FACHLITERATUR
EDITION ROMIOSINI
ΕΠΙΣΤΗΜΗ

ICGL12 | 12th INTERNATIONAL CONFERENC ON GREEK LINGUISTICS
16 – 19 SEPTEMBER 2015
FREIE UNIVERSITÄT BERLIN, CEMOG

Proceedings of the ICGL12

vol. 2

The International Conference on Greek Linguistics is a biennial meeting on the study and analysis of Greek (Ancient, Medieval and Modern), placing particular emphasis on the later stages of the language.

PROCEEDINGS OF THE ICGL12
ΠΡΑΚΤΙΚΑ ΤΟΥ ICGL12

Thanasis Georgakopoulos, Theodossia-Soula Pavlidou, Miltos Pechlivanos, Artemis Alexiadou, Jannis Androutsopoulos, Alexis Kalokairinos, Stavros Skopeteas, Katerina Stathi (Eds.)

PROCEEDINGS OF THE 12TH INTERNATIONAL CONFERENCE ON GREEK LINGUISTICS

ΠΡΑΚΤΙΚΑ ΤΟΥ 12ΟΥ ΣΥΝΕΔΡΙΟΥ ΕΛΛΗΝΙΚΗΣ ΓΛΩΣΣΟΛΟΓΙΑΣ

VOL. 2

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Vertrieb und Gesamtherstellung: Epubli (www.epubli.de)
Satz und Layout: Rea Papamichail / Center für Digitale Systeme, Freie Universität Berlin
Gesetzt aus Minion Pro
Umschlaggestaltung: Thanasis Georgiou, Yorgos Konstantinou
Umschlagillustration: Yorgos Konstantinou

ISBN 978-3-946142-35-5
Printed in Germany

Online-Bibliothek der Edition Romiosini:
www.edition-romiosini.de

ΠΕΡΙΕΧΟΜΕΝΑ

Σημείωμα εκδοτών 7

Περιεχόμενα 9

Peter Mackridge:
Some literary representations of spoken Greek before nationalism(1750-1801) 17

Μαρία Σηφιανού:
Η έννοια της ευγένειας στα Ελληνικά 45

Σπυριδούλα Βαρλοκώστα:
Syntactic comprehension in aphasia and its relationship to working memory deficits 75

Ευαγγελία Αχλάδη, Αγγελική Δούρη, Ευγενία Μαλικούτη & Χρυσάνθη Παρασχάκη-Μπαράν:
Γλωσσικά λάθη τουρκόφωνων μαθητών της Ελληνικής ως ξένης/δεύτερης γλώσσας: Ανάλυση και διδακτική αξιοποίηση 109

Κατερίνα Αλεξανδρή:
Η μορφή και η σημασία της διαβάθμισης στα επίθετα που δηλώνουν χρώμα 125

Eva Anastasi, Ageliki Logotheti, Stavri Panayiotou, Marilena Serafim & Charalambos Themistocleous:
A Study of Standard Modern Greek and Cypriot Greek Stop Consonants: Preliminary Findings 141

Anna Anastassiadis-Symeonidis, Elisavet Kiourti & Maria Mitsiaki:
Inflectional Morphology at the service of Lexicography: ΚΟΜΟΛεξ, A Cypriot Morphological Dictionary 157

Γεωργία Ανδρέου & Ματίνα Τασιούδη:
Η ανάπτυξη του λεξιλογίου σε παιδιά με Σύνδρομο Απνοιών στον Ύπνο 175

Ανθούλα- Ελευθερία Ανδρεσάκη:
Ιατρικές μεταφορές στον δημοσιογραφικό λόγο της κρίσης: Η οπτική γωνία των Γερμανών 187

Μαρία Ανδριά:
Προσεγγίζοντας θέματα Διαγλωσσικής Επίδρασης μέσα από το πλαίσιο της Γνωσιακής Γλωσσολογίας: ένα παράδειγμα από την κατάκτηση της Ελληνικής ως Γ2 199

Spyros Armostis & Kakia Petinou:
Mastering word-initial syllable onsets by Cypriot Greek toddlers with and without early language delay 215

Julia Bacskai-Atkari:
Ambiguity and the Internal Structure of Comparative Complements in Greek 231

Costas Canakis:
Talking about same-sex parenthood in contemporary Greece: Dynamic categorization and indexicality 243

Michael Chiou:
The pragmatics of future tense in Greek 257

Maria Chondrogianni:..
The Pragmatics of the Modern Greek Segmental Markers 269

Katerina Christopoulou, George J. Xydopoulos &Anastasios Tsangalidis:
Grammatical gender and offensiveness in Modern Greek slang vocabulary 291

Aggeliki Fotopoulou, Vasiliki Foufi, Tita Kyriacopoulou & Claude Martineau:
Extraction of complex text segments in Modern Greek 307

Αγγελική Φωτοπούλου & Βούλα Γιούλη:
Από την «Έκφραση» στο «Πολύτροπο»: σχεδιασμός και οργάνωση ενός εννοιολογικού λεξικού 327

Marianthi Georgalidou, Sofia Lampropoulou, Maria Gasouka, Apostolos Kostas & Xanthippi Foulidi:
"Learn grammar": Sexist language and ideology in a corpus of Greek Public Documents 341

Maria Giagkou, Giorgos Fragkakis, Dimitris Pappas & Harris Papageorgiou:
Feature extraction and analysis in Greek L2 texts in view of automatic labeling for proficiency levels 357

Dionysis Goutsos, Georgia Fragaki, Irene Florou, Vasiliki Kakousi & Paraskevi Savvidou:
The Diachronic Corpus of Greek of the 20th century: Design and compilation 369

