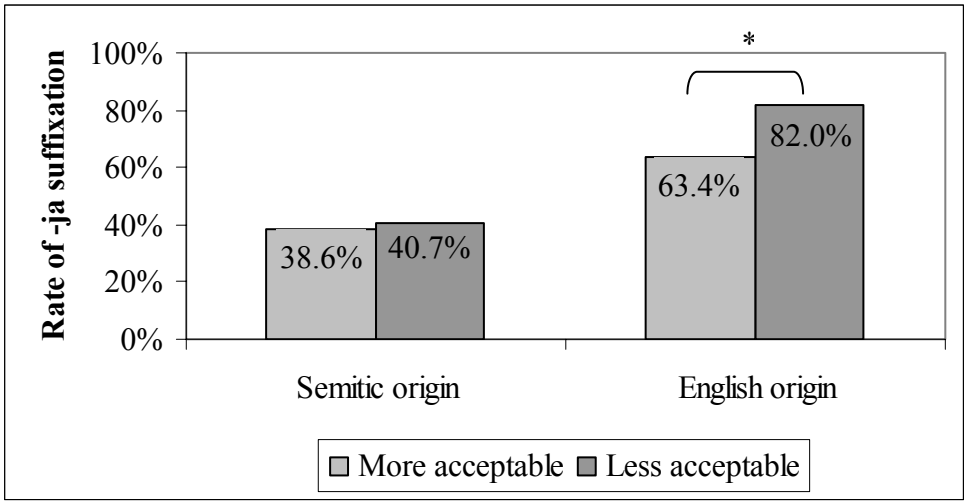
[5] In a by-subjects analysis of the same data, the two groups (responses to verbs of Semitic and English origin) contained so little variability that the results of an ANOVA ($F_1(1, 35) = 67{,}670.69$, $p<.0001$) were impossible to interpret.

[dgɛrrɛʃ] ‘to be scared away’ (Semitic origin). Since the consonants of the stimulus are preserved in the correct order in the response and the [d-] is a licit prefix as a variant of [t-], this response was coded as valid.

Having determined that participants were able to successfully negotiate the task and use *-ja* suffixing only for real words of foreign origin, the responses to non-words were analyzed. An ANOVA was conducted on non-words only with *-ja* suffixing as the dependent factor, and word origin and acceptability as the independent factors. The interaction of word origin and acceptability was not significant in by-subjects ($F_1(1, 34) = 1.22$, $p < .05$) or by-items ($F_2(1, 56) = 1.63$, $p > .05$) analyses. The main effect of stimulus origin was significant in both by-subjects ($F_1(1, 34) = 92.31$, $p < .01$) and by-items ($F_2(1, 56) = 26.34$, $p < .01$) analyses.

The main effect of item acceptability was significant in the by-subjects analysis ($F_1(1, 34) = 13.36$, $p < .01$) but not in the by-items analysis ($F_2(1, 56) = 2.58$, $p > .05$). Further analysis revealed that the effect of item acceptability differed according to the stimulus origin. For non-words modeled after Semitic words, the effect of item acceptability was not significant in by-subjects ($F_1(1, 34) = 2.10$, $p > .05$) or by-items ($F_2 < 1$) analyses. However, for English origin non-words, both by-subjects ($F_1(1, 35) = 32.94$, $p < .01$) and by-items ($F_2(1, 34) = 7.38$, $p < .02$) analyses yielded significant results. Less acceptable items elicited more *-ja* suffixation than more acceptable items, as shown below.

Table 3.23 Difference in *-ja* suffixation in response to non-words: Responses to non-words of Semitic origin were less likely to elicit *-ja* suffixation, but the rate of suffixation did not differ significantly according to the acceptability of the stimulus. Responses to English origin non-words elicited different levels of *-ja* suffixation depending on the relative acceptability of the stimulus. Less acceptable stimuli prompted more *-ja* suffixation than more acceptable stimuli. The * indicates a statistically significant difference.

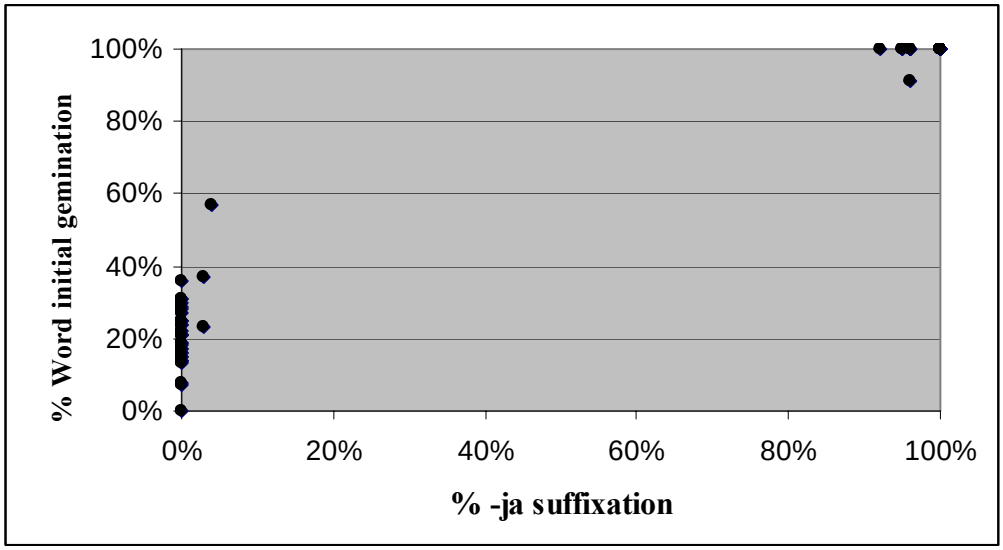


3.5.3 Results of initial gemination

As outlined in Section 3.2, non-Semitic Maltese (NSM) loan verbs typically display gemination of an initial single consonant or first consonant of a consonant-sonorant cluster. Word initial gemination is not characteristic of Semitic Maltese (SM) verbal patterns. Therefore, it was expected that this type of gemination would correlate with *-ja* suffixation in responses to nonce forms. In other words, responses formed with *-ja* suffixation would be expected to conform to all aspects of loan word phonology, including initial gemination. Those responses formed by way of Semitic verbal patterns would not be expected to exhibit this trait.

In fact, word initial gemination is highly correlated with *-ja* suffixation in responses to both real word and nonce forms, as shown below.

Table 3.24 Correlation between word initial gemination and *-ja* suffixation



A Pearson correlation was run on initial gemination and *-ja* suffixation on responses to both real words and nonce forms. For real words, a strong positive correlation was found between initial gemination and *-ja* suffixation in both by-subjects ($r=.98$, $p<.01$) and by-items ($r=.88$, $p<.01$) analyses. Strong positive correlations were also found for responses to nonce forms in both by-subjects ($r=.78$, $p<.01$) and by-items ($r=.88$, $p<.01$) analyses. These results confirm that the word formation strategy of *-ja* suffixation is related to the lengthening of word initial consonants.

3.6 Discussion

The results presented above show that two morphological systems are available to Maltese speakers to form new words. The selection of a particular strategy is partially, but not completely, dependent on linguistic structure. For instance, *-ja* suffixation was a

productive verb formation strategy, even for some items that could have been formed according to regular Semitic verbal morphology. However, the results also indicate that regular Semitic verbal morphology is still productive and favored for items that are perceived as Semitic in origin. The use of *-ja* suffixation was preferred for items that are perceived as foreign in origin. The less an item resembled a Semitic word, the more likely it was to be targeted for *-ja* suffixation. The results show that *-ja* suffixed items were also much more likely to exhibit word initial gemination than those items that conformed to Semitic verbal patterns.

Based on this evidence, it is clear that factors other than word structure have influenced the shape of borrowed verbs in Maltese. If only linguistic structure were at play, many fewer borrowed verbs would be suffixed. Foreign borrowings would be expected to use *-ja* suffixation only if the target item contained noticeably marked phonetic segments, such as [p] or [v], unexpected consonant clusters, or prosodic shapes dispreferred in Maltese. Under these conditions, words like those shown below would be expected to follow regular root and pattern morphology. Instead, all of these borrowings exhibit verbs with the *-ja* suffix. In the data elicited, however, the unattested regular forms shown below are all produced by at least one speaker. Other unsuffixed, non-word forms of these items were sometimes produced as well. The incorrect responses illustrate variation in cluster retention similar to that described for Hebrew earlier in this chapter.

Table 3.25 Examples of loans expected to exhibit root and pattern morphology

Noun	Existing loan verb	Non-word response (# in data)	Gloss
a) ċans	ɪt͡ʃt͡ʃansja	*t͡ʃannas (1)	to risk
b) faks	ɪffaksja	*fɪkkɛs (3)	to fax
c) film	ɪffɪlmja	*fɪllɛm (1)	to film
d) pikit	ɪppɪkɪtja	*pɪkkɛt (1)[6]	to picket
e) ċekk	ɪċċɛkkja	*t͡ʃɛkkɛk (1)	to check
f) trikk	ɪttrɪkkja	*trɛkkɛk (2)	to trick
g) ġamm	ɪd͡ʒd͡ʒammja	*d͡ʒammɛm (4)	to jam
h) ħajk	ɪhhajkja	*hajjɛk (4)	to hike
i) skrin	skrɪnja	*skrɛjjɛn (2)	to screen
j) spid	ɪsspɪdja	*spɛjjɛt (2)	to speed
k) flowt	ɪfflowtja	*flowwɛt (1)	to float
l) klejm	ɪkklɛjmja	*klɛjjɛm (10)	to claim

The verbs above are shown in three groupings based on the strategy needed to form the listed non-words. In (a) through (d), the non-words were formed by the gemination of the second consonant. This pattern may result in the dissolution of consonant clusters, even when the clusters are licit in Maltese. No non-word responses of the type *[t͡ʃansas] or *[fɪksɛs] were recorded. These data show a preference for adopting a Theme 2 $C_1VC_2C_2VC_3$ word structure, as is typical in other related dialects, including Egyptian, Algerian, and Saudi Arabic. (Mifsud, 1995).

[6] This response was also produced without gemination 4 times.

The data in the second group, shown in (e) through (g), begin with items that exhibit a final geminate consonant. These items all form non-words by repeating the geminate consonant at the end of the word. Critically, this strategy is employed even when additional consonants are present in the word to fill out a pattern with four consonants without further repetition. For instance, in the case of (f), no non-words of the shape *[tɛrrɛk] or *[tɛrkɛk] were recorded.

In the last group of data, all the items contain either a glide (reflected in the orthography) or a long high front vowel. These items form non-words by using a geminate glide as the central consonant cluster. As in the case of repeating the geminate consonant above, this strategy is employed even when other consonants in the word could be used to fill out a pattern. For instance, instead of *[spɛjjɛt] in (j), speakers never produced *[sɛppɛt] or *[sɛpjɛt].

These data show the availability of root and pattern morphology as a productive verb formation strategy in Maltese, in direct opposition to Hoberman and Aronoff's (2003) claim to the contrary. In some instances speakers chose this strategy even in response to real word stimuli with established loan verbs formed with concatenative suffixation. Responses to the nonce stimuli indicate that root and pattern morphology is a profitable strategy in an experimental context devoid of influences beyond word structure, such as semantics or social context.

Although root and pattern morphology is available to Maltese speakers, a second verb formation strategy, *-ja* suffixation, is also productive. In order to decide which strategy to use to form new words, speakers must consider structural factors such as

prosodic shape and phonological segments. However, these factors alone are not sufficient to explain all of the variation exhibited by the participants in this study. The next chapter investigates some sociolinguistic factors that may influence the profitability of root and pattern morphology in commonly spoken Maltese.

CHAPTER 4: INDIVIDUAL SPEAKER VARIATION

Chapter 3 outlined an elicitation experiment that showed that the variation in the morphology of loan verbs in Maltese cannot be explained by structural factors alone. Therefore, it is reasonable to expect that interlinguistic influence by way of contact with Indo-European languages is responsible for the concatenative properties of loan verbs. This chapter explores the connection between the results of the elicitation experiment and the sociolinguistic backgrounds of the participants.

4.1 Language background questionnaire

All participants in the masked priming and elicitation experiments completed a two part language questionnaire, included in its entirety in Appendix A. The first part of the questionnaire asked participants to describe and assess how frequently they use Maltese, English, and other languages. The questions covered language use in the home, at school, at work, and abroad. The second part of the questionnaire included two short grammar exercises and a writing task.

