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Documentation and analysis of endangered languages: A 2011 study of Vlachika in Metsovo

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Abstract

Aromanian (Vlachika) is an oral language spoken in Greece, among other countries. All speakers are bilingual and the contact language is Greek. The aim of this project was to document digitally verb forms in Vlachika as spoken in Metsovo in 2011 and provide linguistic and mathematical analyses regarding language use. To that end, we collected data by interviewing native speakers of various age groups. We organised the collected material into two databases: (i) a digital dictionary containing the recordings and (ii) a semantic network which categorises verbs into semantic groups. The linguistic treatment was formulated within the framework of Distributed Morphology (Halle and Marantz, 1993). Furthermore, we developed mathematical models that describe the dynamics and internal aspects of Vlachika. By applying these models to the current status of Vlachika, based on experimental evidence, we provided the first findings regarding time evolution of the relative density of the Vlachika speakers.

In this technical report, we provide an overview of the implemented project. More information is available at the project website (http://docanel.icte.uowm.gr/) and forthcoming publications (cf. Bakalis and Galani (ms), Galani (2011a, b), Galani-Sifaki (ms)).

Περίληψη

Αρωμανική (Βλάχικη) είναι μια προφορική γλώσσα που ομιλείται στην Ελλάδα, μεταξύ άλλων χωρών. Όλοι οι ομιλητές είναι δίγλωσσοι και η γλώσσας επαφής είναι η Ελληνική. Σκοπός της παρούσας μελέτης ήταν η ψηφιακή καταγραφή ρημάτων της Βλάχικης, όπως ομιλείται στο Μέτσοβο το 2011 καθώς και μια γλωσσολογική και μαθηματική ανάλυση σχετικά με τη χρήση της γλώσσας. Προς αυτή την κατεύθυνση, συλλέξαμε δεδομένα μέσω συνεντεύξεων με διαφορετικών ηλικιών φυσικούς ομιλητές της γλώσσας. Οργανώσαμε το συγκεντρωμένο υλικό σε δύο βάσεις δεδομένων: (α) ένα ψηφιακό λεξικό που περιέχει τις ηχογραφήσεις (β) ένα σημασιολογικό δίκτυο μέσω του οποίου τα ρήματα κατηγοριοποιούνται σε σημασιολογικές ομάδες. Η γλωσσολογική ανάλυση δίνεται μέσω του θεωρητικού πλαισίου της Κατανομημένης Μορφολογίας (Halle and Marantz, 1993). Επιπλέον, αναπτύξαμε μαθηματικά μοντέλα για την περιγραφή της δυναμικής καθώς και εσωτερικών διεργασιών της Βλάχικης. Εφαρμόζοντας αυτά τα μοντέλα στην παρούσα κατάσταση της Βλάχικης, όπως προκύπτει από εμπειρικά δεδομένα, παρείχαμε τα πρώτα αποτελέσματα αναφορικά με τη χρονική εξέλιξη της πυκνότητας των ομιλητών της γλώσσας.

Σε αυτή την τεχνική αναφορά, δίνουμε μια επισκόπηση του προγράμματος που υλοποιήσαμε. Περισσότερες πληροφορίες είναι διαθέσιμες στον ιστότοπο της μελέτης (http://docanel.icte.uowm.gr/) και σε προσεχείς δημοσιεύσεις (βλ. Bakalis and Galani (ms), Galani (2011a, b), Galani-Sifaki (ms)).

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Vlachs in Greece

Vlachs in Greece are one of the most idiosyncratic and dynamic groups of Hellenism. This can be proven on the basis of their participation in the liberating fights, their contribution to the financial development of Hellenism as well as the social and culture role they played in Modern Greek life. There is no sufficient information to specify when exactly Vlachs appear in history. The first testimonial is found in Byzantine writers in the 10th century.A As far as the origin of Vlachs is concerned, various theories have been proposed. The majority of them serve various political aims: Vlachs are descendants of Illirii, Thracians, Missi, even of Celts or Italians (Roman colonists). The problem is due to the ethnological establishment of Vlachs, the location where they first appeared and their language.[1]

1.1 The distribution of Vlach population in Greece

The presence of Vlachs is mainly spotted in Epirus, Thessaly and Macedonia. Nevertheless, they do not form a solid (geographical) unit in any of these regions. Vlachs initially resided in various Vlach villages, known as metropolitan or

[1] See also, Capidan (1932), Caragiu-Marioteanu (1968), Hâciu (1925), Papahagi(1932), Papahagi (1974), Papahagi (1935), Rosetti (1968), Sandfeld (1930), Tagliavini (1964), Wace and Thompson (1989), Weigand, (1895), Katsanis and Dinas (1990), Katsanis (1977), Katsuyanis (1964), Keramopulos (1939), Lazaru (1983), Martinianu (1957), Busbukis (1909), Dinas (1987), Christochou(1909).

principal dorms. They moved from these metropolitan regions to the Hellenic and partially to the Balkan area as diaspora, where they either created new solid Vlach settlements or they lived together with other Vlach populations. The formation of Vlach settlements began when Vlachs abandoned the purely nomadic life and became semi-nomads (winter was spent in winter quarters – summer in the mountains).

There is a group of solid Vlach villages, such as Metsovo, Livadi in Olympos, Klissoura, Milia, etc., inhabited throughout the year. A second group of villages is only inhabited in the summer by a small number of farmers and holidaymakers, who originally come from these villages. Such villages are: Samarina, Smiksi, Avdela, Perivoli, Megala Livadia of Paiko, etc.

Additionally, there are villages with only a very small number of inhabitants or no inhabitants at all, such as Nimfeo, Pisoderi, Sirrako, Hionohori, etc.

Finally, Vlachs are found in many villages, towns (such as Elassona, Tirnavos, Prosotsani, Iraklia, Neo Petritri, Velestino, Argos Orestiko, etc.) or cities (such as Larissa, Trikala, Katerini, Kastoria, Florina, Thessaloniki, Veroia, Serres, Ksanthi, Kavala, Ioannina).

1.2 How many Vlachs are there?

Several estimations regarding the number of Vlachs have been made by people who were driven by various political reasons. All these numbers are arbitrary, conflicting and scientifically unsupported. It is easy to distinguish supporters of two different trends depending on their aims: to increase or decrease the

number of the population.

Until the second world war, Vlachs –especially the farmers (breeders)- showed inbred trends, with only a few exceptions in the Greek-speaking populations. More recently, dramatic upheavals are noted in the bilingual Greek groups. Urbanism, abandonment of the traditional professions, immigration, discovery of new professions, reachable education and easier transportations resulted in breaking the tradition of inbreeding among Vlachs.

Consequently, specific criteria need to be set and established prior to a population census of Vlachs.

1.3 The language of Vlachs

Vlachika is a neo-Latin language, independent and equivalent to Italian, French, Spanish, Romanian and originates from the vulgar oral language of the Balkans. It is not a dialect of Romanian, as has been unsuccessfully supported, but a daughter of Latin. It is a language with no (official) state status and no written tradition, as it is also the case with thousands of other languages in the world. This does not determine ethnologically Vlachs, as language is not a unique evidence of national identity, e.g. Mexicans who speak Spanish are not Spanish. Africans who speak French are not French.