Kleanthes K. Grohmann & Maria Kambanaros:
Bilectalism, Comparative Bilingualism, and theGradience of Multilingualism:
A View from Cyprus 383

Günther S. Henrich:
„Γεωγραφία νεωτερική" στο Λίβιστρος και Ροδάμνη: μετατόπιση ονομάτων βαλτικών
χωρών προς την Ανατολή; 397

Noriyo Hoozawa-Arkenau & Christos Karvounis:
Vergleichende Diglossie - Aspekte im Japanischen und Neugriechischen:
Verietäten - Interferenz 405

Μαρία Ιακώβου, Ηριάννα Βασιλειάδη-Λιναρδάκη, Φλώρα Βλάχου, Όλγα Δήμα, Μαρία Καββαδία, Τατιάνα Κατσίνα, Μαρίνα Κουτσουμπού, Σοφία-Νεφέλη Κύτρου, Χριστίνα Κωστάκου, Φρόσω Παππά & Σταυριαλένα Περρέα:
ΣΕΠΑΜΕ2: Μια καινούρια πηγή αναφοράς για την Ελληνική ως Γ2 419

Μαρία Ιακώβου & Θωμαΐς Ρουσουλιώτη:
Βασικές αρχές σχεδιασμού και ανάπτυξης του νέου μοντέλου αναλυτικών
προγραμμάτων για τη διδασκαλία της Ελληνικής ως δεύτερης/ξένης γλώσσας 433

Μαρία Καμηλάκη:
«Μαζί μου ασχολείσαι, πόσο μαλάκας είσαι!»: Λέξεις-ταμπού και κοινωνιογλωσσικές
ταυτότητες στο σύγχρονο ελληνόφωνο τραγούδι 449

Μαρία Καμηλάκη, Γεωργία Κατσούδα & Μαρία Βραχιονίδου:
Η εννοιολογική μεταφορά σε λέξεις-ταμπού της ΝΕΚ και των νεοελληνικών
διαλέκτων 465

Eleni Karantzola, Georgios Mikros & Anastassios Papaioannou:
Lexico-grammatical variation and stylometric profile of autograph texts
in Early Modern Greek 479

Sviatlana Karpava, Maria Kambanaros & Kleanthes K. Grohmann:
Narrative Abilities: MAINing Russian–Greek Bilingual Children in Cyprus 493

Χρήστος Καρβούνης:
Γλωσσικός εξαρχαϊσμός και «ιδεολογική» νόρμα: Ζητήματα γλωσσικής διαχείρισης
στη νέα ελληνική 507

Demetra Katis & Kiki Nikiforidou:
Spatial prepositions in early child Greek:Implications for acquisition, polysemy and historical change 525

Γεωργία Κατσούδα:
Το επίθημα -ούνα στη ΝΕΚ και στις νεοελληνικές διαλέκτους και ιδιώματα 539

George Kotzoglou:
Sub-extraction from subjects in Greek: Its existence, its locus and an open issue 555

Veranna Kyprioti:
Narrative, identity and age: the case of the bilingual in Greek and Turkish Muslim community of Rhodes, Greece 571

Χριστίνα Λύκου:
Η Ελλάδα στην Ευρώπη της κρίσης: Αναπαραστάσεις στον ελληνικό δημοσιογραφικό λόγο 583

Nikos Liosis:
Systems in disruption: Propontis Tsakonian 599

Katerina Magdou, Sam Featherston:
Resumptive Pronouns can be more acceptable than gaps: Experimental evidence from Greek 613

Maria Margarita Makri:
Opos identity comparatives in Greek: an experimental investigation 629

2ος Τόμος

Περιεχόμενα 651

Vasiliki Makri:
Gender assignment to Romance loans in Katoitaliótika: a case study of contact morphology 659

Evgenia Malikouti:
Usage Labels of Turkish Loanwords in three Modern Greek Dictionaries 675

Persephone Mamoukari & Penelope Kambakis-Vougiouklis:
Frequency and Effectiveness of Strategy Use in SILL questionnaire using an Innovative Electronic Application 693

Georgia Maniati, Voula Gotsoulia & Stella Markantonatou:
Contrasting the Conceptual Lexicon of ILSP (CL-ILSP) with major lexicographic examples 709

Γεώργιος Μαρκόπουλος & Αθανάσιος Καρασίμος:
Πολυεπίπεδη επισημείωση του Ελληνικού Σώματος Κειμένων Αφασικού Λόγου 725

Πωλίνα Μεσηνιώτη, Κατερίνα Πούλιου & Χριστόφορος Σουγανίδης:
Μορφοσυντακτικά λάθη μαθητών Τάξεων Υποδοχής που διδάσκονται την Ελληνική ως Γ2 741

Stamatia Michalopoulou:
Third Language Acquisition. The Pro-Drop-Parameter in the Interlanguage of Greek students of German 759

Vicky Nanousi & Arhonto Terzi:
Non-canonical sentences in agrammatism: the case of Greek passives 773

Καλομοίρα Νικολού, Μαρία Ξεφτέρη & Νίτσα Παραχεράκη:
Το φαινόμενο της σύνθεσης λέξεων στην κυκλαδοκρητική διαλεκτική ομάδα 789

Ελένη Παπαδάμου & Δώρης Κ. Κυριαζής:
Μορφές διαβαθμιστικής αναδίπλωσης στην ελληνική και στις άλλες βαλκανικές γλώσσες 807

Γεράσιμος Σοφοκλής Παπαδόπουλος:
Το δίπολο «Εμείς και οι Άλλοι» σε σχόλια αναγνωστών της Lifo σχετικά με τη Χρυσή Αυγή 823