The grammar portion of the questionnaire was designed to serve two purposes. First, the questions served as a screening instrument to ensure that all participants performed adequately in reading, writing, and comprehending written Maltese. The exercises required participants to complete sentences with semantically and grammatically appropriate words, form nominal plurals, and write a few sentences on a topic of their choice.

The language usage portion of the questionnaire asked participants to rate themselves in their abilities to read, write, speak, and understand Maltese, English, and any other

languages they used. They were asked to quantify how often they use each language in daily activities as well. Participants provided information about their personal language use in the schools they attended as a child, in the home, at school, in the workplace, and while traveling abroad. Lastly, participants listed the language(s) in which they habitually watch television and read newspapers and magazines. Each participant's answers to this series of questions formed a profile that shows which language is preferred in a variety of social situations.

4.2 Overall statistics of questionnaire

A series of statistical correlations was conducted on the questionnaire data to determine if any of the factors considered had influence on each other. Five factors were included in a two-tailed Pearson correlation on questionnaire responses only. Five factors represented the percentage of Maltese that participants reported using when a) interacting on a daily basis (% Interaction), b) attending primary school (% Primary), c) attending secondary school (% Secondary), d) reading newspapers and magazines (% Reading), and e) watching television (% TV). These factors were all continuous variables ranging from 0 to 100 percent.

There were a number of statistically significant correlations, as summarized in the table below. The percentage of Maltese spoken in secondary school was correlated with the percentage of Maltese spoken in primary school ($r=.79$, $p<.01$). The overall percentage of Maltese spoken was correlated with the amount of Maltese spoken in primary school ($r=-.38$, $p<.03$). The percentage of Maltese used for reading was correlated with the use of Maltese in secondary school ($r=.35$, $p<.01$). The percentage of

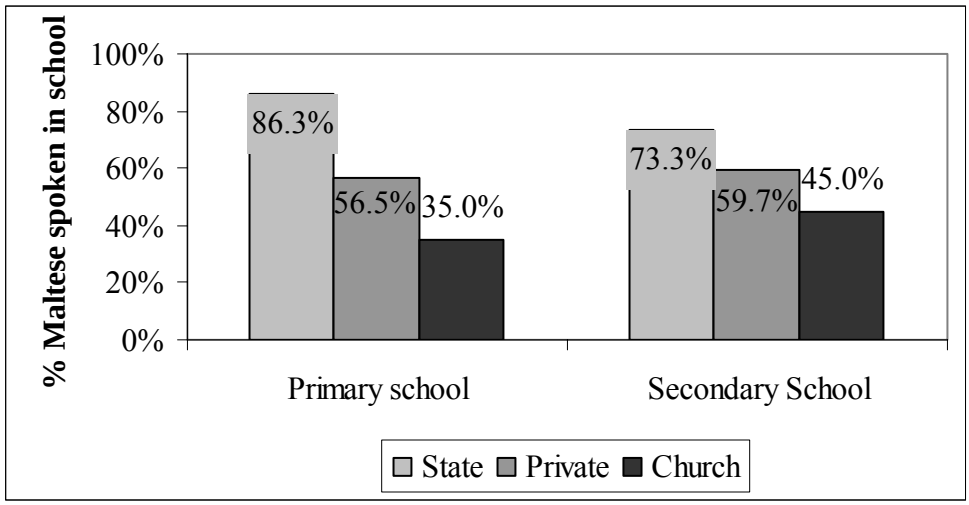
Maltese used for watching television was correlated with the amount of Maltese used in both levels of schooling (primary school: r=-.48, p<.01, secondary school: r=-.45, p<.01). The percentage of television watched in Maltese was also correlated to the percentage of reading in Maltese (r=.53, p<.01).

Table 4.1 Summary of significant correlations on questionnaire data

% Primary and % Secondary	r = .79, p < .01
% Interaction and % Primary	r = .38, p < .03
% Secondary and % Reading	r = .35, p < .05
% TV and % Primary	r = .48, p < .01
% TV and % Secondary	r = .45, p < .01
% TV and % Reading	r = .53, p < .01

The rates of Maltese spoken in primary and secondary school reflected the type of school participants attended. The structure of the Maltese educational system includes state, church, and private schools at both the primary and secondary level. ANOVAs were conducted using the percentage Maltese spoken at school as the dependent factor and the type of school as the single independent factor. For primary schools, the difference in the rate of Maltese spoken by school type was significant ($F_1(2, 31) = 9.64$, $p < .01$). For secondary school, the difference was not significant ($F_1(2, 31) < 1.7$). However, the graphs for both levels of schooling look similar, indicating that the relationship between school type and language use is similar for primary and secondary school.

Table 4.2 Difference in rates of Maltese language use among school types



The relationship between the percentage of Maltese spoken at each type of school was predictable. It is widely known that one important way in which the types of schools differ is in the emphasis placed on the learning and use of English. Private schools put a high value on the use of English, and state schools typically minimize English use. Church schools are more variable in their language emphasis, and it is difficult to draw a generalization about the group as a whole, but they tend to emphasize English more than Maltese. Knowing already that most students remain in the same type of school through primary and secondary education, it is not surprising that the language emphasis in school is reflected in aspects of their daily language use.

Both church and private schools operate on limited enrollment systems, while state schools are open to all. Once accepted at a particular school, students tend to remain at that school until they have completed the final grade. Their chances of acceptance at a church or private secondary school are better if they have attended a non-state primary school. Therefore, students typically attend the same type of school through primary and

secondary school. Of the participants in this study, 79% of those who attended state primary schools also attended state secondary schools. A slightly higher percentage (82%) of those who attended church primary schools stayed in church schools for their secondary education. However, students who attended private primary schools were almost equally as likely to stay in private secondary schools (38%) as they were to attend state secondary schools (50%).

It is also important to note that parents may choose to send their children to a particular type of school due to the language emphasis. Those parents who place a high value on English, for instance, might be more inclined to send their children to private school. It is not unreasonable to expect that these parents would place a high value on the use of English in the home as well, thus making it difficult to discern the direction of influence. In other words, it may be that the language use of the parents influences the selected school type as much as the school type influences the student's language use. The questionnaire did not ask for any information about the language use of the participants' parents.

Since language use in school is related to overall language use, it makes sense that it is also correlated to the percentage of reading done in Maltese. However, since these correlations account for only part of the variation in choice of reading language, there must be other factors that affect the language of reading choice. One possible influence is the availability of reading materials. There are seven regularly published newspapers written in Maltese. The Nationalist Party publishes a daily paper, *In-Nazzjon*, and a weekly, *Il-Mument*. The daily *L-Orizzont* and weekly *It-Torca* are run by the General

Worker's Union (Labour Party). Other Maltese papers include *Lehen is-Sewwa*, *Il-Kullħadd*, and *L-Antenna*. In contrast, some newspapers are available in English. The daily publications *The Malta Independent* and *The Times of Malta* (including *The Sunday Times of Malta*) along with *Malta Business Weekly*, the weekly *Malta Today*, and a few business and financial newspapers are available only in English. Since party affiliations of media companies are strong, readers are faced with choosing a newspaper based not only on the language, but also on political ideology. Magazines written in Maltese are sparse, and even those containing Maltese articles are filled with English as well. Although people's language preferences may drive them to seek out newspapers and magazines in one language or another, the type of information they seek may not be available in their preferred format, making the correlation between language use and reading somewhat low.

A similar situation applies to the relationship between the percentage of reading and television watching in Maltese. Satellite and cable television reception are the norm in Malta, as there are only three local channels, and the reception of those is poor without cable. Most of the channels available through cable are broadcast in Italian, with a few being broadcast in English. Therefore the opportunity to watch television in a language other than Maltese is prevalent. It seems logical that those people who prefer to use Maltese would seek out media of all types in that language.

With the exception of the last result discussed, all the significant correlations involved the type of schooling participants had as children. It seems that this factor is a good, though not absolute, predictor of certain linguistic preferences. The next section

discusses the relationships between sociolinguistic factors and participants' responses to items in the elicitation experiment.

4.3 Relationship of questionnaire responses to elicitation data

Chapter 3 described the results of an elicitation experiment in which participants were asked to create novel verbs in Maltese. In order to complete this task, speakers had to choose between two morphological strategies for verb formation. This section describes a the results of a series of correlations to determine if the language background of any given individual speaker is related to that speaker's preferred verb formation strategy.

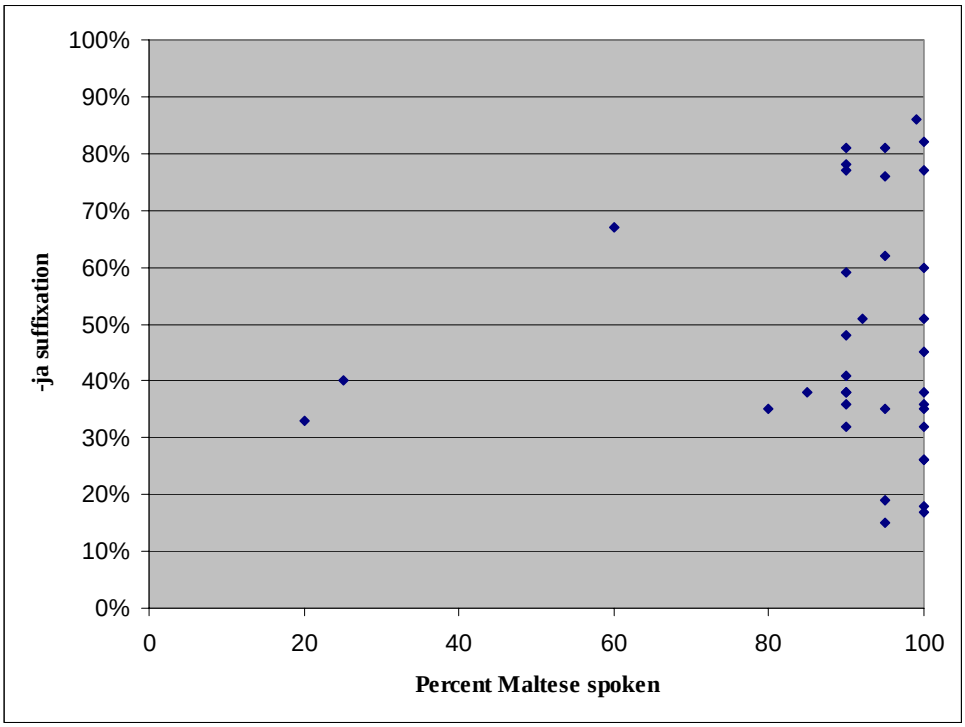
A by-subjects ANOVA was conducted on the elicitation data, similar to that described in Chapter 3. Rate of *-ja* suffixation was used as the dependent factor, and stimulus origin and item acceptability were included as between-subjects factors. This analysis included the additional within-subjects factor of % interaction, the extent to which each participant reported using Maltese on a daily basis. The data was collapsed across items to run by-subjects analyses. Since the % interaction figure is identical for all items for any given subject, collapsing across subjects to run by-items analyses is not possible. Unlike the correlations between sociolinguistic variables alone, the ANOVA included only those 36 subjects whose responses to the elicitation task were originally analyzed.

The interaction between the three variables was not significant ($F_1 < 1$). Likewise, none of the two-way interactions provided significant results (origin and acceptability: $F_1 < 1$; acceptability and % interaction: $F_1 < 1$; origin and % interaction: $F_1 < 1$). The main

effect of stimulus origin was significant ($F_1(1, 25) = 15.33$, $p < .01$), which is consistent with the results presented in Chapter 3. The effect of item acceptability was also significant ($F_1(1, 25) = 9.92$, $p < .01$). This result is consistent with the results from Chapter 3, although a by-items ANOVA reported there failed to confirm this finding. The effect of the newly added variable, % interaction, was not significant ($F_1(9, 25) < 1.9$).

To isolate the effect of the rate of Maltese usage, a Pearson correlation was run on the data, using percentage *-ja* suffixation and percentage of Maltese spoken as variables. No correlation was found ($r = .05$, $p > .05$). This indicates that participants who reported a high level of Maltese language use were no more or less likely to use *-ja* suffixation than those who reported a less frequent use of Maltese. The scatter plot below shows that the amount of *-ja* suffixation varies widely for speakers who report using similar percentages of Maltese.