Vlachika originates from Balkan-Latin, the language of the Roman troops. Until the arrival of Slavs, Latin managed to push aside the ancient languages of the region (Thrakiki and Illiriki) whereas its contact with Greek in the south of the peninsula was not very effective to the extent that Latin could be imposed to the Greek-speaking world. So, prior to the Slavic immigrations and invasions in

the Balkan region (which changes the linguistic map), the peninsula is divided in two sections; the Latin-speaking section in the North and the Greek-speaking section in the South. These sections are distinguished from one another with the "Jiricek line" –based on the existence of Greek and Latin inscriptions. The line departs from Avlona (Albania), passes through Achrida, Skopia, Sofia and terminates in the estuaries of Dounavis. South of the line the Greek language is in order, whereas the Latin language is met in the north (of course transitional linguistic regions (where both languages are met) are not excluded). The Roman presence –and consequently the Latin language- in the north Greek region lasted over seven centuries (146 B.C. – 530 A.C.).

The presence of the Roman army is strong on both arterial roads (Egnatia and Dounavi). Four neo-Latin languages have been developed around them: Dakoromanian (Romanian), Istroromanian (Dounavi), Aromanian (Vlachika) and Moglenitic around Egnatia. The variation of the Latin dialects, which had been transferred over from the Italian peninsula in the Balkan region, and the aboriginal (native) languages the dialects came in contact with contributed to the creation and distinction of the four neo-Latin languages. The neo-Latin Balkan languages -in comparison to the ones in the West- have a number of common linguistic features which they have inherited from the oral Latin language.

There are several similarities and differences between Aromanian and Dakoromanian. Aromanian is more traditional and has an older character than Dakoromanian, something which brings Aromanian closer to vulgar Latin.

Finally, it should be noted that the largest linguistic influence Aromanian received comes from the Greek language and education. More specifically the linguistic features (some of which are not found in the neo-classical dialects) that

have been incorporated from the Ancient Greek Language to Aromanian convince us that the Romanised Vlachs must have had Greek as their mother tongue.

The use of Aromanian has always been oral and only in the middle 18th century the first written testimonials in the Greek communities abroad (and especially in the region of Moschopoli) appeared for educational reasons explicitly.

1.4 The Vlach names

Vlachs call themselves Αρμάνοι/Αρμάνιι, aka Romanus (cf. Romania = Byzantium) –and in colloquial language "Romious"– the same way all citizens of the Byzantine Empire used to call themselves. The word Αρμάνοι/Αρμάνιι has absolutely no historical connection to the term Romania, Roman (= Romania, Romanian), since those are verbal constructs of the 19th century that were imposed after the foundation of the Romanian State.

The term Vlach is not used by Vlachs themselves just because it was imposed on them by non-Vlachs. Its appearance after the 10th century in byzantine manuscripts was normal and expected, considering that until the 6th – 7th century the Latin language was predominant in the Byzantine Empire. Hence, the term Vlachs, meaning "Latin speakers", was common and well-known. After the 6th century, when the Byzantine Empire became oriented towards the Greek culture, the Latin speakers started causing the curiosity of the foreigners, and particularly the Slavs, when they were trying to separate the Latin speakers from the Greek speakers in the Empire. Scientists came up with the terms Aromanians,

Aroumanians, Aroumains, Macedoroumains etc. These do not fully represent what Vlachs call themselves but they satisfy those who wish to connect the name used for Vlachs to Romains, Romania etc.

The word Vlach originates from the Latin words Volcae, Volci (Volks, Wolks) which refer to a Celtic tribe that lived in Gaul and had learnt Latin. The Volks - Wolks were the closest neighbours to Germanic tribes, a fact that resulted in Germans calling all Latin speakers Volks, the same way they did with their language. The word Volci evolved by Germans and their neighbours and took different forms: Walachen, Welchland, Wallis, Wallais, Wallons, Wales, Welschme etc. These terms are found nowadays in different European languages meaning Latin speaker. The Slavs received it from the Germans as: Olahy, Olahi, Valachi, Voloh, Vloh whereas the Byzantines as Vlachs. Vlachs in Greece have other names too.

Chapter 2

Documentation

In this chapter, we first discuss the data collection methodology and then we offer a sketch analysis of the verbal morphology in Vlachika within Distributed Morphology, (DM), (Halle and Marantz, 1993). We focused on verbal forms, as they show interesting inflectional morphological patterns. They also affect the formation of nominal, adjectival and participial forms, the formation of which may rely to a large extend on verbs.

2.1 Data collection

The data which were used for the purposes of this project were collected through interviews, all of which took place in 2011 in Metsovo. The collection process consisted of two parts:

The first part of the interviews was conducted based on a questionnaire (an implemented version of Beis' (2000) also to allow comparisons) collecting data about: age, educational background, origin, language use (e.g. degree of understanding and speaking, place of practice) of the interviewees and their family members (parents, grandparents, siblings). The age of the interviewees ranged from six to eighty-two years old. One hundred and thirty participants took part.

During the second part of the interviews, the speakers were invited to identify verbs in Vlachika –as used in Metsovo in 2011- which we recorded

digitally. The list of verbs presented to the speakers was a collection of verbal forms we collected during the literature review. The sources varied from dictionaries in Vlachika (c.f. Nikolaidis (1909), Dasulas (2011)), grammar books (c.f. Koltsidas, 1978, Dinas, 1987), online and published material (e.g. poems, songs, short-stories). The elicitation method (contextualisation, translation, judgments) was preferred to naturalistic data. This method was selected as it aimed directly to the speakers' knowledge of the available forms which are found in Metsovo nowadays and excluded forms which may be used in other Vlachika-speaking communities or verbs which are no longer in use. The dictionary consists of six hundred and thirty-nine entries.

2.2 Literature review

Vlachika is spoken in Greece mainly in the north-western part of the country (Epirus and Western Macedonia), in villages and towns surrounding the mountain range Pindos (Metsovo, Milia, etc.). Speakers, who migrated from the villages, are also found in the big cities of the regions (e.g. Ioannina and Kozani, amongst others) nowadays. As early as Koltsidas (1978), reports alert us to the dangers of the language's death. According to the UNESCO findings in 1993, Vlachika has been characterised an endangered language (Salminen (1993); the same claims have also been made in Dinas (2004)).

Several attempts have been made to preserve the language and the cultural heritage of its speakers; a wide selection of poems, songs and short stories are available in audio and written form (the Greek alphabet is mostly used). It is interesting to note the attempts that have been made to compile dictionaries of

Vlachika (c.f. Nikolaidis (1909), Dasulas (2011)); in their majority they come in the form of short dictionaries at the end of books (Vlachika – Greek translations are offered). As far as the formal analyses are concerned, Koltsidas (1978), Dinas (1986, among others), Katsanis and Dinas (1990), and Beis (2000) offer typological descriptions of Vlachika.

Among other topics, the following studies explore the verbal morphology in Vlachika. Koltsidas (1978) briefly sketches verb formation in Vlachika highlighting the formation of ten paradigms on the basis of the suffixes selected. Katsanis and Dinas (1990) offer a grammatical description of the verbal system focusing on conjugational classes. Additionally, Beis (2000) follows Martinet (1985) and provides an analysis of the verbal morphological system. The present study does not aim to identify any weaknesses the afore-mentioned treatments might encounter. It is vital to acknowledge the importance of all attempts that have been made to document and preserve the language. It is best seen as an attempt to formalise a descriptive account and highlight issues that remain open for future research.

2.3 Morphological patterns

The regular morphological patterns are presented in this section. Here we follow Katsanis and Dinas (1990). The interested reader though is also referred to Golab (1984) and Beis (2000), among others, for a similar discussion.