Ελένη Παπαδοπούλου:
Η συνδυαστικότητα υποκοριστικών επιθημάτων με β′ συνθετικό το επίθημα -άκι στον διαλεκτικό λόγο 839

Στέλιος Πιπερίδης, Πένυ Λαμπροπούλου & Μαρία Γαβριηλίδου:
clarin:el. Υποδομή τεκμηρίωσης, διαμοιρασμού και επεξεργασίας γλωσσικών δεδομένων 851

Maria Pontiki:
Opinion Mining and Target Extraction in Greek Review Texts 871

Anna Roussou:
The duality of mipos 885

Stathis Selimis & Demetra Katis:
Reference to static space in Greek: A cross-linguistic and developmental perspective of poster descriptions 897

Evi Sifaki & George Tsoulas:
XP-V orders in Greek 911

Konstantinos Sipitanos:
On desiderative constructions in Naousa dialect 923

Eleni Staraki:
Future in Greek: A Degree Expression 935

Χριστίνα Τακούδα & Ευανθία Παπαευθυμίου:
Συγκριτικές διδακτικές πρακτικές στη διδασκαλία της ελληνικής ως Γ2: από την κριτική παρατήρηση στην αναπλαισίωση 945

Alexandros Tantos, Giorgos Chatziioannidis, Katerina Lykou, Meropi Papatheohari, Antonia Samara & Kostas Vlachos:
Corpus C58 and the interface between intra- and inter-sentential linguistic information 961

Arhonto Terzi & Vina Tsakali:
The contribution of Greek SE in the development of locatives 977

Paraskevi Thomou:
Conceptual and lexical aspects influencing metaphor realization in Modern Greek 993

Nina Topintzi & Stuart Davis:
Features and Asymmetries of Edge Geminates 1007

Liana Tronci:
At the lexicon-syntax interface Ancient Greek constructions with ἔχειν and psychological nouns 1021

Βίλλυ Τσάκωνα:
«Δημοκρατία είναι 4 λύκοι και 1 πρόβατο να ψηφίζουν για φαγητό»:Αναλύοντας τα ανέκδοτα για τους/τις πολιτικούς στην οικονομική κρίση 1035

Ειρήνη Τσαμαδού- Jacoberger & Μαρία Ζέρβα:
Εκμάθηση ελληνικών στο Πανεπιστήμιο Στρασβούργου: κίνητρα και αναπαραστάσεις ... 1051

Stavroula Tsiplakou & Spyros Armostis:
Do dialect variants (mis)behave? Evidence from the Cypriot Greek koine 1065

Αγγελική Τσόκογλου & Σύλα Κλειδή:
Συζητώντας τις δομές σε -οντας 1077

Αλεξιάννα Τσότσου:
Η μεθοδολογική προσέγγιση της εικόνας της Γερμανίας στις ελληνικές εφημερίδες 1095

Anastasia Tzilinis:
Begründendes Handeln im neugriechischen Wissenschaftlichen Artikel: Die Situierung des eigenen Beitrags im Forschungszusammenhang..... 1109

Κυριακούλα Τζωρτζάτου, Αργύρης Αρχάκης, Άννα Ιορδανίδου & Γιώργος Ι. Ξυδόπουλος:
Στάσεις απέναντι στην ορθογραφία της Κοινής Νέας Ελληνικής: Ζητήματα ερευνητικού σχεδιασμού 1123

Nicole Vassalou, Dimitris Papazachariou & Mark Janse:
The Vowel System of Mišótika Cappadocian 1139

Marina Vassiliou, Angelos Georgaras, Prokopis Prokopidis & Haris Papageorgiou:
Co-referring or not co-referring? Answer the question!..... 1155

Jeroen Vis:
The acquisition of Ancient Greek vocabulary..... 1171

Christos Vlachos:
Mod(aliti)es of lifting wh-questions..... 1187

Ευαγγελία Βλάχου & Κατερίνα Φραντζή:
Μελέτη της χρήσης των ποσοδεικτών λίγο-λιγάκι σε κείμενα πολιτικού λόγου 1201

Madeleine Voga:
Τι μας διδάσκουν τα ρήματα της ΝΕ σχετικά με την επεξεργασία της μορφολογίας..... 1213

Werner Voigt:
«Σεληνάκι μου λαμπρό, φέγγε μου να περπατώ …» oder: warum es in dem bekannten Lied nicht so, sondern eben φεγγαράκι heißt und ngr. φεγγάρι 1227

Μαρία Βραχιονίδου:
Υποκοριστικά επιρρήματα σε νεοελληνικές διαλέκτους και ιδιώματα 1241

Jeroen van de Weijer & Marina Tzakosta:
*The Status of *Complex in Greek*..... 1259

Theodoros Xioufis:
The pattern of the metaphor within metonymy in the figurative language of romantic love in modern Greek..... 1275

THE CONTRIBUTION OF GREEK SE IN THE DEVELOPMENT OF LOCATIVES

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Περίληψη

Η κατάκτηση των σύνθετων τοπικών προθέσεων της Ελληνικής οδηγεί στο συμπέρασμα ότι ο τρόπος που οι γλώσσες εκφράζουν μία τοπική έννοια αντικατοπτρίζεται στην ηλικία και τη σειρά κατάκτησής τους (Terzi κ.α. 2015). Το παρόν άρθρο επικεντρώνεται στη μελέτη της κατάκτησης των διαφορετικών σημασιών της τοπικής πρόθεσης σε και στη σύγκριση των ζευγών σε - μέσα σε και σε - πάνω σε. Στόχος είναι η εμβάθυνση του ρόλου που διαδραματίζει η γλωσσική κωδικοποίηση στην κατάκτηση των τοπικών εννοιών. Τα πειραματικά ευρήματα της παρούσας εργασίας δείχνουν ότι ταυτόχρονα με την καθολική γνωστική σειρά κατάκτησης των τοπικών εννοιών, και η γλωσσική κωδικοποίηση επηρεάζει το χρόνο κατάκτησης τους.