Table 4.3 Lack of correlation between percent Maltese spoken and *-ja* suffixation

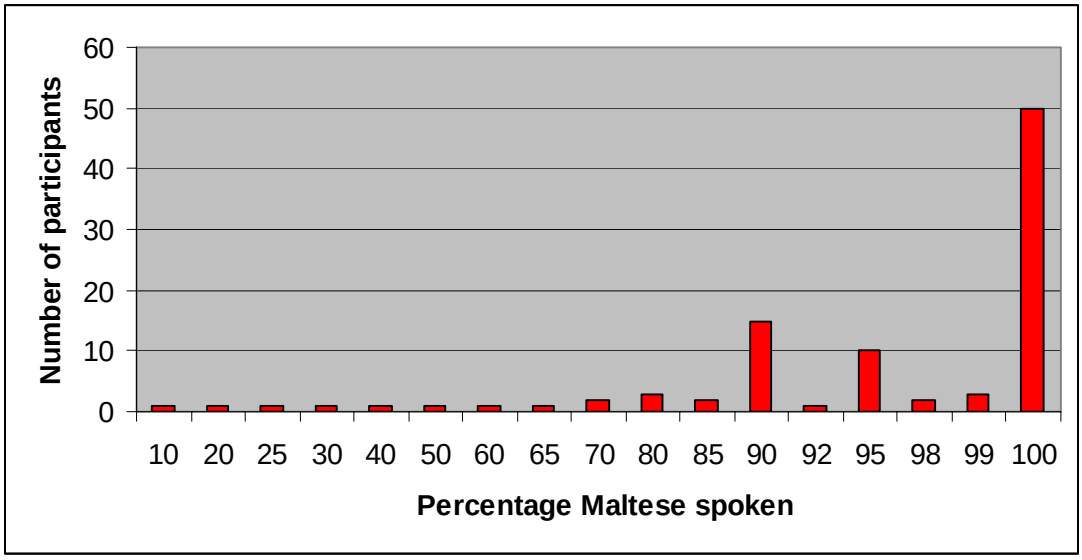


One possible interpretation of the results of the correlation test is that language use and *-ja* suffixation are unrelated. However, some characteristics of the data hint that this may be a premature conclusion. One problem with the evaluation of participants' language use is that it is a completely subjective, self-reported measure. The accuracy of each participant's data is far from assured, even in relation to the data from other participants. Even if the overall accuracy could be confirmed, it is likely that the social situations in which participants prefer one language or the other are just as important as how often each language is used.

An issue related to the measurement of language use is that the experiment participants formed a fairly homogenous group. They were all young adult speakers, and almost all (90 out of 96) were university students. The few who were not students were

recent graduates and so could arguably still be considered part of this social group. This homogeneity is reflected in their self-reported language use data. Out of 96 respondents, only 10 reported that they use Maltese for less than 80% of their communication. The total distribution is shown below.

Table 4.4 Distribution of self-reported percentage of Maltese spoken among all questionnaire participants



The distribution of language preference showed that although all participants were bilingual, they were heavily biased towards Maltese. The distribution is even more lopsided when considering only those thirty six participants whose elicitation responses were analyzed. Only three of these speakers reported using Maltese less than 80% of the time. It may be the case that this skewed distribution makes it impossible to observe any correlation between language preference and verb formation strategy. Although it seems likely that language use affects variation in verbal morphology, the information gained

from the previously described research has thus far been insufficient to discover the connection. The following sections discuss the implications of these findings and suggest alternative methods of exploration of language variation in Maltese.

4.4 Implications of sociolinguistic factors on word formation

Attempting to establish a reliable predictor for morphological variation in Maltese verbs has so far been elusive. Chapter 3 showed that linguistic structure is only a part of the puzzle. This chapter has shown that even speakers with similar language experiences may not form verbs in the same way. These two observations taken together lead to the conclusion that two morphological strategies exist in almost free variation. In this case, it is important to take into consideration the overall dynamics of language interaction in the community in order to understand how this situation could arise.

4.4.1 Language situation in Malta

The language situation in Malta is quite complex. The majority of inhabitants exhibit compound bilingualism, using different languages to navigate the same social environment (Ellul, 1978). In other words, they are equally comfortable conducting private and public transactions in either English or Maltese. This contrasts with coordinate bilingualism, in which a speaker uses different languages in different environments, e.g. Maltese only at home and English at school. Davidson (1996) refers to the Maltese situation as an "ambilingual" environment, in which the languages co-exist, but their socio-economic roles do not completely coincide; rather, they overlap. The exact nature of the split between English and Maltese speaking environments is

complicated by the prevalence of code-switching. Compound bilinguals frequently engage in code-switching between languages and are thus especially prone to cross-language interference.

Camilleri (1996) argues that code-switching provides speakers a means through which to mediate their social roles in the face of unclear language policies. She notes that attitudes towards languages are strongly ingrained in children as young as eight. People who speak mainly English are thought of as "snobs", while those who speak non-standard dialects of Maltese are considered "uneducated" or "unsophisticated". Even those who speak standard Maltese are labeled as language purists. It seems there is no way to escape being negatively classified except to show proficiency in several forms of language.

About 90% of the population of Malta acquires Maltese as a first language. The exceptions, children raised in English speaking households, occur mostly in the prime tourist locations of Valletta, St. Julian's, and Sliema. These areas have also historically been the home of the densest British influence, further reinforcing the importance of English (Camilleri, 1996). Ellul (1978) and Camilleri provide evidence that the high rate of code-switching is induced and reinforced by the fused learning of both languages in tandem. The Maltese educational system provides language and curriculum instruction in both English and Maltese through the end of secondary school. Despite the outward appearance of the promotion of multilingualism, Camilleri notes that differing attitudes toward language exist even within the school system. Teachers report using more Maltese with low ability children, while English is used more with more talented

students. This elitism is reinforced by the fact that all written exams, except those in Maltese language and literature, are administered solely in English. This may encourage students to associate higher academic achievement with English proficiency.

Despite the complex history of power relationships and prolonged language contact that may threaten the status of the Maltese language, it continues to thrive. As Malta entered the European Union (EU) in the summer of 2004, the debate over the importance of the Maltese language was still at the forefront of political posturing. As recently as 1996, the Labour party was able to defeat a measure that would have gained Malta earlier acceptance into the EU partially because there was no provision made for the status of Maltese within the EU. The party felt that anything less than equal status for Maltese would be an insult to the Maltese national identity (Mitchell, 2002). The final terms of Malta's entry into the EU included provisions for Maltese as an official EU language. This status, among other things, requires that all EU laws and official documents be translated into Maltese and that Maltese citizens may address and receive replies from EU organizations in Maltese (Malta-EU Information Centre, 2003).

One factor that is strongly unified throughout the Maltese islands is the use of Maltese as the mark of an insider. In a country besieged by over a million tourists each year (nearly 3 times the population), most of whom are English speakers, speaking Maltese remains a symbol of national uniqueness (Camilleri, 1996; Mitchell, 2002). Even with such a strong sense of nationalism, some people favor the idea of an English only Malta. According to Camilleri (1996), this group fears that Maltese may eventually replace English, thereby isolating Malta and demoting its status in the world economy. A

larger faction, grounded in their conviction by democratic principles, social justice, and pedagogical theory, believes that it is possible to promote the use of Maltese without diminishing ability in English.

Few dialects of Arabic have survived an evolutionary path similar to that of Maltese. Linguistic integrity is difficult to maintain under pressure from intense contact and geographic isolation from related languages. According to Borġ (1978), the closest parallel to the Maltese language situation is that of Cypriot Arabic. Faced with geographical isolation and intense contact with Greek and Turkish, the condition of Cypriot Arabic is moribund compared to Maltese. With only a few hundred speakers, all still living on Cyprus, this variety of Arabic is still unwritten and does not exhibit dialectal variation. It remains a language spoken exclusively in the home, and outlook for its survival is grim. In contrast, Maltese retains over 350,000 native speakers in Malta, plus thousands of emigrants in the United States, Canada, Australia, and the United Kingdom. Multiple mutually intelligible dialects are spoken within the islands, and the speaking and writing of Maltese is firmly ingrained in society, including the educational system. Hayes (2001) lists the ability to freely incorporate loan words as one characteristic that has contributed to the survival of Maltese.

4.4.2 Language interference and transfer in a bilingual society

According to Treffers-Daller and Mougeon (2005, p.93),

> "…when two or more languages are spoken by groups of speakers in the same geographical area, over time, features from one language can be transferred to the other language, especially when the languages in question are unequal in terms of prestige, institutional support and demographic factors."

This definition can be applied to processes at the word level, resulting in lexical borrowing, or at sublexical levels, resulting in the adoption of phonological or morphological features from one language into another. While this notion of transfer has been widely studied in fields such as second language acquisition and creole studies, it has only recently become a topic of interest in bilingual societies.

Grosjean (2001) discusses transfer as a consequence of the psycholinguistic activation of two languages at once. According to his account, bilingual speakers can operate along a continuum of many language modes. On one end of the continuum is the bilingual mode, used when among other bilinguals in an atmosphere that allows for rampant mixing of languages without negative social consequences. Monolingual mode occurs on the other end of the continuum, in circumstances in which it is inappropriate to use more than one language. Grosjean argues that even when bilinguals operate in a monolingual mode, the unused language still exerts pressure on the language that is used. This pressure results in interference, "a speaker-specific deviation from the language being spoken due to the influence of the other 'deactivated' language" (p. 262). Some interferences are fleeting, amounting to slips of the tongue or other isolated speech errors. However, some types of interference have permanent consequences for the affected language.

According to Grosjean (1995) and Treffers-Dahler and Mougeon (2005), one source of permanent interference is imperfect learning in bilingual environments. Children may use features from one language in the other language in order to fill a gap in their

knowledge of the second language. If the features are used inappropriately past the language learning stage, they may become ingrained in speech. Interferences of this sort need not be between languages, they also occur within languages. For instance, the declining distinction between *who* and *whom* in American English reflects imperfect learning of the case system[1]. When such interferences occur between languages, however, they can result in the transfer of features from one to the other.

Imperfect learning is not the only source of language transfer, especially in highly bilingual environments. The extent of transfer between two or more languages depends on a number of context-specific social factors which are unique to each contact situation. However, Thomason and Kaufman (1988) isolate three general categories of influence over morphological transfer, including intensity of contact, feature markedness, and typological distance. They also voice the opinion that language transfer is fueled by sociolinguistic factors and not structural considerations. Thus they support the view that any linguistic feature may be subject to transfer. However, some features are more likely to be affected by transfer than others.

Intensity of contact encompasses both the duration that two or more languages are present in the same social system and the extent of bilingualism in the community. Short periods of contact resulting in relatively little bilingualism may result in some lexical borrowing, but not much transfer of linguistic structures. The Maltese case involves two successive periods of sustained, intense contact, the first between Maltese and Italian, and

---

[1] The *who/whom* distinction may in fact reflect the static effect of imperfect learning, in that many speakers of American English consider the difference between the two forms one of register, not of case.

the second between Maltese and English, including the continued though diminishing presence of Italian. During both periods, bilingualism is reported as the norm. The shift between Maltese-Italian and Maltese-English bilingualism occurred gradually during the 19th century, after England gained political control of the islands. In such cases of prolonged, intense contact, extensive transfer between languages is anticipated. Furthermore, most of this transfer is expected to originate in the politically and socially dominant language, resulting in foreign elements appearing in the less powerful language. The case of *-ja* suffixation fits these expectations, since this feature originated in Italian dialects and Italian was the language of the ruling power in Malta for approximately 250 years.

The role of markedness in feature transfer is not as clear as that of intensity of contact. Many researchers have argued for the position that morphological transfer is a process of simplification, often resulting in the convergence or leveling of features. Convergence occurs when the systems of the languages in contact become more like one another, i.e., their features become less diverse. Leveling can be defined as the loss of a functional category, such as the loss of the dual number in Ethiopic Semitic languages due to influence from Cushitic, which has no dual number (Thomason & Kaufman, 1988). This is consistent with the hierarchy of transferable features, in which more complex linguistic units are less prone to adoption by a language in contact. Comrie (1981) notes that morphological transfer is more likely to affect segmentable units, like affixes, than aspects of fusional morphology. Siegel (1997) introduces another factor related to markedness: frequency. He argues that the frequency of use of a feature will

affect its likelihood of undergoing transfer. Considering Maltese *-ja* suffixation, it is difficult to separate the notions of markedness and frequency. In Italian and Sicilian dialects *-iare*, the source for the Maltese *-ja*, is a very frequent verbal suffix. It is also quite unmarked in the sense that it is easily separable from the verb stems due to its consistency. Taken together, these factors make *-ja* suffixation an ideal target for transfer.

Lastly, typological distance is expected to play a role in language transfer. The more similar two languages are in terms of structure, the easier it is to transfer elements between them. This is arguably the most interesting aspect of transfer to Maltese from Indo-European languages and the characteristic which sets it apart from other Semitic languages. The case of *-ja* suffixation is an example of the transfer of a dissimilar feature. Although Maltese does exhibit inflectional suffixation in verbs, derivational suffixation is only seen in loan verbs.