Present active (indicative)				
Scapų *(finish)*	**lucredzų** *(work)*	**mol˘ų** *(soften)*	**isk´edzų** *(straighten)*	**asudų** *(sweat)*
scapų	lucredzų	mol˘ų	isk´édzų	asudų
scak´i	lucredzį	mol˘į	isk´édzį	asudzį
scapă	lucriadză	mual˘e	isk´ádză	asudă
scăpămų	lucrămų	mol˘emų	isk´émų	asudămų
scăpatsį	lucratsį	mol˘atsį	isk´átsį	asudatsį
scapă	lucriadză	mual˘e	isk´ádză	asudă

Table 2.1 Class I: Present active (indicative) (Katsanis and Dinas, 1990: 81)

Present active (indicative)			
Tacų *be silent*	**Vedų** *see*	**Ngapų** *fit*	**Dorų** *Hurt*
tacų	vedų	ngapų	dorų
tatsį	vedzį	ngak´į	dorį
tatse	viade	ngape	duare
tătsemų	videmų	ngăpemų	duremų
tătsetsį	videtsį	ngăpetsį	duretsį
tacų	vedų	ngapų	dorų

Table 2.2 Class II: Present active (indicative) (Katsanis and Dinas, 1990: 87)

Present active (indicative)			
Arupų *tear*	**Dzîcų** *say*	**Armînų** *stay*	**Mulgu** *milk*
arupų	dzîcų	armînų	mulgu
arukį	dzîtsį	armînį	muldzi
arupe	dzîtse	armîne	muldze
arupemų	dzîtsemų	armînemų	muldzemų
arupetsį	dzîtsetsį	armînetsį	muldzetsį
arupų	dzîcų	armînų	mulgu

Table 2.3 Class III: Present active (indicative) (Katsanis and Dinas, 1990: 92)

Present active (indicative)				
Dormu *sleep*	**Hivrescu** *get ill*	**Fugų** *leave*	**Patų** *suffer*	**Avdu** *hear*
dormu	hivrescu	fugų	patų	avdu
dorni	hivrešti	fudzį	patsį	avdzî
duarme	hivriašte	fudze	pate	avde
durnimų	hivrimų	fudzimų	patsimų	avdzîmų
durnitsį	hivritsį	fudzitsį	patsîtsį	avdzîtsį
dormu	hivrescu	fugų	patų	avdu

Table 2.4 Class IIII: Present active (indicative) (Katsanis and Dinas, 1990: 97)

As far as the imperfective, active forms are concerned, the patterns are presented in tables 2.5-2.8 below.

Imperfective, active				
Scapų *(finish)*	**lucredzų** *(work)*	**molˇų** *(soften)*	**iskˊedzų** *(straighten)*	**asudų** *(sweat)*
Scăpamų Scăpaį Scăpa Scăpamų Scăpatsˇį Scăpa	Lucramų Lucraį Lucra lucramų lucratsį lucra	molămų molˇaį mulˇa molˇa ų molˇatsį mualˇa	iskˇ˜amų iskˇ˜aį iskˊa iskˇ˜amų iskˊátsˇį iskˊa	asudamų asudaį asuda asudamų asudatsˇį asuda

Table 2.5 Class I: Imperfective, active (Katsanis and Dinas, 1990: 81)

Imperfective, active			
Tacų *be silent*	**Vedų** *see*	**Ngapų** *fit*	**Dorų** *Hurt*
Tătsiamų Tătsiaį Tătsia Tătsiamų Tătsiatsį Tătsia	Vidiamų Vidiaį Vidia Vidiamų Vidiatsį Vidia	Ngăpiamų Ngăpiaį Ngăpia Ngăpiamų Ngăpiatsį Ngăpia	Duriamų Duriaį Duria Duriamų Duriatsį Duria

Table 2.6 Class II: Imperfective, active (Katsanis and Dinas, 1990: 87)

Imperfective, active			
Arupų *tear*	**Dzîcų** *say*	**Armînų** *stay*	**Mulgu** *milk*
Arupiamų Arupiaį Arupia Arupiamų Arupiatsį Arupia	dzîtsiamų dzîtsiaį Dzîtsia Dzîtsiamų Dzîtsiatsį Dzîtsia	Armîniamų Armîniaį Armînia Armîniamų Armîniatsį Armînia	Muldziamų Muldziaį Muldzia Muldziamų Muldziatsį Muldzia

Table 2.7 Class III: Imperfective, active (Katsanis and Dinas, 1990: 92)

Imperfective, active				
Dormu *sleep*	**Hivrescu** *get ill*	**Fugų** *leave*	**Patų** *suffer*	**Avdu** *hear*
Durńamų Durńaį Durńa Durńamų Durńatsį Durńa	Hivriamų Hivriaį Hivria Hivriamų Hivriatsį Hivria	Fudziamų Fudziaį Fudzia fudziamų fudziatsį Fudzia	Pătsamų Pătsaį Pătsa Pătsamų Patsatsį Pătsa	Avdzamų Avdzaį Avdza Avdzamų Avdzatsį Avdza

Table 2.8 Class IIII: Imperfective, active (Katsanis and Dinas, 1990: 98)

Finally, representative examples of the morphological patterns of the perfective, active forms are presented in tables 2.9-2.12.

Perfective, active				
Scapų *(finish)*	**lucredzų** *(work)*	**molˇų** *(soften)*	**iskˊedzų** *(straighten)*	**asudų** *(sweat)*
Scăpaį Scăpašį Scăpă Scăpămų Scăpatų Scăpară	Lucraį Lucrašį Lucră lucrămų lucratų lucrară	Molˇaį molˇašį mulˇe molˇemų molˇatų mualˇară	iskˊaį iskˊašį iskˊe iskˊemų iskˊatų iskˊ ară	asud aį asud ašį asudă asudămų asudatų asudară

Table 2.9 Class I: Perfective, active (Katsanis and Dinas, 1990: 82)

Perfective, active			
Tacų *be silent*	**Vedų** *see*	**Ngapų** *fit*	**Dorų** *Hurt*
Tăcuį Tăcušį Tăcu Tăcumų Tăcutų Tăcură	Vidzuį Vedzušį Vidzu vidzumų Vidzutų Vedzură	Ngapuį Ngapušį Ngapu Ngapumų Ngaputų Ngapură	Duruį Durušį Duru Durumų Durutų Dorură

Table 2.10 Class II: Perfective, active (Katsanis and Dinas, 1990: 87)

Perfective, active			
Arupų *tear*	**Dzîcų** *say*	**Armînų** *stay*	**Mulgu** *milk*
Arupšų Arupšišį Arupse Arupsimų Arupsitų Arupsiră	dzîšų dzîšišį Dzîse Dzîsimų Dzîsitų Dzîsiră	Armašų Armašišį Armase Armasimų Armasitų Armasiră	Mulšų Mulšišį Mulse Mulsimų Mulsitų Mulsiră

Table 2.11 Class III: Perfective, active (Katsanis and Dinas, 1990: 93)

Perfective, active				
Dormu *sleep*	**Hivrescu** *get ill*	**Fugų** *leave*	**Patų** *suffer*	**Avdu** *hear*
Durńiį Durńaišį Durńi Durńimų Durńitų Durńiră	Hivriį Hivrišį Hivri Hivrimų Hivritų Hivriră	Fudziį Fudzišį Fudzi fudzimų fudzitų Fudziră	Pătsiį Pătsišį Pătsi Păts imų Patsitų Pătsiră	Avdziį Avdzišį Avdzi Avdz imų Avdzitų Avdziră

Table 2.12 Class IIII: Perfective, active (Katsanis and Dinas, 1990: 98)

2.4 Distributed Morphology

Distributed Morphology is a post-syntactic framework developed by Halle and Marantz (1993). A significant aspect of this framework is the way syntactic terminal nodes are seen. Syntactic terminal nodes are complexes of syntactic and semantic features which are called morphemes. These morphemes lack any phonological specification. Head-movement applies at the syntactic component. Once the syntactic operations are complete, the structure enters the morphological component. Morphological processes may further modify the structure mainly before Vocabulary Insertion. *Fusion*, for instance, is the morphological operation by which two terminal nodes are fused into a single one. Only one Vocabulary Item (VI), the specification of which matches the specification of the fused node, can compete for insertion in this node. This contradicts Halle and Marantz (1993) who suggest that the item inserted in the fused node should have a subset of the features of the fused node, including features of both input nodes. It is also contrary to what Oltra-Massuet (1999) claims; the item that may be inserted, should match all or a subset of the features of the fused node.