Keywords: spatial concepts, spatial expressions, mapping, opacity, homonymity, acquisition of

1. Introduction

In this work we investigate the developmental order of certain spatial expressions manifested as either morphologically simplex or morphologically complex P(reposition)s in Greek. Building on recent findings from the investigation of spatial development in Greek (Terzi et al. 2015), the aim of the present study is to examine possible differences in the comprehension of spatial terms when the same spatial concept is

expressed via different linguistic means within a language, that is, via more than one linguistic expressions. In doing so, we focus on the spatial concepts *in, on* and *to*, for which Greek uses either two-word (complex) or one-word (simplex) prepositions, namely, *mesa se* or *SE* for 'in', *pano se* or *SE* for 'on', and *SE* for 'to' (Terzi 2010). In addition, we compare the development of *SE* in its different uses above. Our approach intends to shed light on the role of the syntactic structure of locative prepositions in the process of their acquisition and, consequently, in the overall development of spatial terms. At the same time, we keep an eye on the possible impact that the (order of) acquisition of the spatial concepts has on the acquisition of the corresponding spatial terms.

To anticipate some of our main conclusions, our findings show, on the one hand, that the universal order of the development of locative expressions as reported in the literature (Piaget and Inhelder, 1956) is attested to a large extent, on a par with Terzi et al. (2015). On the other hand, Greek shows that the linguistic form of locative expressions affects their order of acquisition, as light Ps are not acquired at the same rate as their fully formed counterparts. Hence, *SE* meaning 'in' is significantly delayed compared to *mesa se* (in), but appears to be mastered before *pano se* (on).

The paper is organized as follows: In the first part we report the main findings and assumptions in the literature regarding the acquisition of spatial terms. In the second part we present the current study followed by the conclusions and the issues that are open to further examination.

2. Previous studies: Theoretical and experimental background

One of the central issues that have preoccupied the study of spatial terms and their mapping to the corresponding spatial concepts has been the nature of this mapping. Researchers have been preoccupied with what is the link between knowledge of locative expressions and cognition of space, the developmental paths of both, as well as whether and how they relate.

A long standing idea held that languages partition the world differently and children acquire the world view according to this partitioning (Whorf, 1956). This approach was questioned by the cognitive revolution of the '60s and the '70s, who adopted the view that children's first words label concepts that have already originated non-linguistically (Piaget and Inhelder, 1956). Spatial terms had a good amount of

evidence to offer in favor of this view since, a) children know a lot about space before they use language to represent this knowledge, b) words like *up*, *down* and *back* appear early and rapidly, and c) acquisition of spatial terms seems to follow the order of spatial concepts in (2), which was established by Piaget and Inhelder (1956) via non-linguistic tasks.

(1) Words of containment (*in*) > words of contiguity and support (*on*) and occlusion (*under*) > words for proximity (*next to*, *beside*, *between*) > words for projective relationships (*in front of*, *behind*).

More recently, in a series of experiments, Choi and Bowerman (1991) and Bowerman and Choi (2001), focusing on spatial terms, argued for a more interactive view of how children's early word meanings arise. The languages they compared are English and Korean, which structure and encode aspects of space differently, with consequences on how the corresponding terms are acquired in each language. Within this line of reasoning, we examine whether and how the linguistic means encoding spatial expressions affect the acquisition of the associated terms. We look into the role of language specific properties, by focusing on the locative expression *SE*, since it can express the meaning of three different locative concepts, namely 'in', 'on' and 'to'. On the other hand, it constitutes the invariable component of two complex linguistic expressions, namely, *pano se* (on), *mesa se* (in), which express the same meaning respectively. In this respect, *SE* sets an ideal candidate for testing language specific properties.

Terzi et al. (2015) studied the order of development of complex locative expressions and found that it is similar to what has been found to hold for other languages. They found one significant exception however: *pano se* 'on' does not follow the expected developmental pattern, in the sense that it is acquired significantly later than 'in' and 'under'. Terzi et al. (2015) had conjectured that this unexpected finding follows from the morphological opacity of *pano se* 'on', and *pano apo* 'above', and the fact that the latter seems to be one of the last to be acquired crosslinguistically (Durkin 1981). Thus, in the spirit of Jonhston and Slobin (1979), Terzi et al. (2015) consider morphological opacity created by the sharing of the heavily semantic part of 'pano' in both 'on' and 'above', as one of the language specific factors responsible for delaying the development of *pano se* (on) in Greek.

Within the same rationale, the current study raises the question of whether the delay in the acquisition of *pano se* 'on' may (also) be due to the fact that the same concept is

expressed by the small P *SE* in Greek, which, moreover, has a number of other interpretations. Hence, *SE* raises the question as to what extent *lexical homonymity* and/or *semantic opacity* (thus, semantic and syntactic underspecification) has an effect in the order of acquisition of the relevant spatial terms. Besides lexical homonymity, *SE* also interacts with *morphological opacity* since *SE* meaning 'on' is an alternate of *pano se*, which shares a crucial morphological part with *pano apo* 'above'. Thus, *SE* is involved in a morphologically opaque pair of two distinct locative concepts, 'on' and 'above' which are expressed by different lexical items in English and other languages. For this reason, in the current study we investigate the comprehension of *SE* with the interpretation of 'on', 'in' and 'to'.[1]

3. The current study

3.1. Theoretical Issues and the main hypothesis

As mentioned already, this work examines whether the linguistic means encoding spatial expressions affect the acquisition of the relevant terms. An ideal candidate for addressing this question is set by the highly frequent Greek lexical item *SE*, which can express a number of spatial concepts, i.e., containment (2), support (3), location-not specified (4), and direction (5). A crucial element to our discussion is the complex P *pano se* (above) in example (6), which is juxtaposed to example (3); both (3) and (6) share the lexical part *pano*, which has been argued to affect the development of (3), (Terzi et al. 2015).