Thomason and Kaufman (1988) state that morphological transfer can result in the replacement of existing functional categories or the complete loss of previously existing categories. The case of *-ja* suffixation falls into the first group, though the introduction of this new morphological strategy has not entirely replaced the old system. The fact that there are apparently two morphological strategies available for new verb formation, along with other structural anomalies, has sparked debate about the status of Maltese as a mixed language.

4.4.3 Maltese -ja suffixation as interference

Maltese is clearly exhibiting the effects of transfer in its verbal morphology, as *-ja* affixation cannot be found in any related language. The *-ja* suffix was likely adopted into Maltese from Sicilian or another southern Italian dialect sometime during the rule of the The Knights of the Order of St. John (Mifsud, 1995). This is consistent with the usage of -iare as a verbal suffix in those languages and also explains why nearly all recent loans from Romance languages display this suffix. However, if this were simply a case of borrowing verbal features along with verbs, *-ja* suffixation on loan words from English would not be expected. Thus *-ja* suffixation must be fully incorporated into the language as an independent feature, as its primary use now is to form verbs from English loan words.

The question then arises, at what point does influence from another language cease to be transfer or interference and begin to be simply a feature of the target language itself? Most of the participants in the elicitation experiment were not Italian speakers, yet they were adept at using the *-ja* suffix to form new words of Maltese. So the initial importation of the affix could have been direct transfer, but its continued presence and productivity is not, even though it is viewed as a foreign element in the language. The complicated succession of language contact on Malta has resulted in the permanent influence of Italian verb structure, even on verbs not of Italian origin. It may be impossible to trace the exact origin and timeline of acquisition of the *-ja* suffix into Maltese, but further studies may be able to uncover the intricacies of its current use.

The elicitation experiment described here was designed specifically to determine the productivity of *-ja* suffixation absent any mitigating factors like semantics or social context. While the results of this study are informative, it is apparent that some of the factors purposely omitted from the experiment may be useful in describing morphological variation in real language. The next chapter outlines directions for future exploration of Maltese verbal morphology.

CHAPTER 5: CONCLUSION

The previous chapters discussed the individual results of two psycholinguistic experiments and a language background questionnaire. This chapter reviews the findings as a whole and relates them back to the models of lexical processing introduced in Chapter 1. In closing, some ideas are given for further research to explore the questions raised in this dissertation.

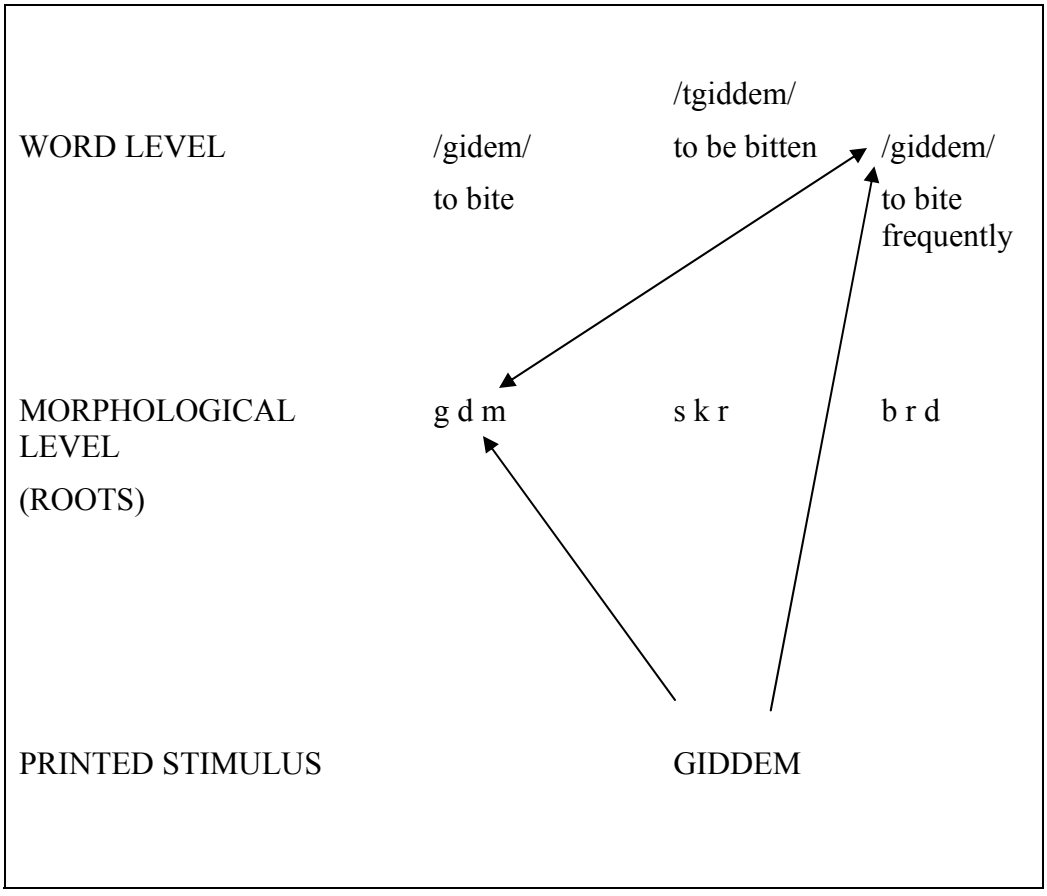
5.1 Empirical conclusions

Several questions about the verbal morphology of Maltese were investigated in the experiments described in earlier chapters. The first issue concerned the structure of SM verbs. The results of the masked priming study revealed that consonantal roots bear psychological salience, supporting models of lexical access that allow for sublexical levels of representation. Such models allow for the possibility of the decomposition of words into multiple morphological units. The status of verbal patterns is inconclusive, as there is no firm evidence that speakers are able to capitalize on pattern similarities to speed access to verbs.

Whether or not verbal patterns bear psychological salience, the fact that consonantal roots do supports a morphological decomposition approach to lexical access. Using a search-based approach (e.g. Taft & Forster, 1975), words would be expected to be organized in the lexicon according to accessible morphological structures. In the case of Maltese, the consonantal root is such a structure. Deutsch et al. (1998) proposed that verbal patterns provide an additional unit of organization for verbs in Hebrew, but the evidence for this layer of organization is not as strongly supported by the current study.

Instead, it appears that Maltese verbs behave similarly to nouns in Hebrew (Frost et al., 1997) and Algerian Arabic (Mimouni, Kehayia, & Jarema, 2003), in which consonantal roots provide organizational structure but pattern similarities do not. The following figure provides a schema for the organization of the Maltese lexicon, at least as relates to verbs.

Figure 5.1 Schematic of lexical organization and access of verbs in Maltese (adapted from Frost et al., 1997 and Deutsch et al., 1998)



As shown, lexical entries are accessible at both the word and morpheme level. The presentation of a written stimulus prompts searching at both levels of organization. Additionally, there is feedback between the word and morphological levels.

The conditions in the masked priming study were insufficient to either support or challenge parallel activation or connectionist accounts of Maltese morphology. As described in Chapter 1, neither of these types of models assumes explicit representations at the word level. Instead, these models predict that the recognition of a word is dependent on the activation, either serially or simultaneously, of featural units related to phonology, orthography, and semantics. There are no overt representations of morphological features, so any conclusions based on morphological similarity are not subject to interpretation by these models. Effects that search-based models attribute to morphological connections are instead credited to the composite effect of the featural units present in the models. Since all of the prime-target relationships in this study except for those in the control condition necessarily contained some degree of overlap in the relevant areas, it is difficult to interpret the results in terms of these models. It would be impossible, for instance, to create stimuli that had phonological overlap without orthographic overlap, or vice versa, so any attempt to disentangle the effects of these features is meaningless. Dual-route and connectionist models predict that morphologically complex words are accessed differently depending on whether they are regular or exceptional forms, but the experiment presented here did not include any exceptional verbs against which to compare the regular ones.

One way to contrast regular and irregular verb forms would be to include different classes of weak verbs as stimuli. The masked priming items used here included only verbs with strong roots and weak roots with defective final radicals. Though this class of weak roots follows different patterns than strong roots, the resulting derivations are

regular in form, always displaying a missing final consonant. Other types of weak roots include those with defective radicals in initial or medial position. These roots result in verb forms that are less predictable in prosodic shape. Experiments on weak verbs of different types in Hebrew have shown no effect of pattern priming (Frost et al., 2000) or a slight inhibitory effect (Sumner, 2003), as discussed in Chapter 2. These results are comparable to the pattern priming effects obtained in the present experiment across strong and weak verb categories. Conducting an experiment designed to contrast different classes of weak verbs would serve to refine the effects of pattern priming in Maltese.

The elicitation experiment showed that two morphological strategies are available for word formation in Maltese: root-and-pattern association and concatenative suffixation. The fact that speakers are able to extract consonantal roots from nonce items to interleave with existing verbal patterns points to the root acting as an organizational unit in word formation. Speakers have an intuition about which series of segments are acceptable as roots and, all other things being equal, form words based on these units. When segmental sequences do not conform to expected structural requirements, speakers are more likely to bypass the morphological tier of organization and create new words based on word level representations of the input.

Bilingualism and related social issues also influence the formation of new words. Though structural characteristics such as prosodic shape and phonological segment inventory play a role in determining which word formation strategy speakers prefer, additional systematic variation is caused by sociolinguistic factors. The results of the

language background questionnaire suggest that the extent to which a bilingual speaker uses each of her languages is correlated with such factors as type of schooling and preferred media, but the causality of these relationships is not clear. In other words, it is not possible to tell whether attendees of public schools speak more Maltese than English because of their educational background, or if the fact that their families prefer speaking Maltese to English was a factor in school selection. The complex combination of structural considerations and sociolinguistic factors makes this area of investigation ideal for further research.

5.2 Further research

As some of the first psycholinguistic experiments ever carried out in Maltese, the experiments described earlier were designed to explore the questions surrounding lexical organization. Using the results of these studies as a starting point, it will now be possible to investigate the issues in more detail. The expansion of this research program must include a greater understanding of the distribution and structure of the Maltese lexicon, as well as a broad variety of experimental techniques to exploit the unique properties of the language.

At the time of experimentation, there was no reliable corpus of Maltese available. The first expansion to this research program should be the replication of the masked priming experiment with items carefully controlled for factors such as word frequency, neighborhood density, and morphological family size. As discussed in Chapter 1, similar research has shown these parameters to have effects on lexical access, so it will be important to determine the consistency of these effects in Maltese. The effects of word

frequency (Forster, 1976, 1989, 1992) have been determined to be stable, resulting in faster recognition times for higher frequency words. The effects of neighborhood density (Andrews, 1989; Coltheart et al., 1977; Grainger, 1992; Grainger et al., 1989) and morphological family size (de Jong et al., 2000) have been less consistent. More data taking these factors under consideration would be helpful in untangling the conflicting effects.

Part of the inconsistency of morphological family size effects stems from the experimental modality. Items from large morphological families induce faster recognition of visual targets, but slower recognition of auditory targets (de Jong et al., 2000). Therefore, it would be relevant to reproduce these effects in Maltese as well. Ussishkin and Twist (2006) used auditory presentation in a preliminary study, described in Chapter 2, but due to mismatches in stimulus length, no firm conclusions could be drawn. The problem of differences in stimulus length stemmed from the contrast between Theme 1 and Theme 2 verb forms. Since Theme 2 verbs contain medial geminates, they are consistently longer than their Theme 1 counterparts. One solution to this complication would be to use pairs of different verbal themes matched for auditory length.

Aside from further investigation into the organization of nonconcatenative morphologies, Maltese has great potential to inform linguistic theory about the interaction of different morphological systems in contact. The present elicitation experiment showed that speakers are competent in the application of two word formation strategies, and that the way in which new words are formed is dependent on more than just structural

properties. It was expected that sociolinguistic variables would account for much more variation than shown, but the homogeniety of the backgrounds of the participants might have disguised some of the anticipated effects. Therefore, it would be informative to conduct a similar elicitation experiment on populations with different language usage characteristics, e.g. Maltese monolinguals or Maltese speakers living outside of Malta.

One criticism of the current elicitation experiment is that it has no semantic component; participants were asked to create new words devoid of any context. Since social factors may be affecting word formation strategy, it is reasonable to expect that contextual information might affect them as well. An experiment could be devised to include nonce stimuli similar to those already used, but including definitions or illustrations. Another way to reduce the artificiality of the task would be to present auditory stimuli, as this might more closely resemble the way in which new words are adopted into Maltese from foreign sources.