In addition, Embick and Noyer (1999) develop Marantz's (1988) *Morphological Merger* and claim that the relation between two heads, X and Y, can be replaced by suffixation of the head X to the head Y through *Lowering Merger*. *Lowering Merger* can only occur once all syntactic operations have been completed and especially after raising- but crucially before Vocabulary Insertion. Up to this point, this operation has been mainly treated as part of well-formedness conditions between levels of representation.

Moreover, Vocabulary Insertion is the operation which supplies the terminal nodes with phonological features. It should be noted that Vocabulary Insertion is subject to the *Subset Principle* (Halle 1997); the competition between the VIs is won by the most highly specified item for the features of the given terminal node. VIs are stored in the vocabulary.

Finally, in line with the principle of *Feature Disjointness* (Embick 2000:188), features that are phonological, or purely morphological, or arbitrary properties of VIs, are not present in the syntax; syntacticosemantic features are not inserted in the morphology.

2.5 A DM sketch of conjugational class I verbs in Vlachika

On the basis of the data presented in tables (2.13 – 2.14), one could suggest that the verbal forms consist of the roots, *scap-* (finish) and *asud-* (sweat) and the inflectional suffixes.

Scapų (finish)		
Present, active	*Imperfective, active*	*Perfective, active*
Scapų	scăpamų	scápaį
scak´i	Scăpaį	scăpasį
Scapă	Scăpa	scăpă
Scăpămų	scăpamų	scăpămų
Scăpatsį	scăpatsį	scăpatų
Scapă	Scăpa	scăpară

Table 2.13 Class I (Katsanis and Dinas, 1990: 81-82)

Asudų (sweat)		
Present, active	*Imperfective, active*	*Perfective, active*
Asudų	asudamų	asudai
Asudzį	asudaį	asudašį
Asudă	Asuda	asudă
Asudămų	asudamų	asudămų
Asudatsį	asudatsį	asudatų
Asudă	Asuda	asudară

Table 2.14 Class I (Katsanis and Dinas, 1990: 81-82)

Similarly, the inflectional suffixes are shown in table (2.15). These are the vocabulary items which compete for insertion during the process of vocabulary insertion in Distributed Morphology.

Inflectional suffixes (Agreement/Tense)		
Present, active	*Imperfective, active*	*Perfective, active*
-ų	-amų	-aį
-i	-aį	-asį
-ă	-a	-ă
-ămų	-amų	-ămų
-atsį	-atsį	-atų
-ă	-a	-ară

Table 2.15 Class I (Katsanis and Dinas, 1990: 81-82)

If inflection was either a syntactic or morphological process and based on the afore-mentioned morphological units, one would derive the following forms:[2] *scapă*.3SG.AC.PRES, **scapa*.3SG.AC.PST.IMP (compared to *scăpa*.3SG.AC.PST.IMP) **scapă*.3SG.AC.PRES.PER (compared to scăpă.3SG.AC.PRES.PER) and *asudă*.3SG.AC.PRES, *asuda*.3SG.AC.PST.IMP, *asudă*.3SG.AC.PRES.PER, respectively.

The ungrammaticality of these two forms is an indication that stems exist in the morphological system of Vlachika. The aspectual features seem to be mirrored in the phonological status of the stem. It goes without saying that such a claim requires further thorough investigation (*scapă*.3SG.AC.PRES, *scăpa*.3SG.AC.PST.IMP, scăpă.3SG.AC.PRES.PER).

Moreover, the importance phonology plays in Vlachika seems to be further pictured in the following cases: **scapămų*.1PL.PRES.AC (compared to *scăpămų*. 1PL.PRES.AC), *scapamų*.1PL.IMP.PST.AC, **scapămų*.1PL.PER.AC.PST (compared to *scăpămų*. 1PL.PER.AC.PST).

As for as the 3rd person plural (present and imperfective-past, respectively), the following forms are initially predicted: *scapă*.3PL,PRES.AC, **scapa*.3PL.IMP.AC.PST (compared to *scăpa*.3PL.IMP.AC.PST). finally, if one looks at the 2nd singular, imperfective (active, past) in comparison to the 1st singular, perfective (active, past), the forms would have been identical: **scapaį*.2SG.IMP.AC.PST (in comparison to *scăpaį*.2SG.IMP.AC.PST), and **scapaį*.1SG.PER.AC.PST (compared to *scápaį*.2SG.IMP.AC.PST).

Finally, another interesting point regarding Vlachika based on the data provided is the morphological similarities between the 1st singular/plural

[2] The following abbreviations are used: 3SG (3rd singular), AC (active), PRES (present), PST (past), IMP (imperfective), PER (perfective), PL (plural).

(perfective, active, past): *scăpamų*1SG.AC.PST.IMP and *scăpamų*1PL.AC.PST.IMP. In a similar fashion, the 3rd singular/plural (active, present) forms are: *scapă*.3SG.PRES.AC. and *scapă*.3PL.PRES.AC.

In terms of Distributed Morphology, the syntactic structure would be:[3]

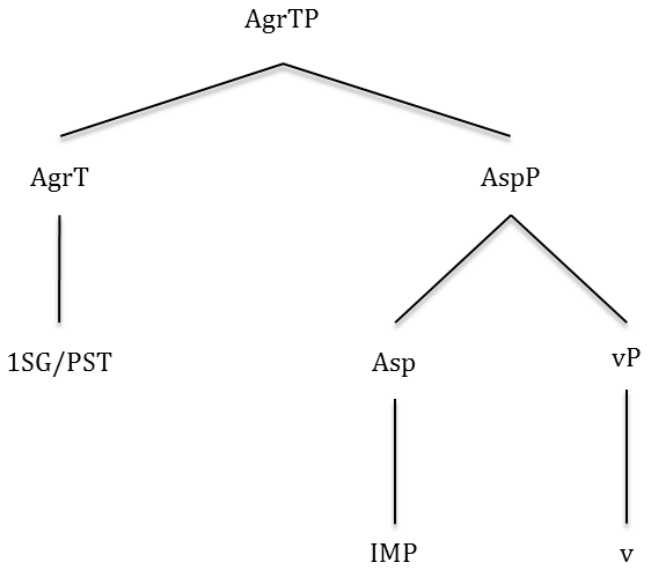

Figure 2.1 DM syntactic structure

Head-movement applies. When the structures enters the morphological component, stem formation occurs. Following, Vocabulary Insertion takes place and the most highly specified items for the features of the terminal nodes are selected. The structure then moves onto the phonological component where further rules modify stems (these may be phonological or readjustment rules).

[3] This is relevant to the verbal forms presented in this section. For the full analysis, see Galani and Sifaki (2012).