(2) To vivlio ine (mesa) **sto** sirtari. [LOCATION-CONTAINMENT]
the book is (mesa) **se +the** drawer
'The book is in the drawer.'

1 A reviewer points out that one expects similar behavior of *mesa* se 'in', hence, presumably delayed acquisition, given the existence of *mesa apo* 'from inside' in the language. *Mesa se* is not acquired late, however, as we have noted already and will discuss again in the remainder of the paper (although *mesa apo* is, Xypolias & Christopoulos 2004). Hence, the reviewer makes a valid and interesting point, which deserves a more in depth answer than the limitations of this paper allow. Our response for the time being is that the two spatial terms of the pair the reviewer brings to our attention are not equivalent. This is because a) they are not both locative: while *mesa se* is a locative, *mesa apo* is a directional, and b) as is expected because of its directional interpretation, *mesa apo* cannot appear in predicative sentences, i.e. **to vivlio ine mesa apo to sirtari* 'the book is from the drawer', by contrast to *mesa se*, (2).

(3) To vivlio ine (pano) **sto** trapezi. [LOCATION-SUPPORT]
the book is (pano) **se +the** table
'The book is on the table.'

(4) To vivlio vriskete **sti** vivliothiki. [LOCATION-NOT SPECIFIED]
the book is **se +the** library
'The book is at the library.'

(5) Pigeno **sto** grafio. [DIRECTIONAL-GOAL]
go-1s **se+the** office
'I am going to the office.'

(6) To vivlio ine **pano apo** to trapezi [LOCATION-NON-SUPPORT]
The book is **pano apo** the table
'The book is above the table.'

We remind that the main question raised by the data so far is whether the grammatical encoding of the aforementioned spatial terms obstructs or facilitates their acquisition. The specific hypothesis tested in this study is as below:

(7) If language specific properties affect the development of spatial notions we should be able to observe differences in the developmental pattern of *SE* compared to the fully specified semantic counterparts (i.e. *mesa se*, *pano se*).

In what follows, we will present the methodology and the results regarding the order of development of the different meanings of *SE* and will subsequently look for potential differences between the pairs of simplex and complex forms in which *SE* participates.

3.2. Methodology

3.2.1. The participants

The participants of the study were 110 Greek-speaking monolingual children, which made up 5 age groups of 22 children each. Age groups were as follows:

Age groups	Age	N
1	4;0 – 4;5	22
2	4;6 – 4;11	22
3	5;0 – 5;5	22
4	5;6 – 5;11	22
5	6;0 – 6;5	22

Table 1 | Age groups

3.2.2 The tasks

Children were administered one comprehension and two production tasks. Here we present and analyze the results of the comprehension task. This was a picture selection task in which participants were presented with 3 pictures per sentence, and had to choose the one corresponding to the sentence they heard. Sentences were recorded by two female native Greek speakers so that everyone heard them in exactly the same manner. Target items were tested in 6 sentences in the case of complex Ps, while simplex Ps were tested in 4 sentences each. Sentences were pseudo-randomized and pictures within each condition were pseudo-randomized as well. The material was also administered to a control group consisting of 22 adults of various educational backgrounds.

In order to be able to compare the results to those of other languages and to atypical populations, the testing was preceded by checking non-verbal and verbal skills of the participating children. Thus, we run the following baseline tasks: Raven's coloured progressive matrices (Raven, 1998) > 80, DVIQ morphosyntax task (Stavrakaki and Tsimpli, 2000), and Expressive Vocabulary task (Vogindroukas et al., 2009).

The prepositions tested were used in predicative sentences, namely, in sentences such as (8)-(10). A sample of a three picture set used for *SE*, *pano se* (on) and *pano apo* (above) appears in Figure 1. Figure 2 contains a set of pictures used for *mesa se* and *se* (inside/in). Figure 3 contains a set of pictures used for *SE* directional (towards/to).

(8) a. To kadro ine (pano) ston kanape.
'The picture is on the sofa.'

b. To kadro ine pano apo ton kanape.
'The picture is above the sofa.'

(9) To pulaki ine (mesa) **sto** kluvi
'The bird is in the cage.'

(10) O skilos erhete (**sto)** spitaki tu
'The dog is coming to the dog house.'

Figure 1 | Set of pictures testing SE, pano se (on), pano apo (above)

Figure 2 | Set of pictures testing SE, mesa se (in)

Figure 3 | Set of pictures testing SE (to)

3.3.Results

Figure 4 below reports the comprehension results on the three types of *SE*, namely, *SE*-support (on), *SE*-containment (in), and *SE*-direction (to) for all age groups.