The most natural way to collect data on novel word formation would be to record and analyze spontaneous speech interactions. This would allow for the analysis of contextual information such as social relationships and semantic content as well as linguistic structure. This method would also provide an opportunity for extensive investigation of individual variation and language experience. In addition to the analysis of novel word formation, a study of this sort would lend itself to follow-up with the participants about their attitudes and perceptions about their own use of Maltese.

5.3 Concluding remarks

The experiments described here have provided a platform from which to expand research on verbal morphology in Maltese. The results of the masked priming experiment confirmed findings from earlier studies in related languages that supported the consonantal root as a morphological unit. Importantly, this result was consistent even though the orthography of Maltese is not biased toward consonants. This experiment did not strongly support a similar morphological status for verbal patterns, but the interpretation presented here does not preclude that possibility. Further research is needed in this area to determine if subtle variations in experimental design could help resolve this discrepancy.

The elicitation experiment supported the conclusion that Maltese speakers have available to them two strategies for verb formation. Along with structural considerations, certain measures of language use were investigated as possible sources of variation between the two processes. Although it was difficult to quantify the relationship between language use and morphology, it was apparent that the two interact. This study made clear that linguistic structure alone, although central to morphological processes, is not enough to explain the productivity of the two types of verb formation.

APPENDIX A: LANGUAGE BACKGROUND QUESTIONNAIRE

English translation

Section 1: Language background

Please answer the following questions about your language background.

1. What is your occupation? _____

2. In which town or region did you grow up? _____

3. In which town or region do you now live? _____

4. What language(s) were spoken often in the home where you grew up? (In this and subsequent questions, if you tick multiple languages, please specify the approximate percentage of time applicable to each language. For instance, if Maltese was spoken most of the time in your childhood home, but some English was also spoken, you could indicate Maltese: 90% and English:10%)
    a. Maltese_____%
    b. English_____%
    c. Other (please specify) _____%

5. What type of primary school did you attend?
    a. State
    b. Church
    c. Independent

6. What was the primary language spoken in this school? Please indicate all that apply.
    a. Maltese_____%
    b. English_____%
    c. Other (please specify) _____%

7. What type of secondary school did you attend?
    a. State
    b. Church
    c. Independent

8. What was the primary language spoken in this school? Please indicate all that apply.
    a. Maltese_____%
    b. English_____%
    c. Other (please specify) _____%

9. Did you attend university?
    a. No
    b. Yes
    Please list number of years attended _____
    Highest degree obtained _____
    Course of study_____
    If your university training was in a country other than Malta, please specify the institution and languages used:
    _____

10. In which language(s) do you usually speak to the following people?

    a. Father _____
    b. Mother_____
    c. Grandparents_____
    d. Siblings_____
    e. Children_____
    f. Friends_____
    g. Co-workers_____
    h. Customer/clients/other business contacts_____

11. In which language(s) are the newspapers and magazines you read regularly?
    a. Maltese_____%
    b. English_____%
    c. Other (please specify) _____%

12. In which language(s) are the television programs you watch regularly?
    a. Maltese_____%
    b. English_____%
    c. Other (please specify) _____%

13. Please list all languages you speak and rate your overall proficiency in each:
    a. Maltese: Excellent Good Fair Poor
    b. English: Excellent Good Fair Poor
    c. Other_____: Excellent Good Fair Poor
    d. Other_____ Excellent Good Fair Poor
    e. Other_____: Excellent Good Fair Poor

14. What is the longest period of time you have spent continuously outside of Malta?
    a. Never been outside Malta
    b. One week or less
    c. Less than one month
    d. Two to five months
    e. Six months to a year
    f. Longer than one year

15. Which language(s) did you use most during this absence?
    _____

16. On average, how much time do you spend outside of Malta per year?
    a. None
    b. One week or less
    c. Less than one month
    d. Less than six months
    e. More than six months

17. Which language(s) do you use most during these absences?
    _____

Section 2: Grammar Exercises

Please complete the following sentences with any word that makes sense.

1. The dog _____ the cat. (chased)
2. I _____ the bus to Valletta. (rode)
3. The children _____ together in the park every day. (play)
4. Have you _____ your lines for the play? (memorized)
5. We _____ the ball back and forth for an hour. (kicked)
6. The _____ flowers in the garden are blooming. (yellow)
7. I prefer to read _____ novels. (mystery)
8. She has a _____ trip home. (long)
9. There are many _____ dishes in the sink. (dirty)
10. Do they have any _____ vegetables? (fresh)

Please give the plural form of the following words.

1. rope _____
2. ceiling_____
3. puppy_____
4. chair _____
5. sailor _____
6. tomb _____
7. peach _____
8. well _____

Please write a sentence or two describing your favorite way to relax.

Maltese version

Taqsima 1: Ambjent Lingwistiku

Jekk jogħġbok wieġeb dawn il-mistoqsijiet dwar l-ambjent lingwistiku.

1. X'inhu l-impjieg tiegħek? _____

2. F'liema belt jew raħal trabbejt? _____

3. F'liema belt jew raħal toqgħod illum? _____

4. B'liema lingwa(i) kontu titkellmu fid-dar fejn trabbejt? (F'din il-mistoqsija u f'li ġejjin, jekk tittikkja aktar minn lingwa waħda, jekk jogħġbok speċifika l-persentaġġ ta' żmien ta' kemm bejn wieħed u ieħor kienet tiġi mitkellma kull lingwa. Pereżempju, jekk fit-tfulija l-Malti kien l-iktar mitkellem fid-dar, imma xi ftit Ingliż kien mitkellem ukoll, tista' tindikah Malti: 90% u Ingliż:10%)
    a. Malti_____%
    b. Ingliż_____%
    ċ. Oħrajn (jekk jogħġbok speċifika) _____%

5. Liema skola primarja attendejt?
    a. tal-Gvern
    b. tal-Knisja
    ċ. Privata

6. Liema kienet il-lingwa ewlenija ta' din l-iskola? Jekk jogħġbok indika fejn japplika.
    a. Malti_____%
    b. Ingliż_____%
    ċ. Oħrajn (jekk jogħġbok speċifika) _____%

7. Liema skola sekondarja attendejt?
    a. tal-Gvern
    b. tal-Knisja
    ċ. Privata

8. Liema kienet il-lingwa ewlenija ta' din l-iskola? Jekk jogħġbok indika kull fejn japplika.
    a. Malti_____%
    b. Ingliż_____%
    ċ. Oħrajn (jekk jogħġbok speċifika) _____%

9. Attendejt università?
    a. Le
    b. Iva
    Jekk jogħġbok niżżel in-numru ta' snin li attendejtha _____
    L-ogħla grad li lħaqt _____
    Il-kors ta' studju _____
    Jekk studjajt f'università barra minn Malta, jekk jogħġbok speċifika l-istituzzjoni u l-lingwi użati:
    _____

10. B'liema lingwa(i) titkellem ma' dawn in-nies?

    a. Missier _____
    b. Omm _____
    ċ. Nanniet _____
    d. Aħwa _____
    e. Ulied _____
    f. Ħbieb _____
    ġ. Kollegi tax-xogħol _____
    g. Klijenti u nies li tinnegozja magħhom _____

11. B'liema lingwa(i) jkunu l-gazzetti u l-magazins/rivisti li taqra regularment?
    a. Malti_____%
    b. Ingliż_____%
    ċ. Oħrajn (jekk jogħġbok speċifika) _____%

12. B'liema lingwa(i) jkunu l-programmi televiżivi li ssegwi regularment?
    a. Malti_____%
    b. Ingliż_____%
    ċ. Oħrajn (jekk jogħġbok speċifika) _____%

13. Jekk jogħġbok elenka l-lingwi li titkellem u agħmel stima tal-profiċjenza ġenerali tiegħek f'kull waħda minnhom:

a.	Malti :	Eċċellenti	Tajjeb	Mhux ħażin	Ħażin
b.	Ingliż :	Eċċellenti	Tajjeb	Mhux ħażin	Ħażin
ċ.	Oħra _____:	Eċċellenti	Tajjeb	Mhux ħażin	Ħażin
d.	Oħra _____:	Eċċellenti	Tajjeb	Mhux ħażin	Ħażin
e.	Oħra _____:	Eċċellenti	Tajjeb	Mhux ħażin	Ħażin

14. Liema hu l-itwal perjodu ta' żmien li qattajt barra minn Malta bla ma ġejt lura?
    a. Qatt ma mort barra minn Malta
    b. Ġimgħa jew inqas
    ċ. Inqas minn xahar
    d. Bejn żewġ u ħames xhur
    e. Bejn sitt xhur u sena
    f. Iktar minn sena

15. Liema lingwa(i) l-iktar li użajt kemm domt barra? _____

16. Bħala medja (li kieku kellek tieħu *average*), kemm tqatta' żmien barra minn Malta kull sena?
    a. Xejn
    b. Ġimgħa jew inqas
    ċ. Inqas minn xahar
    d. Inqas minn sitt xhur
    e. Iktar minn sitt xhur

17. Liema lingwa(i) tuża l-iktar meta tkun barra?
    _____

Taqsima 2: Eżerċizzji tal-Grammatika

Jekk jogħġbok kompli s-sentenzi li ġejjin b'kelma li tagħmel sens.

1. Il-qattusa _____ wara l-ġurdien.
2. Il-bieraħ aħna _____ il-karozza tal-linja għall-Belt.
3. It-tfal _____ flimkien fil-ġnien kuljum.
4. It-tarbija _____ għax ma sabitx il-ġugarell.
5. Intom _____ il-karti tagħkom fil-klassi?
6. Il-fjuri _____ qed jifthu.
7. Dak ir-raġel _____ b'dik il-maskra f'wiċċu.
8. Għandha triq _____ biex tmur lura d-dar.
9. Hemm ħafna platti _____ fis-sink.
10. Dawk l-erba' tadamiet _____?

Jekk jogħġbok agħti l-plural tal-kliem li ġej.

1. ħabel _____
2. saqaf _____
3. ġeru _____
4. siġġu _____
5. baħri _____
6. qabar _____
7. ħawħa _____
8. bir _____

Jekk jogħġbok ikteb sentenza jew tnejn dwar il-passatemp favorit tiegħek.

APPENDIX B: MASKED PRIMING ITEMS

Real word items

Target/ Identity condition	Root condition	Pattern condition	Unrelated condition
daħak	ndaħak	resaq	ressaq
to laugh	*to be mocked*	*to approach, get near*	*to bring something closer, nearer*
daħal	daħħal	xiref	xerref
to enter	*to insert*	*to look/lean out of a window*	*to make someone look/lean out of a window*
feraħ	nferaħ	tebaq	ntebaq
to be glad	*to be victim of the evil eye*	*to shut airtight*	*to be closed, shut airtight*
firex	ferrex	ħobol	ħabbel
to spread	*to scatter and spread again*	*to become pregnant*	*to get a girl into trouble*
giref	gerref	daħal	daħħal
to scratch	*to scratch repeatedly*	*to enter*	*to insert*
ħadem	ħaddem	sefaq	seffaq
to work	*to employ*	*to become thick, dense*	*to make something become/grow dense*
ħolom	nħolom	feraq	nferaq
to dream	*to be dreamed, imagined*	*to separate, cut asunder*	*to be separated*

hemeż	hemmeż	faraġ	farraġ
to fasten with pins	*to stitch or sew badly*	*to console, comfort*	*to console, comfort*
kiser	nkiser	telaq	tellaq
to break	*to be broken*	*to leave a place*	*to take part in a race*
kotor	katter	qadef	nqadef
to abound, increase	*to abound, increase*	*to row*	*to be rowed*
maħat	maħħat	giref	ngiref
to blow one's nose	*to blow one's nose frequently*	*to scratch*	*to be scratched*
marad	marrad	kesaħ	kessaħ
to be or fall sick	*to cause someone to fall ill*	*to grow cold, to cool*	*to make cold*
nifed	niffed	ħaseb	ħasseb
to pierce	*to connect with one another*	*to think*	*to make one think seriously about something*
niseġ	nisseġ	ħarab	ħarrab
to weave	*to weave, render intricate*	*to run away from*	*to make one run away*
niżel	niżżel	kiber	kabbar
to descend	*to bring down*	*to grow large*	*to enlarge*
qabeż	nqabeż	ħataf	nħataf
to jump, to leap	*to be omitted*	*to snatch, grab*	*to be seized, grasped*