Chapter 3

Language evolution dynamics

In this chapter, we study the time evolution of the relative density of Vlachika speakers in Metsovo. In particular, we consider language competition between Greek and Vlachika by means of a two and a three-state model. The first attempts to study language competition were based on classical Lotka-Volterra equations (Case, 1999), where the simplest scenario of two competing species was considered. Later, Abrams and Strogatz (AS) (2003) also introduced a simple two-state model concerning the competition between two languages. The AS model fits well on experimental data and gives the time evolution of two competing monolingual states. The AS model does not account for the internal structure of languages. An extension of the AS model that introduces a third state for bilingual speakers was proposed by Mira and Paredes (MP) (2005). Furthermore, the model introduces the similarity parameter which accounts for the easiness of learning a language, if both languages have common roots.

We focus on the geographical region of North-Western Greece, more specifically the city of Metsovo and the region around it which is part of the prefecture of Ioannina, where both languages, Greek (X) and Vlachika (Y), are spoken. Language X is taught in schools, is used in public services and in most of the commercial transactions. Instead, language Y is used only by a small fraction of the total population of the prefecture of Ioannina; it does not exist in written form and it is transferred orally from one generation to the next. All residents have always been bilingual in X and Y. It is of interest to predict how the number

of bilingual speakers changes as a function of time. For bilinguals, the use of Vlachika constitutes an element of cultural identity. It is also an element related to the residents' professional activities. However, the evolution of the society (for instance, from rural activities to other professions, e.g. services, tourism) resulted at a decrease of the number of speakers, leading progressively to the reduction of the number of individuals who speak or understand Vlachika. Elements of cultural identity are those that encourage bilinguals to use Vlachika and characterize the local community. We consider that this element remains active in the community and it is not influenced by death or birth rates.

3.1 An analytical solution of a two-state model in the limit $y \ll x$

We consider the bilingual community as one state, independent of the tendency of the members of the state to speak to each other in Vlachika, then the time evolution of the competing languages, X (Greek) and Y (Vlachika), could be described on the basis of a two-state model, which can be schematically depicted as in figure 1:

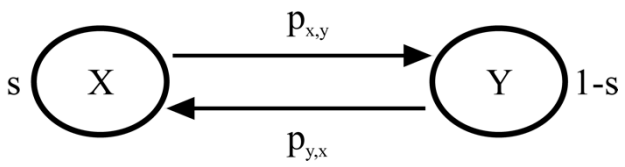

Figure 3.1 A schematic representation of the two-state model, x is the fraction of the total Greek speaking population (X) with prestige s_x, y the fraction of bilingual speakers with prestige s_y, and $s_x + s_y = 1$. The transition probabilities from Greek to Vlachika and vice versa are denoted by $p_{x,y}$, $p_{y,x}$.

All speakers who belong to state Y (Vlachika) are bilingual and the transition probabilities from Greek (X) to Vlachika (Y), and from Vlachika (Y) to Greek (X) are $p_{x,y} = c(1-s)y^{\alpha}$, and $p_{y,x} = csx^{\alpha}$, where $s_x = s$, $s_y = 1-s$, are the prestige parameters of each language, x, y are the relative fractions of speakers at each state, α is the volatility parameter and c is a parameter reflecting the frequency of interaction between pairs of individuals. The rate of change of the relative density of speakers is $\frac{dy}{dt} = xp_{x,y} - yp_{y,x}$ for state Y, and $\frac{dx}{dt} = yp_{y,x} - xp_{x,y}$ for state X. By substituting the form of the transition probabilities, the differential equations that describe figure 1 are $\frac{dx}{dt} = cysx^{\alpha} - cx(1-s)y^{\alpha}$ and $\frac{dy}{dt} = cx(1-s)y^{\alpha} - cysx^{\alpha}$. The changes of the relative fraction of the bilingual speakers as a function of time will be described by the following equation, where the parameter x has been replaced by $x = 1-y$.

$$\frac{dy}{dt} = c(1-y)(1-s)y^{\alpha} - cys(1-y)^{\alpha} \quad (1)$$

Equation (1) can be solved numerically; however, under certain conditions, it can lead to an analytical solution. We consider the case where the number of bilingual speakers, N_Y, is much smaller than the number of monolinguals in X, N_X, and this assumption is true for the case under study. As $y \ll x$, which is equivalent to $y \ll 1$, equation (1) can be expanded regarding the parameter y, and by solving the latter we arrive to the analytical solution

$$y(t) = \exp(-cst)\left\{\left(\frac{N_Y(0)}{N_X(0)+N_Y(0)}\right)^{(1-\alpha)} + \frac{1-s}{s}(\exp\,(cs(1-\alpha)t) - 1)\right\}^{\frac{1}{1-\alpha}} \quad (2)$$

Equation (2) gives the relative density of bilingual speakers, $y(t)$, as a function of time, the prestige, and the volatility parameter. Additionally, this is given for the first time. The number of bilinguals is given by the following expression:

$$N_Y(t) = \big(N_X(0) + N_Y(0)\big)\exp(-cst)\left\{\left(\frac{N_Y(0)}{N_X(0)+N_Y(0)}\right)^{(1-\alpha)} + \frac{1-s}{s}(\exp\,(cs(1-\alpha)t) - 1)\right\}^{\frac{1}{1-\alpha}} \quad (3)$$

3.2 The three-state model

The three-state model can be schematically depicted as in figure 2:

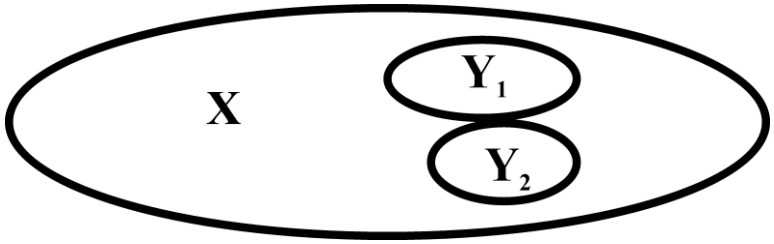

Figure 3.2 A schematic representation of the three-state model; X is the Greek speaking population with relative fraction x, Y_1 stands for bilinguals who do not have the tendency to speak to each other in Vlachika with relative fraction y_1, and Y_2 stands for bilinguals with the tendency to speak to each other in Vlachika with relative fraction y_2. All bilinguals are contained in Y_1 and Y_2 and $x + y_1 + y_2 = 1$.

Similarly to the two-state model, we define as $p_{k,m}$ the transition probability from state k to state m and it has the form $p_{k,m} = cs_m m^{\alpha}$ $(k, m = x, y)$, where s_k is the prestige of each language $(s_k + s_m = 1)$, k is the fraction of speakers in K and α is the volatility parameter. We have three different pairs of interaction (X, Y_1), (X, Y_2), and (Y_1, Y_2). The prestige parameter of the language X, s_x, will be the same in both cases: for speakers transferred from Y_1 to X and from Y_2 to X. For the pair of interaction (Y_1, Y_2) we define the relative culture parameters $w_{2,1}$ and $w_{1,2}$ which reflects the tendency of a bilingual to use Vlachika among bilinguals. Prestige parameters and culture parameters are added to unity, $s_x + s_y = 1$, and $w_{1,2} + w_{2,1} = 1$. The transition probabilities for figure 2 are the following $p_{x,y_1} = cs_y y_1^{\alpha}$, $p_{x,y_2} = cs_y y_2^{\alpha}$, $p_{y_1,x} = p_{y_2,x} = cs_x x^{\alpha}$, $p_{y_1,y_2} = c_1 w_{1,2} y_2^{b}$, and $p_{y_2,y_1} = c_1 w_{2,1} y_1^{b}$. For the pair (Y_1, Y_2) the parameter c_1, which expresses rates of interactions between individuals, is different than the corresponding parameter c for the pairs (X, Y_1) and (X, Y_2), as in this case the interactions are more frequent than the other two pairs. The rate of change for the fraction of speakers is given by the following equations:

$$\frac{dy_1}{dt} = c_1 y_2 w_{2,1} y_1^{b} + cxs_y y_1^{\alpha} - y_1(c_1 w_{1,2} y_2^{b} + cs_x x^{\alpha})$$

$$\frac{dx}{dt} = cs_x(y_1 + y_2)x^{\alpha} - cs_y x(y_1^{\alpha} + y_2^{\alpha})$$

$$\frac{dy_2}{dt} = c_1 y_1 w_{1,2} y_2^{b} + cxs_y y_2^{\alpha} - y_2(c_1 w_{2,1} y_1^{b} + cs_x x^{\alpha})$$