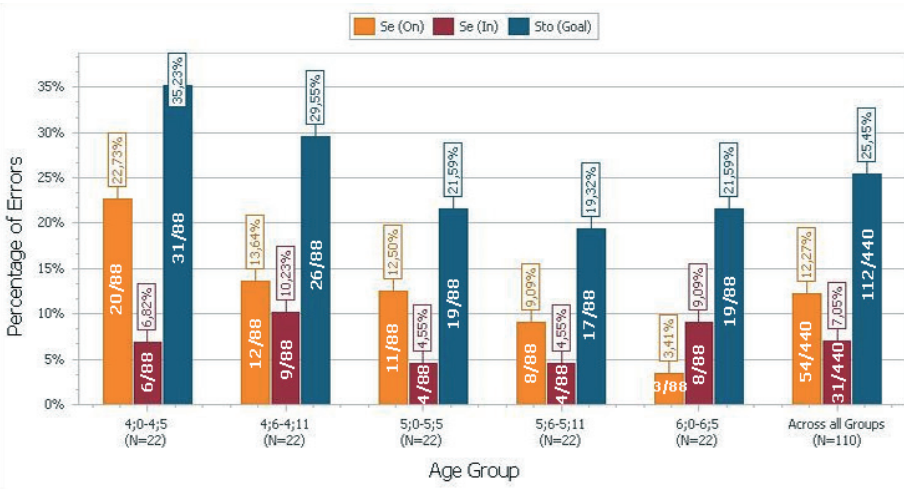

Figure 4 | *Comprehension of the three types of SE*

We can easily observe that *SE* is not acquired uniformly, that is, regardless of its different interpretations. There is a low percentage of errors (below 10%) across age-groups with *SE*-containment, supporting claims that favor a universal cognitive shaping of locative terms with containment acquired first (Jonhston and Slobin 1979, Casasola and Cohen 2002). *SE*-support follows (with highest error rate 23% in the youngest group, decreasing with age), while *SE*-direction errors are statistically higher compared to both *SE*-containment and *SE*-support. Thus, the developmental order of *SE* (11a) is comparable to the corresponding complex PPs (11b) as reported in Terzi et al. (2015).

(11) a. *SE*-containment (in) > *SE*-support (on) > *SE*-direction (to)
b. Mesa se (in) > pano se (on) > pros (to)

Figure 5 from Terzi et al. (2015) illustrates the overall children's comprehension performance on locative expressions and depicts the distinct developmental path for the inter-related concepts of *Pano apo* (above) - *Pano se* (on) - *SE* (on), which is crucial for the comparison between *Pano se* with *SE* in the following section.

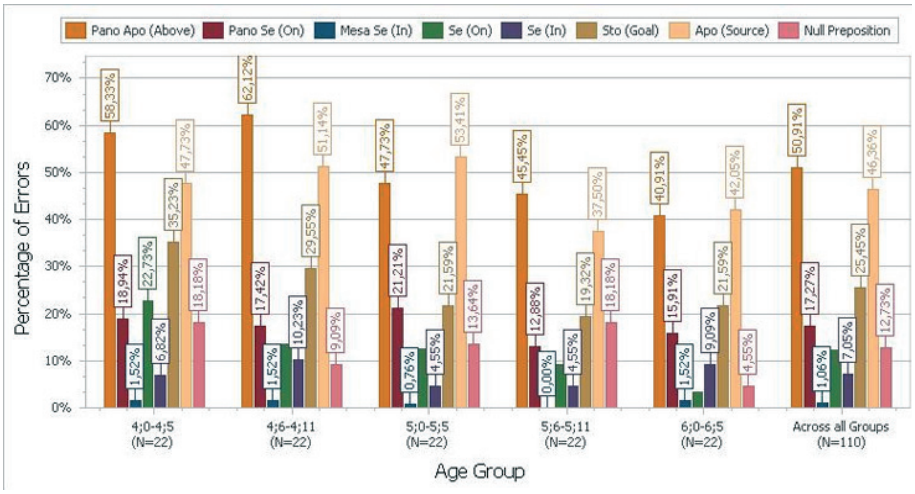

Figure 5 | *Comprehension of the spatial terms of concern*

3.3.1. Testing our Hypothesis

Returning to our initial hypothesis, a question that has to be answered is whether the underspecified form of *SE* is acquired differently than its semantically equivalent complex form, that is, whether there is a difference in the acquisition between *SE*-containment and *mesa se* (in) and between *SE*-support and *pano se* (on). The answer to both questions is in Figures 6 and 7 that follow below.

According to our central hypothesis if mastery of spatial linguistic expressions was unaffected by linguistic encoding, that is, if it just depended on the cognitive development of the corresponding spatial concepts, we should not be able to observe any differences between concepts that can be expressed via more than one linguistic expressions.

Figure 6 shows that there is a significant difference between the development of *SE*-containment and the development of *mesa se* (in). The difference is statistically significant both for each age group and across all age groups. Thus, despite the fact that the concept of *containment* (in) is indeed acquired early, as expected, and the percentage of errors remains low regardless of the form via which the concept is expressed (highest error percentage is only 10% for *SE*), the comparison between the complex and the simplex (and arguably underspecified) form shows that while the complex form does not exceed an error rate of 1,5% for any age group, the rate of errors of the simplex form varies between 4,5% and 10%.