qasam	qassam	ħarab	ħarrab
to break, to split	*to distribute*	*to run away*	*to make someone run away*
saħan	saħħan	qaleb	qalleb
to get hot, warm	*to heat, warm*	*to turn*	*to break up earth in depth*
tilef	ntilef	ġeraħ	ġerraħ
to lose	*to be lost*	*to wound, injure*	*to fill the body with sores*
telaq	ntelaq	barax	nbarax
to leave a place	*to show signs of weakness*	*to scrape, scratch*	*to be scraped or scratched*
beda	nbeda	fela	nfela
to commence, start	*to be commenced*	*to inspect closely*	*to be inspected*
bena	nbena	feda	nfeda
to build, erect	*to be built, erected*	*to redeem*	*to be redeemed*
dewa	ndewa	ħeba	nħeba
to echo	*to be echoed*	*to hide, conceal*	*to conceal, hide oneself*
feda	nfeda	lewa	ltewa
to redeem	*to be redeemed*	*to bend, flex*	*to be bent, flexed*
fela	nfela	tewa	ntewa
to inspect closely	*to be inspected*	*to fold up, wrap up*	*to be folded*

fena	nfena	reħa	rteħa
to wear out	*to pine away*	*to let go*	*to be loosened*
ġeża	nġeża	beda	nbeda
to reward, requite	*to be rewarded*	*to commence*	*to be commenced*
ħeba	nħeba	kesa	nkesa
to hide, conceal	*to conceal, hide oneself*	*to cover*	*to be covered*
ħeja	nħeja	qara	nqara
to revive	*to be revived*	*to read*	*to be read*
ħema	nħema	fena	nfena
to heat	*to be heated*	*to wear out, weaken*	*to pine away*
kera	nkera	dewa	ndewa
to let, rent	*to be letted*	*to echo*	*to be echoed*
lewa	ltewa	tefa	ntefa
to bend, flex	*to be bent, flexed*	*to extinguish*	*to be extinguished*
mela	mtela	qeda	nqeda
to fill	*to be filled*	*to serve*	*to receive service, help*
nieda	tnieda	mela	mtela
to publish banns	*to be published, proclaimed*	*to fill*	*to be filled*

qeda	nqeda	rama	rtama
to serve, to be of use to	*to receive service*	*to arm*	*to be equipped*
reħa	rteħa	ġeża	nġeża
to let go	*to be loosened*	*to reward, requite*	*to be rewarded*
rama	rtama	bena	nbena
to arm	*to be equipped*	*to build*	*to be built*
tefa	ntefa	ħeja	nħeja
to extinguish	*to be extinguished*	*to vivify, revive*	*to feel refreshed*
tewa	ntewa	ħema	nħema
to fold up, wrap up	*to be folded*	*to heat*	*to be heated*
xewa	xtewa	nieda	tnieda
to roast	*to be roasted*	*to publish banns*	*to be published, proclaimed*
berred	bired	xeħħet	xeħet
to refrigerate, cool	*to become cool*	*to cast, throw (intensive)*	*to cast, throw*
barrax	barax	qalleb	tqalleb
to scrape frequently or lightly	*to scrape, scratch*	*to break up earth in depth*	*to toss in bed*
ċaħħad	ċaħad	rikkeb	rikeb
to deprive someone of something	*to deny*	*to make someone ride*	*to ride on the back of an animal*

farrad	fired	libbes	libes
to take away one or more items than a set	*to separate, divide*	*to clothe*	*to dress, get dressed*
ġebbed	nġibed	silet	nsilet
to pull, stretch	*to be drawn*	*to unsheath*	*to be thinned*
giddem	gidem	rebbaħ	rebaħ
to bite frequently	*to bite*	*to make one win*	*to win*
ħeddel	tħeddel	ferraq	feraq
to render torpid	*to be paralyzed*	*to distribute*	*to separate*
ħaddem	ħadem	żeffen	żifen
to employ	*to work*	*to make someone dance*	*to dance*
ħalleb	nħaleb	sikket	siket
to make cows, sheep, etc. yield milk	*to be milked*	*to silence*	*to be silent*
ħammel	tħammel	berred	tberred
to cleanse	*to be cleaned up*	*to refrigerate, cool*	*to be cooled, refrigerated*
libbes	libes	ċaħħad	ċaħad
to dress	*to clothe*	*to deprive someone of something*	*to deny*

naqqax	tnaqqax	raħħas	roħos
to trim	*to be scraped*	*to cheapen*	*to become cheap, cheaper*
qabbad	nqabad	naffar	tnaffar
to light, kindle	*to be caught*	*to startle, scare away*	*to take umbrage at something*
qalleb	tqalleb	neffaħ	tneffaħ
to break up earth in depth	*to toss in bed*	*to puff up*	*to be swollen*
raqqad	raqad	nassab	tnassab
to sleep	*to put to sleep*	*to lay traps*	*to be caught in a trap*
rażżan	trażżan	ħabbat	tħabbat
to restrain, control	*to be controlled, curbed*	*to knock, beat, strike*	*to be knocked, troubled*
kixxef	tkixxef	farrad	nfired
to make someone disclose something	*to try to find out what is happening*	*to lose or take away one or more items in a set*	*to be separated*
sakkar	siker	laħħaq	laħaq
to get someone drunk	*to get drunk*	*to enable someone to reach a place in time*	*to reach*
sellef	silef	naġġar	naġar
to lend	*to lend*	*to dress, trim stone*	*to dress, trim*

xerraq	xeraq	ħabbat	ħabat
to cause someone to choke temporarily	*to suit, to be well-fitting*	*to knock, beat, strike*	*to collide*
bekka	nbeka	naqqa	tnaqqa
to make someone cry	*to be mourned*	*to weed*	*to be weeded*
batta	tbatta	henna	thenna
to knock down, overthrow	*to be knocked down*	*to make one happy*	*to be happy, rejoice*

darra	ndara	batta	tbatta
to accustom	*to become habitual, customary*	*to knock down, overthrow*	*to be knocked down*
ġerra	ġera	nessa	ntnesa
to make someone run, race	*to run*	*to cause someone to forget*	*to be forgotten, neglected*
hedda	heda	qawwa	tqawwa
to calm someone down, soothe	*to cease, stop*	*to strengthen*	*to become stronger*
ħalla	tħalla	darra	ndara
to leave	*to be left, bequeathed*	*to become accustomed*	*to be habituated, accustomed*
herra	therra	qalla	tqalla
to wear, damage	*to be worn away*	*to fry something until it becomes brown*	*to be fried*

mexxa	tmexxa	saqqa	saqa
to make one walk	*to be made to walk*	*to water, irrigate*	*to water, irrigate*
neħħa	tneħħa	mexxa	tmexxa
to take away, remove	*to remove from office*	*to make one walk*	*to be made to walk*
naqqa	tnaqqa	herra	therra
to weed	*to be weeded*	*to wear, damage*	*to be worn away*
nessa	tnessa	rabba	trabba
to make, cause someone to forget	*to be forgotten*	*to bring up, rear*	*to be brought up, reared*
nixxa	tnixxa	bekka	tbekka
to ooze, exude	*to be leaked*	*to make someone cry*	*to whimper, cry too often*
qalla	nqela	tarra	tara
to fry something until it becomes brown	*to be fried*	*to soften, make tender*	*to grow in strength*
qarra	nqara	tenna	ntena
to cause to read	*to be read*	*to repeat*	*to be bent double*
qawwa	tqawwa	ġerra	nġera
to strengthen	*to become stronger*	*to make someone run, race*	*to be run*

rabba	trabba	ħalla	tħalla
to bring up, rear	*to be brought up, reared*	*to leave*	*to be left, bequeathed*
saffa	Safa	nixxa	tnixxa
to purify, cleanse	*to clear up*	*to ooze*	*to be oozed*
saqqa	saqa	hedda	thedda
to water, irrigate	*to water, irrigate*	*to calm someone down*	*to tranquilize oneself*
sewwa	sewa	neħħa	tneħħa
to rectify	*to cost, to be worth*	*to take away, remove*	*to be removed from office*
tenna	ntena	sewwa	sewa
to repeat	*to be bent double*	*to rectify*	*to cost, to be worth so much*

Non-word items

Target/ Identity condition	Root condition	Pattern condition	Unrelated condition
bahad	bahhad	reċaħ	reċċaħ
baħag	baħħag	danaċ	ndanaċ
bażaz	bażżaz	sexaf	sexxaf
galab	gallab	kehad	kehhad
hagaq	haggaq	ħesaf	ħessaf
hagar	haggar	kanab	kannab
ħaqab	nħaqab	hamaċ	nhamaċ
ħaxar	ħaxxar	sanaq	sannaq
kagaħ	kaggaħ	lizen	lizzen
kahag	kahhaq	nagaż	naggaż
kemah	kemmah	lesab	lessab
kemes	kemmes	selaq	sellaq
laċar	laċċar	tebeh	tebbeh
naċam	naċċam	ħakaz	ħakkaz
namab	nammab	gazaċ	gazzaċ
tedaħ	teddaħ	ċexel	ċexxel
taqaħ	ntaqaħ	żagax	nżagax
xaċaz	xaċċaz	gamat	gammat
xenah	xennah	dagas	daggas

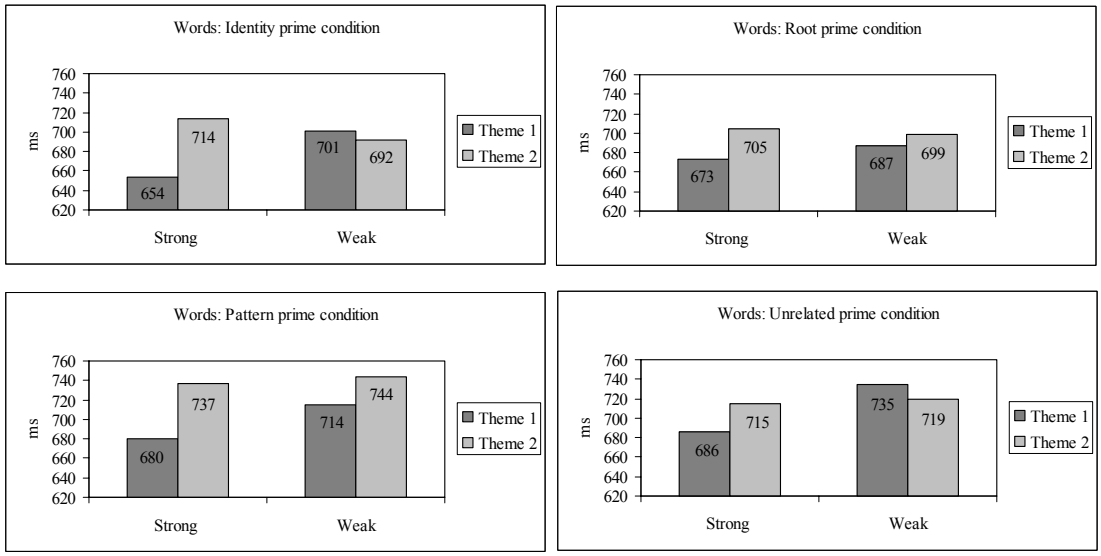
xasaf	xassaf	gaqah	gaqqah
bannal	tbanal	fahher	tfaher
ċaggaħ	ċagaħ	tellez	telez
ċerrek	ċerek	hannaż	hanaż
ċattaÚ	ċataÚ	raħħeq	raħeq
dezzef	dezef	tegges	teges
garraħ	garaħ	tassah	tasah
gozzoh	gozoh	ċiżżed	ċiżed
ħallad	ħalad	tażżeb	tażeb
laggaċ	lagaċ	rakkaz	rakaz
qannak	qanak	biddex	bidex
raffaħ	trafaħ	qekkaċ	nqekaċ
saċċak	saċak	mazzaq	mazaq
siċċem	nsiċem	ħaqqal	nħaqal
sazzah	sazah	mappal	mapal
taddaq	tadaq	rakkaħ	rakaħ
tannaż	tanaż	mihhek	mihek
taxxah	taxah	żessal	żesal
tażżax	ntażax	harraċ	nharaċ
xaffat	nxafat	lesseż	nleseż
żakkaċ	żakaċ	harrat	harat

fiċa	fiċċa	qexa	qexxa
meka	mekka	teda	tedda
bema	bemma	desa	dessa
kema	kemma	ħeqa	ħeqqa
żaxa	żaxxa	gifa	giffa
diba	dibba	ħaża	ħażża
ċeha	nċeha	keda	nkeda
qena	qenna	faha	fahha
dama	dama	gaxa	tgaxxa
taża	taża	seċa	nseċa
kexa	kexxa	lena	lenna
kaha	kahha	nara	narra
feka	nfeka	laċa	tlaċċa
ċara	ċarra	żasa	żassa
raka	rakka	faħa	faħħa
liħa	liħħa	mita	mitta
lixa	lixxa	ħiċa	tħiċċa
rega	nrega	laha	tlahha
kela	kella	qasa	qassa
nela	nella	taqa	taqqa
taħħa	taħa	gekka	geka