The total population remains constant as a function of time. The total fraction of bilinguals independently of their tendency to speak to each other in Vlachika is $y = y_1 + y_2$. By adding the first and the third of the above equations and by substituting $x = 1 - y$ and $y_1 = y - y_2$, we end up with the following of differential equations:

$$\frac{dy}{dt} = c(1 - s_x)(1 - y)((y - y_2)^\alpha + y_2^\alpha) - cs_x y(1 - y)^\alpha \quad (4)$$

$$\frac{dy_2}{dt} = c_1(y - y_2)w_{1,2}y_2^b + c(1 - y)(1 - s_x)y_2^\alpha - y_2(c_1(1 - w_{1,2})(y - y_2)^b + cs_x(1 - y)^\alpha) \quad (5)$$

Independently of the frame of description (two or three-state model), the change of the relative fraction of bilingual speakers as a function of time ought to be the same. The latter means that equation (4) must describe in exactly the same way the change of bilingual speakers, as equation (1) does.

3.3 Discussion

Equation (2) will be fitted on experimental data in order to unravel the prestige of each language s_x and s_y, as well as the volatility parameter α. Then these parameters will be fixed on equation (4) and by fitting the experimental data on equations (4) and (5), we find the relative culture parameter $w_{1,2}$ and the exponent b which reflect internal changes in the bilingual community. Given the fact that the models' parameters are known, then estimations regarding any changes of the relative density of bilinguals as a function of time could be made. Unfortunately, data regarding the number of bilinguals in previous years is not

available, to the best of our knowledge. So, the best solution was to collect data from children, parents, and grandparents as far their ability to use and understand Vlachika is concerned. This could provide useful information about previous stages of the language.

As it has already been mentioned, the region in which Vlachika is spoken, is part of the prefecture of Ioannina. According to the last census, the total population of the prefecture is 170,000 residents of which 6,000 of them live in Metsovo and the surrounding areas and constitute the potential bilingual community. Nowadays, a fraction of the 6,000 residents speak or understand Vlachika. More specifically, people in their 70s are bilingual, the fraction decreases for people in their 40s and it is very small for children around the age of 10. In order to extend our experimental data which was collected in 2011, to previous years, we make the following assumption; the number of grandfathers equals to the number of grandmothers, fathers, mothers and children. So, the residents of the area consist of 1,000 grandfathers (70 years old), 1,000 grandmothers (66 years old), 1,000 fathers (40 years old), 1,000 mothers (35 years old), and 1,000 children (10 years old), and 1,000 speakers for which no data could be collected during the present research. It is worth mentioning that the afore-mentioned ages are mean averages. Furthermore, as Vlachika is an oral language transferred from one generation to the next (mostly used at home and at work), we may also assume that the ability of a 10-year old member of the community to use Vlachika is not expected to be significantly great (in terms of the vocabulary, for instance). In this way, we have a representative sample of the speakers who use Vlachika, as a function of time e.g. the ability of a member of 70 years old in 2011 to use Vlachika is the same with her/his ability when she/he

was ten-years old. So, we only focus on a sub-space of the speakers, namely, the children who give us fractions of bilinguals from 1951 onwards. The fraction of people who use/understand Vlachika are listed in table 3.1, the relative fraction y stands for the two state model and the relative fractions y_1 and y_2 stand for the three-state model.

Year	y	y_1	y_2
1951	0.006	0.0016	0.0044
1955	0.0059	0.0014	0.0045
1981	0.003	0.0022	0.00086
1986	0.0028	0.0022	0.0006
2011	0.0014	0.0012	0.0002

Table 3.1 The relative fraction of bilingual children is listed for each model. The population of the sub-space in which we focus consists of 1,000 children. This number of residents interacts with 164,000 monolinguals in Greek. With y is denoted the relative fraction of bilinguals for the two-state model, y_1 represents the fraction of bilingual speakers with no tendency to speak to each other in Vlachika and y_2 gives the relative fraction of bilinguals with the tendency to speak in Vlachika, y_1 and y_2 are used in the three-state model, $y = y_1 + y_2$.

By setting 1951 as the origin of time, then in 1951 the relative fraction of bilingual children was 0.006, 30 years later it was 0.003, and now it is 0.0014. The analytical solution of the two-state model, equation (2), is fitted on the experimental data, under the constraints $0.5 < s < 1$, $1 < \alpha < 1.5$, and

$0.01 < c < 0.1$. The first constraint holds as the prestige of Greek is greater than that of Vlachika's, the second one allows for α to take values in the range also specified by the findings of the Abrams and Strogatz's (AS) model (2003). The third one sets as an upper limit the findings of the Mira and Parades' (MP) model (2005), where the simulations were done for competing languages with common origin. We find $\alpha = 1.23$, $s = 0.66$ and $c = 0.04$ and both experimental findings and analytical predictions of equation (2) are shown in figure 3.3a. The bilinguals' rate of change is not affected by the frame of description (two or three-state models), so, the estimated values for c, α, and s are substituted in equation (4) and then by fitting equations (4-5) on experimental data (the relative fractions y_1 and y_2) we find $c_1 = 5$, $w_{1,2} = 0.18$ and $b = 0.74$. In figure 3.3c and figure 3.3d the change of the relative fractions y_1 and y_2 is shown.