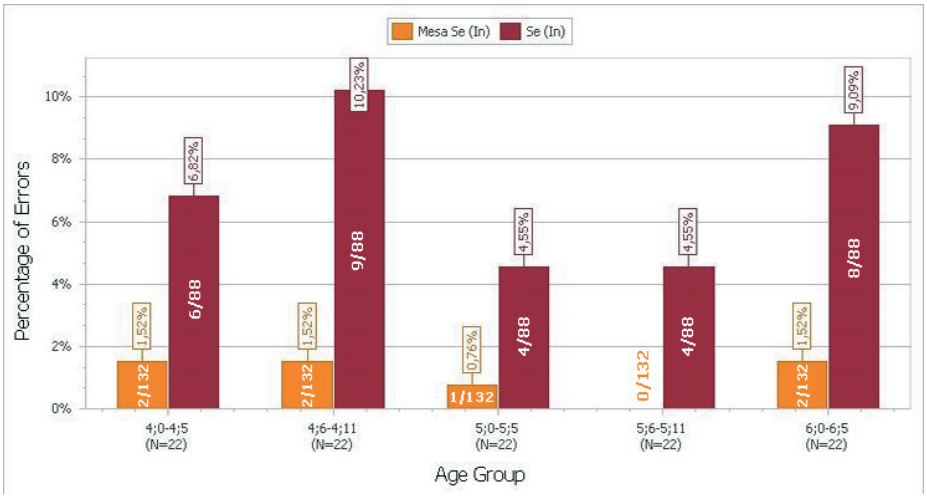

Figure 6 | *Comprehension of SE-containment and mesa se*

The finding is unexpected if one makes the assumption that linguistic form does not play a role in the acquisition of such a fundamental spatial notion as containment. It is however expected under the view we have advocated, according to which linguistic means affect development of spatial expressions in particular ways, namely, by either facilitating or obstructing the development of such expressions. Turning to the next pair of investigation (*Pano se* - *SE* 'on'), we observe apparently similar effects.

Figure 7 shows that the two terms employed for the notion of *support* (on), which is another notion known to be acquired early by children, are not mastered at the same rate when expressed by *SE*-support or by *pano se*. Contrary to the pair in Figure 6, however, the pattern is the opposite this time. We see in Figure 7 that the morphologically complex form *pano se* seems to be delayed compared to the simplex form *SE*, although this time the difference between the two forms is significant for all age-groups but not for each group separately. Nevertheless, the difference in terms of rate of mastery of the two terms corroborates to our central hypothesis that linguistic encoding of a concept affects the emergence/development of this concept.

It should be explained, however, why comprehension of the complex term is what falls behind in this case. We believe that the delay of *pano se* as compared to *SE*-support is due to two factors, probably unrelated to each other. First, the development of *pano se* is relatively delayed in Greek, contrary to the expectations according to

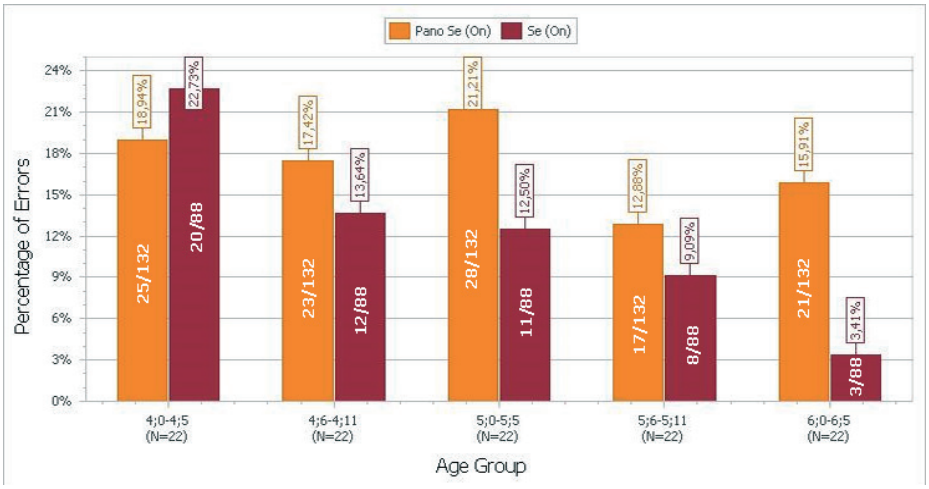

Figure 7 | *Comprehension of SE-support and pano se*

the literature regarding the universal order of spatial notion (Terzi and Tsakali 2009, Terzi et al. 2015). According to the authors, the reason for the unexpected delay of *pano se* (on) is its morphological opacity with *pano apo* 'above'. Figure 8 below reports findings from Terzi et al. (2015), which show clearly that *pano se* 'on' is not among the first spatial terms to be acquired, despite the predictions of the universal order in (1).

As Terzi et al. (2015) report, 'on' is not acquired simultaneously with 'in' and 'under' as expected. Even more importantly, errors on *pano se* exceed errors on 'in front' and 'behind' in some age groups, despite the fact that the latter are some of the spatial terms that are acquired much later than 'on' crosslinguistically.

The second reason arguably explaining the earlier mastery of *pano se* as compared to *SE*-support relates to the preference children have for interpreting *SE* as *in*, rather than *on*, in contexts that either one could be the target answer. This preference was actually tested by a part of our experiment via sentences such as (12) - (15) next page. The pictures that accompanied these sentences were such that either *containment* or *support* interpretation was possible.

(12) To aftokinitaki ine sto dulapi
'The toy-car is in/on the cupboard.'

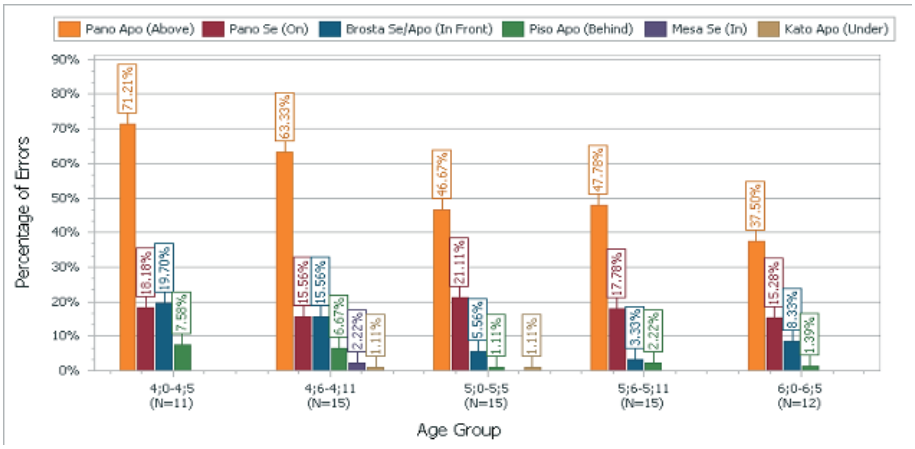

Figure 8 | Comprehension of Complex Ps (Terzi et al. 2015)

(13) To puli ine sto dendro
'The bird is in/on the tree.'