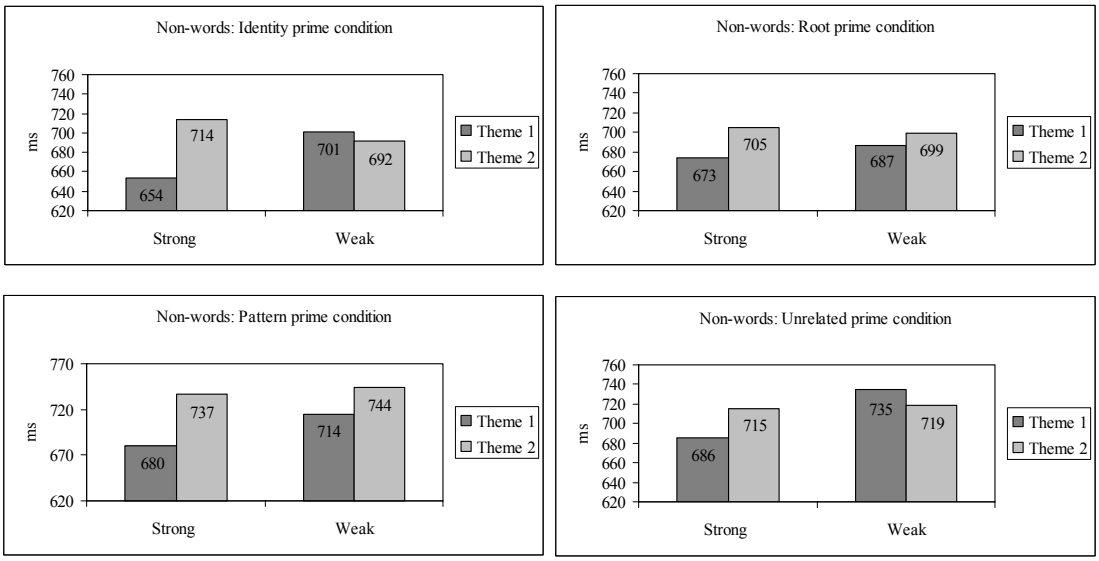
ketta	tketta	ċeqqa	nċeqa
gaqqa	gaqa	tebba	nteba
żeċċa	nżeċa	massa	tmassa
hella	thella	mebba	meba
teċċa	teċa	ligga	liga
gemma	gema	texxa	texa
magga	maga	hebba	heba
biffa	bifa	nagga	naga
ħegga	nħega	qeċċa	nqeċa
qegga	qega	ċetta	ċeta
żegga	żega	keqqa	keqa
heċċa	nheċa	fexxa	nfexa
ċekka	ċeka	ħedda	ħeda
xadda	xada	febba	feba
beċċa	beċa	laffa	lafa
haqqa	thaqqa	ċalla	ċala
netta	neta	sexxa	sexa
rażża	nraża	qaffa	qafa
datta	data	meżża	meża

APPENDIX C: MEAN RTS FROM MASKED PRIMING

All RTs to real word stimuli, arranged by condition



All RTs to non-word stimuli, arranged by condition



APPENDIX D: ELICITATION ITEMS

Real word items

Semitic origin		English origin	
bexxieq	sprayer, sprinkler	blaff	overbearing demeanor
dfin	burying, burial	bojkott	boycott
felliek	unsteady in steering	bokser	boxer
fellus	chicken	ċalinġ	challenge
firxa	a spreading expanse	ċans	opportunity
fqis	hatching	ċekk	check
gdim	biting	dragg	drug
geddum	lower jaw	drill	drill
gidba	a lie, untruth	fansi	colorful
girfa	a scratch, handful	film	film, movie
ħaddiem	worker	fiting	fitting
ħannus	a small pig, porkling	flowt	float
ħbit	hitting, striking	fondi	funds
ħedla	torpor	ġamm	jam
ħlieqa	joke, jest	garaxx	garage
ħofra	hole	gass	gas
ħolma	a dream	ħajk	hike
ħsara	damage, injury	ħendil	handle
mqata	sourness, ill temper	klejm	claim
ndiema	repentance, regret	lider	leader
nfiq	spending, expenditure	marċ	march
nħir	snoring	nokk	knock
nifxa	the act of spreading out cotton	pakk	pack
qallut	turd	pikit	picket
quddies	mass	pinna	pen
riġel	leg	plagg	plug
rkis	stinting	rdupjar	copy, reduplicate
rokna	corner	skrin	screen
seħħa	warping loom	spid	speed
sider	breast, chest	stensil	stencil
tebqa	one part equal to another	stor	store
tgerrim	gnawing	strajk	strike
tiċliq	besmearing	swiċċ	switch
tidrib	striking repeatedly	test	test
tifsir	explaining, significance	trikk	trick
tixrid	scattering, dispersion	xift	shift
tniġġis	infecting, contamination	xutt	shoot
toqba	hole	żum	zoom

Non-word items

Semitic origin		**English origin**	
More probable	Less probable	More probable	Less probable
sammieġ	vallieb	skrit	strub
tammiel	paffien	klid	frim
kattuq	teffug	tran	glik
ħamna	ladga	stirnić	prinliġ
xqim	sxim	blass	klidd
ldir	kdig	britt	fluqq
tmiq	xżih	draxx	braff
rdis	kmig	xuħ	xup
kfieċa	gċieha	naks	barm
xesna	leċda	fint	lirk
mebda	qehża	mirx	relk
naffur	mettup	tamdi	ċimpa
hikża	gikra	bitla	xanfi
girma	sixċa	setrib	viklam
meħin	xetif	ġimir	finil
żonta	ċosma	naġatt	huxiff
toqxa	vodha	ħursamm	pansatt
thettik	txeħħim	nixx	dagg
tifkiż	tidsiċ	tiss	xoċċ
tirqil	tilgih	qarr	murr

REFERENCES

Allport, D.A. & Funnell, E. (1981). Components of the mental lexicon. *Philosophical Transactions of the Royal Society of London, 295*(1077, Series B), pp. 397-410.

Andrews, S. (1989). Frequency and neighborhood effects on lexical access: Activation or search? *Journal of Experimental Psychology: Learning, Memory, and Cognition, 15*(5), 802-814.

Aquilina, J. (1959). T*he structure of Maltese: A study in mixed grammar and vocabulary*. Valletta: The Royal University of Malta.

Baayen, R. H. (1989). *A corpus-based approach to morphological productivity*. Unpublished doctoral dissertation, Free University, Amsterdam.

Baayen, R. H. (1991) Quantitative aspects of morphological productivity. In G. E. Booij & J. van Marle (Eds.), *Yearbook of Morphology 1991* (pp. 109-149). Dordrecht: Kluwer Academic Publishers.

Baayen, R. H. (1992) On frequency, transparency, and productivity. In G.E. Booij & J. van Marle (Eds.), *Yearbook of Morphology 1992* (pp. 181-208). Dordrecht: Kluwer Academic Publishers.

Bat-El, O. (1989). *Phonology and word structure in Modern Hebrew*. Unpublished doctoral dissertation, UCLA.

Bat-El, O. (1994). Stem modification and cluster transfer in Modern Hebrew. *Natural Language and Linguistic Theory, 12*, 571-596.

Bat-El, O. (2003). Semitic verb structure within a universal perspective. In J. Shimron (Ed.), *Language processing and acquisition in languages of Semitic, root-based, morphology* (pp. 29-60). Amsterdam: John Benjamins.

Bates, E., Chen, S., Tzeng, O., Li, P., & Opie, M. (1991). The noun-verb problem in Chinese aphasia. *Brain and Language, 41*(2), 203-233.

Bauer, L. (2004). *A glossary of morphology*. Edinburgh: Edinburgh University Press.

Benmamoun, E. (1999). Arabic morphology: The central role of the imperfective. *Lingua 108*(2-3), 175-201.

Berent, I. & Shimron, J. (1997). The representation of Hebrew words: Evidence from the Obligatory Contour Principle. *Cognition, 64*(1), 39-72.

Borġ, Albert, & Azzopardi-Alexander, M. (1997). Maltese. London: Routledge.

Borġ, Alexander. (1978). A historical and comparative phonology and morphology of Maltese. Unpublished doctoral dissertation, The Hebrew University, Jerusalem.

Boudelaa, S. & Marslen-Wilson, W. D. (2000). Non-concatenative morphemes in language processing: Evidence from Modern Standard Arabic. *Proceedings of the Workshop on Spoken Word Access Processes, 1*, 23-26.

Boudelaa, S. & Marslen-Wilson, W. D. (2004). Abstract morphemes and lexical representation: the CV-Skeleton in Arabic. *Cognition, 92*, 271-303

Camilleri, A. (1996). The Maltese bilingual classroom: A microcosm of local society. *Mediterranean Journal of Educational Studies, 6*(1), 3-12.

Camilleri, A. & Vanhove, M. (1994). A phonetic and phonological description of the Maltese dialect of Mġarr. *Zeitschrift fur arabische Linguistik, 28*, 87-110.

Cassar, C. (2000). *A concise history of Malta*. Msida, Malta: Mireva Publications.

Cassar, C. (2001). Malta: Language, literacy and identity in a Mediterranean island society. *National Identities, 3*(3), 257-275.

Coltheart, M. (2006). Acquired dyslexias and the computational modelling of reading. *Cognitive Neuropsychology, 23*(1), 96-109.

Coltheart, M., Curtis, B., Atkins, P., & Haller, M. (1993). Models of reading aloud: Dual-route and parallel distributed processing approaches. *Psychological Review, 100*, 589-608.

Coltheart, M., Davelaar, E., Jonasson, J., & Besner, D. (1977). Access to the internal lexicon. In S. Dornick (Ed.), *Attention and performance, Vol. VI* (535-556), Hillsdale, NJ: Erlbaum.

Coltheart, M., Rastle, K., Perry, C., Langdon, R., & Ziegler, J. (2001). DRC: A dual route cascade model of visual word recognition and reading aloud. *Psychological Review, 108*, 204-256.

Comrie, B. (1981). Ergativity and grammatical relations in Kalaw Lagaw Ya. *Australian Journal of Linguistics*, 1(1), 1-42.

Davidson, K. (1996). The Malta experience. *English Today, 12*(4), 15-23.

de Jong, N.H., Schreuder, R. & Baayen, R.H. (2000). The morphological family size effect and morphology. *Language and Cognitive Processes, 15*(4/5), 329-365.

De Moor, W., & Brysbaert, M. (2000). Neighbourhood-frequency effects when primes and targets have different lengths. *Psychological Research, 63,* 159-162.

Deutsch, A., Frost, R., & K. Forster. (1998). Verbs and nouns are organized and accessed differently in the mental lexicon: Evidence from Hebrew. *Journal of Experimental Psychology 24*(5), 1238-1255.

Ellul, S. (1978). A case study in bilingualism: Code-switching between parents and their pre-school children in Malta. Cambridge: Huntington Publishers Limited.

Fabri, R. (2001). Maltese: The language of the Maltese archipelago. In T. Stolz (Ed.) *Minor languages of Europe* (pp.43-64), (Bochum-Essener Beiträge zur Sprachwandelforschung 30) Bochum: Brockmeyer.

Forster, K. (1976). Accessing the mental lexicon. In R.J. Wales & E. Walker (Eds.), *New approaches to language mechanisms* (pp. 257-287), Amsterdam: North-Holland.

Forster, K. (1989). Basic issues in lexical processing. In W. Marslen-Wilson (Ed.), *Lexical representation and process* (pp. 75-107), Cambridge, MA: MIT Press.

Forster, K. (1992). *Lexical effects in masked form-priming*. Paper presented at the 33rd Annual Meeting of the Psychonomics Society, St. Louis.

Forster, K. & Bednall, E. (1976). Terminating and exhaustive search in lexical access. *Memory and Cognition, 4*(1A), 53-61.

Forster, K. & Davis, C. (1984). Repetition priming and frequency attenuation in lexical access. *Journal of experimental psychology: Learning, Memory, and Cognition, 10(4)*, 680-698.

Frisch, S. & Zawaydeh, B. (2001). The psychological reality of OCP-Place in Arabic. *Language, 77*(1), 91-106.