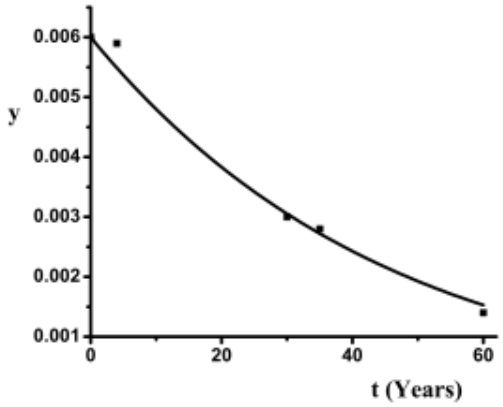

Figure 3.3a

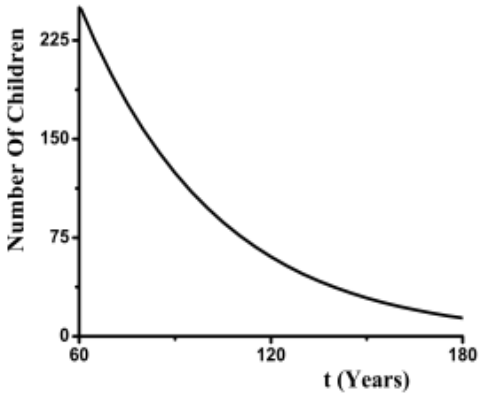

Figure 3.3b

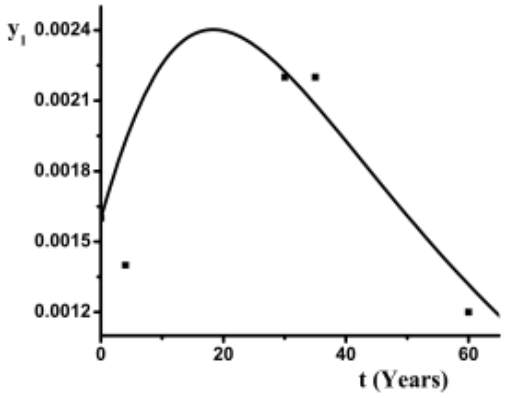

Figure 3.3c

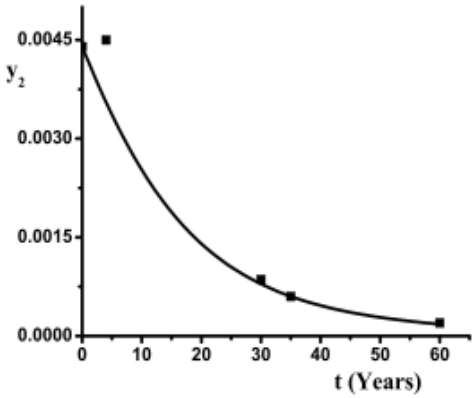

Figure 3.3d

Figure 3.3 In all graphs, squares stand for the experimental data and solid lines for the models' estimations. In figure 3.3a, the solid line for equation (2). In figure 3.3b, the solid line for equation (9) (the number of bilingual children as a function of time). In figure 3.3c, the solid line for the relative fraction y_1. In figure 3.3d, the solid line for the relative fraction y_2 predicted by equation (4). By applying the three-state model, the total fraction of bilinguals, $y = y_1 + y_2$, has exactly the same form with figure 3.3a. In all graphs, the origin of time is 1951.

3.4 Conclusion

A more detailed experimental research, which will cover a broader spectrum of ages, is necessary in order to reach safer conclusions and minimize any possible errors. Nevertheless, the usefulness of the provided model (two and three-state model) is clear; they can provide information not only regarding the linguistic transfer of bilingual speakers into monolingual groups but they may also give information about internal changes occurring in the community. On one hand, it is the first time that an analytical solution regarding the number of speakers between two competing languages is given. On the other hand, the three-state model may reveal internal social self-organisations depending on the speakers' sex, thus reflecting social changes on the transfers occurring in the bilingual communities. Based on the aforementioned graphs, from figure 3.3a to figure 3.3d, and especially from figure 3.3b, it is clear that Vlachika is a language that faces the risk of extinction, as the relative fraction of bilingual children decreases over the years.

Chapter 4

DocAnEL website

In this chapter, we provide some highlights for the project's website together some technical details on how it was implemented. The website is available at http://docanel.icte.uowm.gr and was created using the drupal platform (http://www.drupal.org).

Figure 4.1 DocAnEL Website Homepage

The website has the following structure:

- Background information
- Electronic dictionary
- Modeling language dynamics
- Maps
- Photo gallery
- Bibliography and links

4.1 Background information

This section provides information about the presence of Vlachs in Greece, aspects of their culture and language. Parts of this material is given in Chapter 1.

4.2 Electronic dictionary

The dictionary contains words in Vlachika together with their English and Greek translations. Since Vlachika is an oral language, instead of written forms, the dictionary provides recordings which also help in the preservation of the language.

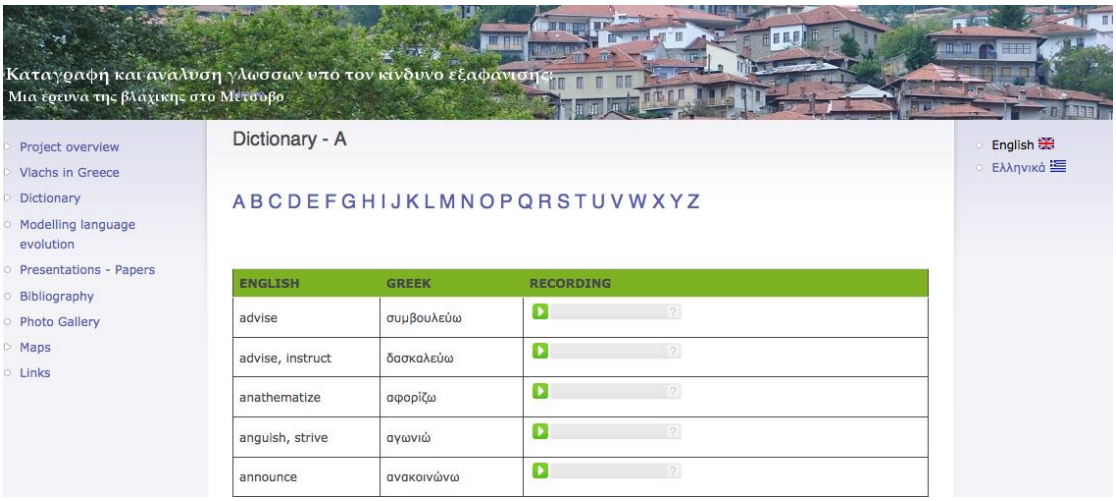

Figure 4.2 Dictionary

The dictionary is stored in a MySQL database hosted in the same server as the web application. The physical address of the audio files is located in the storage medium of the server whereas the English and Greek translations are

hosted in a MySQL table. The contents of the MySQL database were exported automatically to an html format. The audio files were stored in MP3 format. The bit ratio of these files is constant and equal to 44 Kbit/s. In order to make the audio files accessible from the web interface we used the lightweight flash MP3 player dewplayer (http://www.alsacreations.fr/dewplayer.html). To that end, the following fragment was inserted into the html code:

```
<object type="application/x-shockwave-flash" data="dewplayer.swf"
width="200" height="20" id="dewplayer" name="dewplayer">
<param name="movie" value="dewplayer.swf" />
<param name="flashvars" value="mp3=test.mp3" />
<param name="wmode" value="transparent" />
</object>
```

The dewplayer flash plugin provides a simple interface where one can play an MP3 file and increase or decrease its volume. This simple interface suffices for our purposes since the duration of each recorded audio file is very short (a few seconds).

The words are also organized in a semantic network which provides a classification of words into semantic groups, e.g., States, Perception, Emotions (Fellbaum, 1998) (see figure 4.3).

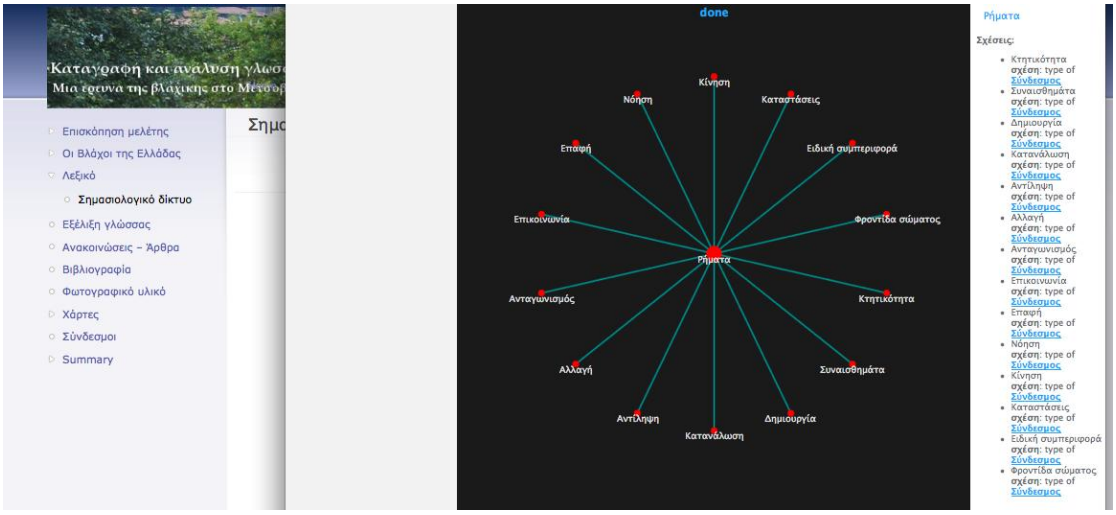

Figure 4.3 Verb classification

For the visualization of the semantic network we used the Javascript InfoVis Toolkit (http://thejit.org), which provides an extensive library of Javascript routines, for visualizing data and viewing them on the Internet. The input files used for the various parts of the semantic network are in the JSON (http://www.json.org) format.