(14) I lampa ine sto dulapi
'The lamp is in/on the cupboard.'

(15) I bluza ine sti valitsa
'The blouse is in/on the suitcase.'

Figure 9 next page shows children's strong tendency to interpret ambiguous *SE* as 'in', while the reverse is extremely rare.

In Figure 9 the first two bars show children's preference for interpreting SE as in (rather than on) in sentences (12) - (13). The next two bars show children's preference for interpreting SE as on (rather than 'in') in sentences (14) - (15). The last two bars simply add the corresponding preference for the aforementioned pairs of sentences. Children's preference exhibited by these data suggests that their default interpretation of *SE* coincides with the notion of *in*. Whether such preference is also supported by frequency factors is unclear, as *SE* seems to be equally used for both *in* and *on* in everyday communication. Nevertheless, it will be interesting to test if there is a significant difference in uses of *SE* in average way of speaking, an issue subject to further research.

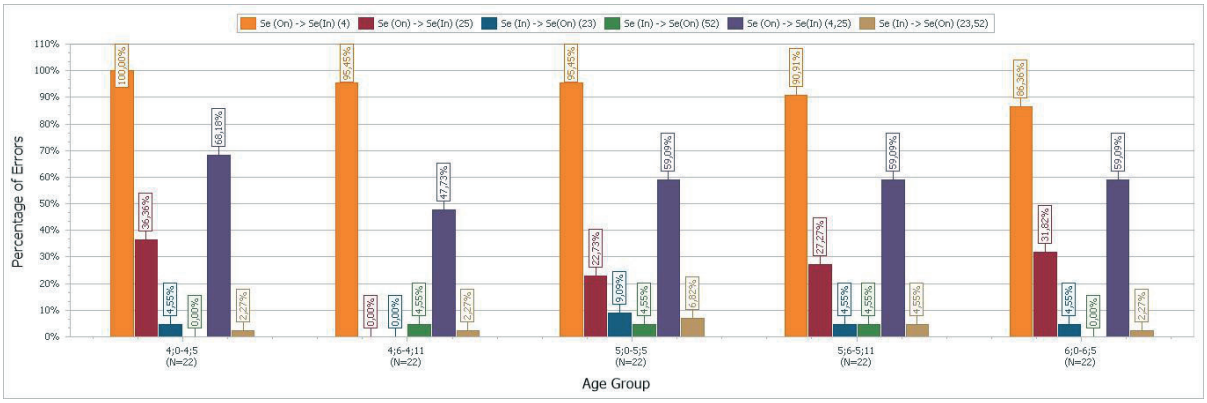

Figure 9 | *Comprehension and preference for ambiguous SE*

Alternatively, it may be that the preference for *SE*-containment is related to the earlier mastery of the term crosslinguistically, which, in turn, reflects the earlier mastery of the corresponding concept, see (1).

4. Conclusions and Remaining Issues

The purpose of this study was to put under further scrutiny the idea that language-specific properties affect the order of acquisition of spatial terms, an idea proposed on the basis of crosslinguistic evidence by Choi and Bowerman (1991) and Bowerman and Choi (2001), and argued to explain the late mastery of the locative preposition *pano se* 'on' in Greek (Terzi and Tsakali 2009, Terzi et al. 2015). We investigated the comprehension of pairs consisting of a simplex and a complex spatial term (Preposition), with each pair denoting the same spatial concept, in particular, 'in' and 'on'. Since the simplex preposition was the same across pairs, it offered the additional opportunity to test the role of homonymity/underspecification, along with opacity, notions that have been considered to affect the acquisition of spatial terms (Johnston and Slobin 1979).

The findings indicate that the same term is not mastered similarly in its different interpretations, hence, homonymity per se cannot account for the difference in mastering homonymous spatial expressions. Our findings rather suggest that the order of acquisition of the spatial terms reflects the order of acquisition of the corresponding spatial concepts in this case. On the other hand, we found strong evidence that the

items of the pairs that denote the same spatial concept are not acquired at the same rate, indicating that the means a language utilizes in order to express a concept affect its rate/order of acquisition. We hold, therefore, that the observed disparities are due to the homonymity/underspecification of a term and/or its morphological opacity.

As for an issue raised in the beginning of the paper, namely, whether the delay in the mastery of *pano se* 'on' is related to the fact that the same concept is expressed by *SE*, an element that has a number of other interpretations, the answer is negative: if that were the case, we would observe the same pattern with *mesa se* 'in' and *SE*. Finally, our results demonstrate that the precise nature of the development of spatial categories undergoes considerable development for long after their first emergence (even after the age of six).

Acknowledgments

This research has been co-financed by the European Union (European Social Fund - ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) - Research Funding Program: ARCHIMEDES III, Investing in knowledge society through the European Social Fund – "The structure of (a)typical language: linguistic theory and intervention." (Grant number *MIS 383592* – Principal Investigator: Arhonto Terzi).

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