Frost, R., Deutsch, A. & K. Forster. (2000). Decomposing morphologically complex words in a nonlinear morphology. *Journal of Experimental Psychology 26*(3), 751-765.

Frost, R., Forster, K., & A. Deutsch. (1997). What can we learn from the morphology of Hebrew? A masked priming investigation of morphological representation. *Journal of Experimental Psychology 23*(4), 829-856.

Frost, R., Katz, L., & Bentin, S. (1987). Strategies for visual word recognition and orthographical depth: A multilingual comparison. *Journal of Experimental Psychology: Human Perception and Performance, 13,* 104-115.

Gafos, A. (1998). Eliminating long-distance consonantal spreading. *Natural Language and Linguistic Theory 16*, 223-278.

Gafos, A. (2002). A grammar of gestural coordination. *Natural Language and Linguistic Theory 20(*2), 269-337.

Gaskell, M.G. & Marslen-Wilson, W.D. (1997). Integrating form and meaning: A distributed model of speech perception. *Language and Cognitive Processes, 12*, 613-656.

Gerlach, B. (2003). *Die Morphologie der Lehnwörter im Maltesischen*. Unpublished manuscript, Heinrich Heine Universität, Düsseldorf.

Glushko, R. J. (1979). The organization and activation of orthographic knowledge in reading aloud. *Journal of Experimental Psychology: Human Perception and Performance, 5*, 674-691.

Grainger, J. (1992) Visual word recognition in bilinguals. In R. Schreuder & B. Weltens (Eds.), *The Bilingual Lexicon* (pp. 11-26), Amsterdam: John Benjamins.

Grainger, J., O'Regan, J., Jacobs, A., Segui, J. (1989). On the role of competing word units in visual word recognition: Neighborhood frequency effect. *Perception and Psychophysics, 45*(3), 189-195.

Grosjean, F. (1995). A psycholinguistic approach to code-switching: The recognition of words by bilinguals. In L. Milroy & P. Muysken (Eds.), *One speaker, two languages* (pp. 259-275), Cambridge: Cambridge University Press.

Grosjean, F. (2001). The bilingual's language modes. In J. Nicol (Ed.), *One mind, two languages: Bilingual language processing* (pp. 1-22), Oxford: Blackwell.

Hayes, J. (2001). The integration of Romance vocabulary in Maltese. *Romance Philology, 54*, 393-405.

Hoberman, R. & Aronoff, M. (2003). The verbal morphology of Maltese. In J. Shimron (Ed.), *Language processing and acquisition in languages of Semitic, root-based, morphology* (pp. 61-78). Amsterdam: John Benjamins.

Holes, C. (1995). *Modern Arabic*. London: Longman.

Inkelas, S. & Zoll, C. (1999). Reduplication as morphological doubling. ROA 412-0800.

Joanisse, M.F. & Seidenberg, M.S. (1999). Impairments in verb morphology after brain injury: A connectionist model. *Proceedings of the National Academy of Sciences, 96*, 7592-7597.

Katz, L. & Feldman, L. (1982). The relation between pronunciation and recognition of printed words in deep and shallow orthographies. *Haskins laboratories status report on speech research, 71-72*, 111-124.

Katz, L. & Frost, R. (1992). The reading process is different for different orthographies: The orthographic depth hypothesis. *Haskins laboratories status report on speech research, 111-112*, 147-160.

Loftus, E.F. & Cole, W. (1974). Retrieving attribute and name information from semantic memory. *Journal of Experimental Psychology, 102*(6), 1116-1122

Lukatela, G., Popadic, D., Ognjenovic, P., Turvey, M.T. (1980). Lexical decision in a phonologically shallow orthography. *Memory and Cognition, 8*(2), 124-132.

Malta-EU Information Centre (2003). *Maltese Language*. Retrieved April 18, 2004, from http://www.mic.org.mt/EUINFO/qeua/Q&A105.htm

Marslen-Wilson, W. D., Tyler, L. K., Waksler, R., & Older, L. (1994). Morphology and meaning in the English mental lexicon. *Psychological Review, 101*, 3-33.

Marslen-Wilson, W., Zhou, X., & Ford, M. (1997). Morphology, modality, and lexical architecture. In G.E. Booij & . Van Marle (Eds.), *Yearbook of morphology 1996* (pp. 117-134), Dordrecht: Kluwer Academic Publishers.

McCarthy, J. (1979). *Formal Problems in Semitic Phonology and Morphology*. Unpublished doctoral dissertation, Massachusetts Institute of Technology, Cambridge.

McCarthy, J. (1981). A prosodic theory of nonconcatenative morphology. *Linguistic Inquiry, 12*(3), 373-418.

McCarthy, J. (1986). OCP Effects: Gemination and antigemination. *Linguistic Inquiry, 17*(2), 207-263.

McCarthy, J. (1993). Template form in prosodic morphology. In L. Stvan et al., (Eds.) *Papers from the Third Annual Formal Linguistics Society of Midamerica Conference* (pp. 187-218), Indiana University Linguistics Club, Bloomington.

McCarthy, J. & Prince, A. (1986). *Prosodic morphology*. Unpublished manuscript, University of Massachusetts, Amherst and Brandeis University.

McClelland, J.L. & Elman, J.L. (1986). The TRACE model of speech perception. *Cognitive Psychology, 18*, 1-86.

McClelland, J.L. & Rumelhart, D.E. (1981). An interactive activation model of context effects in letter perception: Part 1. An account of basic findings. *Psychological Review, 86*, 287-330.

Meunier, F. & Segui, J. (1999). Frequency effects in auditory word recognition: The case of suffixed words. *Journal of Memory and Language, 41*(3), 327-344.

Miceli, G., Silveri, D., Villa, G., & Caramazza, A. (1984). On the basis for the agrammatic's difficulty in producing main verbs. *Cortex 20*, 207-220.

Mifsud, M. (1995). *Loan Verbs in Maltese*. Leiden: E.J. Brill.

Mimouni, Z., Kehayia, E., & Jarema, G. (2003). The mental representation of singular and plural nouns in Algerian Arabic as revealed through auditory priming in agrammatic aphasic patients. *Brain and Language, 61*, 63-87.

Mitchell, J.P. (2002). Ambivalent Europeans: Ritual, memory, and the public sphere in Malta. New York: Routledge.

Moscoso del Prado Martin, F., Deutsch, A., Frost, R., Schreuder, R., De Jong, N. H., Baayen, R H. (2005). Changing places: A cross-language perspective on frequency and family size in Dutch and Hebrew. *Journal of Memory and Language, 53*(4), 496-512.

Norris, D. (1994). Shortlist: A connectionist model of continuous speech recognition. *Cognition, 52*, 189-234.

Pinker, S. (1994). *The language instinct*. New York: Morrow.

Plaut, D. C., McClelland, J. L., Seidenberg, M. S., & Patterson, K. (1996). Understanding normal and impaired word reading: Computational principles in quasi-regular domains. *Psychological Review, 103*, 56-115.

Prince, A. & Smolensky, P. (1993). *Optimality theory: constraint interaction in generative grammar*. Unpublished manuscript, Rutgers University and University of Colorado, Boulder.

Prunet, J., Beland, R., & Idrissi, A. (2000). The mental representation of Semitic words. *Linguistic Inquiry*, *31*(4), 609-648.

Rose, S. (2000). Rethinking geminates, long-distance geminates, and the OCP. *Linguistic Inquiry 31*, 85-122.

Rubenstein, H., Garfield, L., & Millikan, J. A. (1970). Homographic entries in the internal lexicon. *Journal of Verbal Learning and Verbal Behavior, 9*, 487-494.

Rueckl, J.G., Mikolinski, M., Raveh, M., Miner, C. S., & Mars, F. (1997). Morphological priming, fragment completion, and connectionist networks. *Journal of Memory and Language, 36*, 382-405.

Scarborough, D., Cortese, C., & Scarborough, H. (1977). Frequency and repetition effects in lexical memory. *Journal of Experimental Psychology: Human Perception and Performance, 3*, 1-17.

Schneider, W., Eschman, A., & Zuccolotto, A. (2002). *E-Prime Reference Guide*. Pittsburgh: Psychology Software Tools, Inc.

Seidenberg, M.S. (1992). Dyslexia in a computational model of word recognition in reading. In P. Gough, L. Ehri, & R. Trieman (Eds.), *Comprehension processes in reading* (pp. 243-274), Hillsdale, NJ: Erlbaum.

Seidenberg, M.S. (1995). Visual word recognition: An overview. In. J.L. Miller & P. D. Eimas (Eds.), *Speech, language, and communication* (pp.137-179), San Diego: Academic Press.

Seidenberg, M.S. & McClelland, J.L. (1989). A distributed, developmental model of word recognition and naming. *Psychological Review, 96*, 447-452.

Shen, D. & Forster, K. (1999). Masked phonological priming in reading Chinese words depends on the task. *Language and Cognitive Processes, 14*(5-6), 429-459.

Siegel, J. (1997). Mixing, leveling and pidgin/creole development. In A. Spears & D. Winford (Eds.), *The structure and status of pidgins and creoles* (pp. 111-149). Amsterdam: John Benjamins.

Smith, J. (1997). *Noun faithfulness: On the privileged behavior of nouns in phonology*. Unpublished manuscript, University of Massachusetts, Amherst.

Spaelti, P. (1997). *Dimensions of variation in multi-pattern reduplication.* Unpublished doctoral dissertation, University of California, Santa Cruz.

Stolz, T. (2003). Not quite the right mixture: Chamorro and Malti as candidates for the status of mixed language. In Y. Matras and P. Bakker (Eds.), *The mixed language debate* (pp. 271-316). New York: Mouton de Gruyter.

Sumner, M. (2003). Testing the abstractness of phonological representations in Modern Hebrew weak verbs. Unpublished doctoral dissertation, SUNY at Stony Brook.

Taft, M. & Forster, K. (1975). Lexical storage and retrieval of prefixed words. *Journal of Verbal Learning and Verbal Behavior, 14*, 638-647.

Taraban, R. & McClelland, J.L. (1987). Conspiracy effects in word recognition. *Journal of Memory and Language, 26*, 608-631.

Thomason, S. G. & Kaufman, T. (1988). *Language contact, creolization and genetic linguistics*. Berkeley: University of California Press.

Treffers-Dahler, J. & Mougeon, R. (2005). The role of transfer in language variation and change: Evidence from contact varieties of French. *Bilingualism: Language and Cognition 8*(2), 93-98 C

Twist, A. (2004a). *Frequency of Maltese verbs*. Unpublished manuscript, University of Arizona, Tucson.

Twist, A. (2004b). Reduplication in Maltese quadriliteral verbs. Paper presented at the Annual Meeting of the Linguistic Society of America, Boston, MA.

Ussishkin, A. (1999). The inadequacy of the consonantal root: Modern Hebrew denominal verbs and Output-Output correspondence. *Phonology*, *16*(3), 401-442.

Ussishkin, A. (2003). Templatic effects as fixed prosody: The verbal system in Semitic. In J. Lecarme et al. (Eds.), *Research in Afroasiatic Grammar 2*(pp. 511-530), Amsterdam: John Benjamins.

Ussishkin, A. (2005). A fixed prosodic theory of nonconcatenative templatic morphology. *Natural Language & Linguistic Theory*, *23*(1), 169-218.

Ussishkin, A. (to appear). Morpheme position. In P. de Lacy (Ed), *Handbook of Phonology*, Cambridge University Press.

Ussishkin, A. & Twist, A. (2006). *Bases of affixation in Semitic: Psycholinguistic evidence from Hebrew and Maltese*. Paper presented at the Annual Meeting of the Linguistic Society of America, Albuquerque, NM.

Ussishkin, A. & Wedel, A. (2002). Neighborhood density and the root-affix distinction. In M. Hirotani, (Ed.), *Proceedings of NELS 32* (pp. 539-549), GLSA, UMass Amherst.

Wettenger, G. (1993). Plurilingualism and cultural change in medieval Malta. *Mediterranean Language Review, 6-7*, 144-160.

Williams, S. & Canter, G. (1987). Action-naming performance in four syndromes of aphasia. *Brain and Language, 32*(1), 124-136.

Younes, R. (1983). *The representation of geminate consonants*. Unpublished manuscript, University of Texas, Austin.

Zingeser, L. & Berndt, R. (1990). Retrieval of nouns and verbs in agrammatism and anomia. *Brain and Language, 39*(1), 14-32.

Zwitserlood, P. (1989). The locus of the effects of sentential-semantic context in spoken-word processing. *Cognition, 32*(1), 25-64.