Various hyperlinks appear next to the semantic network. There is a hyperlink for each word or semantic group that appears on the network. Clicking on a link corresponding to a semantic group expands the semantic sub-network of the selected group (see figure 4.4). A link corresponding to a word leads to the relevant dictionary entry.

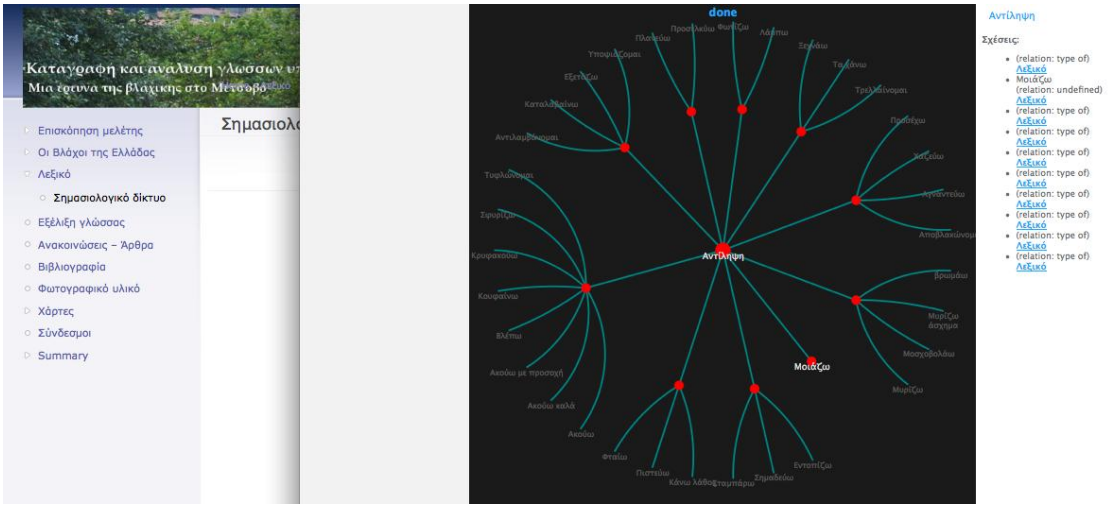

Figure 4.4 Expanded semantic group

4.3 Linguistic analysis

This section refers to the morphological study of the verbs in Vlachika as formulated within the theoretical framework of Distributed Morphology. It also provides information regarding the methodology of the data collection. Part of this material is covered in Chapter 2.

4.4 Models of language dynamics

This section refers to our study of language dynamics, i.e. mathematical models of the time evolution of the relative density of Vlachika speakers in Metsovo, as previously described in Chapter 3.

4.5 Maps

This section contains various maps (geophysical, political and linguistic) of Metsovo and surroundings areas. A linguistic map is shown in figure 4.5 below.

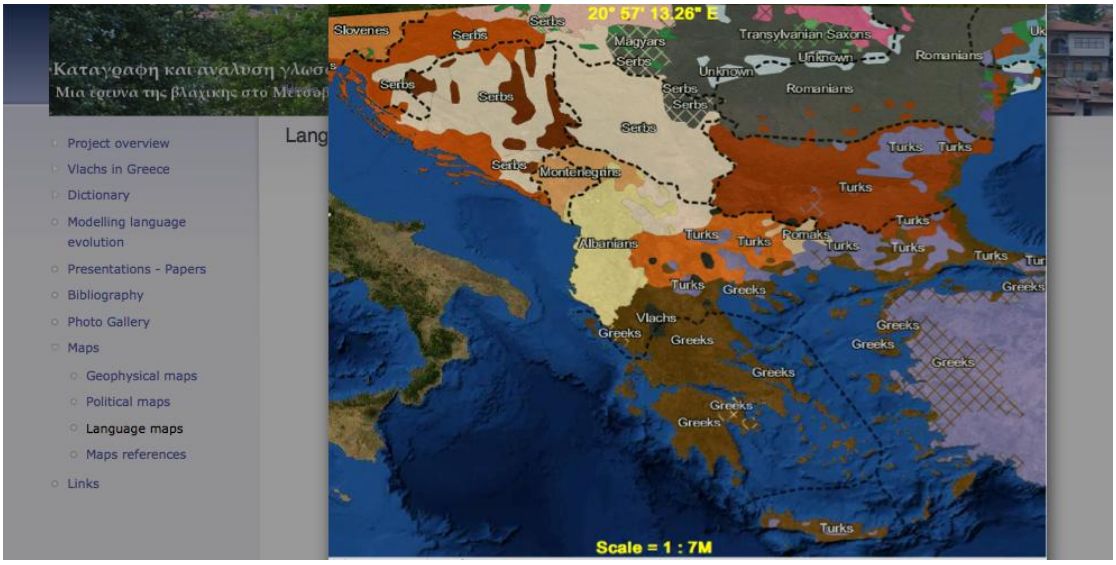

Figure 4.5 Linguistic map

4.6 Photo gallery

Various photos taken in 2011 in Metsovo by our team are available in this section, as shown in figure 4.6.

Figure 4.6 A photo of Metsovo

4.7 Bibliography and links

A selection of relevant publications and useful links are provided in this section.

Chapter 5

Conclusions and future work

In this project, we implemented a documentation of the verbal forms in Vlachika as met in Metsovo in 2011. We provided a linguistic treatment of these forms within Distributed Morphology. Furthermore, we considered mathematical models for the language's dynamics which we applied to experimental data.

Our work, however, does not end here. This project was an important first step towards meeting the following goals:

(a) Provide a comprehensive electronic documentation of Vlachika in Metsovo. Further documentation via data collection extended to other parts of speech and structures will enrich our electronic dictionary. It will also contribute to the preservation of the language at its current state.

(b) Offer theoretical linguistic treatments of the languages' structures (i.e. morphological, syntactic, semantic).

(c) Refine our mathematical models of the language's dynamics. We plan to collect more data in the future to monitor the state of the use of Vlachika in Metsovo. This will enable us to test our models and propose more comprehensive ones.

(d) Enhance the DocAnEL website. We plan to enrich the semantic network by including additional parts of speech and structures which will enable us to represent additional types of relations between the documented words/phrases, following the paradigm of Wordnet

(http://wordnet.princeton.edu) and related efforts. We also plan to explore other forms of data visualisation and operations.

Finally, we believe it would be interesting to carry out similar studies to other Vlachika-speaking regions (not only in Greece but also abroad), as this will give the opportunity to compare and contrast the findings on linguistic structures and language use.

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