

Projective vs. interpretational properties of nuclear accents and the phonology of contrastive focus in Greek¹

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Abstract

Nuclear accents have two interesting properties. First, they have a projective property, i.e., they may refer to a focus domain that encompasses a higher syntactic projection. Second, at least for some languages, nuclear accents may have an interpretational property, i.e., they may have alternative realizations that reveal particular interpretations, such as contrast, correction, surprise, etc. The present article examines the interaction between the projective and the interpretational properties of nuclear pitch accents. Based on an experimental study on Greek, we show that the nuclear accent that is interpreted as 'contrastive' refers to a local focus domain, i.e., it is not projected to higher layers of the constituent structure. Furthermore, our experimental findings show that these properties interact with syntactic and prosodic markedness, in a way that the canonical word order and the unmarked accentual structure are felicitous in a larger array of contexts than the marked syntactic and accentual configurations.

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1. Preliminaries

The function of nuclear accents involves two dimensions that are theoretically orthogonal (see Gussenhoven 2007: § 3). The first dimension refers to the identification of the focus domain and interacts with properties of the constituent structure. The basic observation is that the example (1a) with a nuclear accent (indicated by the star) aligned with the final constituent allows for an array of interpretations with respect to the portion of the utterance that is in focus (henceforth, the focus domain): it is either local (object focus) or encompasses a higher constituent (either VP focus or sentence focus). The example (1b) with a nuclear accent on the leftmost constituent is an unambiguous instance of subject focus. This asymmetry has given rise to a number of accounts based on the idea that accentual prominence is determined by rules that map the prosodic structure to the constituent structure (Chomsky 1971, Jackendoff 1972, Cinque 1993, Selkirk 1995, Zubizarreta 1998, Szendrői 2001, Reinhart 2006, Féry and Samek-Lodovici 2006, Truckenbrodt 2007, Büring 2009). The property of the nuclear accents to associate with higher syntactic projections is referred to as a *projective* property hereafter (see detailed discussion in Section 2).

- (1) a. *The thief stole the ring.*
 b. *The thief stole the ring.*

The projective property refers to the alignment of the nuclear accent with a particular constituent and not to its phonetic realization. Beyond the projective property, it is reported for several languages that there is a contrast between alternative nuclear accents which has an effect on the interpretation. For instance, Steube (2001: 233) points out that contrastive focus in German is associated with an increase of the F_0 and a change in the alignment of the F_0 maximum with the syllable resulting in a LH*(L) tonal event. The crucial statement is that this particular tonal event is “the linguistic sign of contrastive focus” (Steube 2001: 233). In other accounts, the tonal realization of the nuclear accent indicates whether it applies locally to the accented constituent or it can be projected to a higher prosodic domain (see Frota 2002 on European Portuguese). We subsume all types of tonal contrasts that affect the interpretation of the utterance under the notion of the *interpretational* property of nuclear accents (see Section 3 for further discussion).

This article addresses the question whether the projective and the interpretational properties of nuclear accents interact with each other. This question is of particular relevance for the conceptual architecture of information structure. If the two properties do not interact with each other, i.e., if “contrastive accents” may be projected to higher constituents just like “non-contrastive accents” do, then we will have evidence that these two properties are orthogonal

to each other, i.e., they are two independent and necessary grammatical features. However, if the two properties interact in a particular way, namely if only non-contrastive accents display the projective property, then the concepts of ‘±contrastive’ and ‘±local’ accent are confounded, hence we may come up with a simpler grammar that only includes one of them. The challenge is empirical, and for this purpose we carried out an experiment on the intuition of contextual felicity examining exactly the focus sets of two different prosodic realizations of the nuclear accent in Greek (see Section 4).

The results of this empirical study reveal a complex interaction pattern between word order properties, accent placement, and realization of the nuclear accent. Our findings show that the variety of nuclear accents that are characterized as ‘contrastive’ are not projected on higher layers of the hierarchical clause structure; beyond this conclusion they reveal an interaction with syntactic and prosodic markedness that challenges current assumptions about the syntax-prosody mapping (see findings in Section 5 and discussion in Section 6).

2. Projective property

The projective possibilities of the nuclear accents are determined by the nuclear stress rule. This rule captures the generalization that head-initial languages such as English display prosodic prominence of the rightmost prosodic unit, while the most prominent constituent in head-final languages such as German is the leftmost one within the relevant syntactic projection. In order to capture the cross-linguistic variation depending on the head-directionality, the nuclear stress rule refers to the embeddedness of the prosodic constituents (see Cinque 1993: 245, Zubizarreta 1998: 34), see (2).

(2) Nuclear stress rule

Given two sister categories C_i and C_j , the one lower in the asymmetric c-command ordering is more prominent. (Zubizarreta 1998: 34)

The nuclear stress rule determines the placement of the intonational nucleus of an utterance under neutral contextual conditions. In languages with free accent placement, the generalization in (2) may be violated if particular information structural conditions are met.² In particular, when a constituent is in narrow focus, then it hosts the intonational nucleus (independently of the nuclear stress rule), as indicated by the rule of focus prominence in (3).

2. The restriction to languages with free accent placement relates to the observation that some languages do not use deviations from the unmarked accentual structure in order to express focus on the accented constituent (see Féry 2001 on French, Szendrői 2001 on Hungarian, Büring 2009 on Spanish and Italian, Skopeteas and Féry 2010 on Georgian).

goes obligatory V-to-T movement following standard assumptions in Greek syntax. These assumptions yield the constituent structure in (6). Applying the nuclear stress rule to this configuration, we obtain a focus set with three options: (a) an object-focus domain (answer to the question ‘What did the mother cook?’); (b) a predicate-focus domain encompassing the T’ projection (answer to the question ‘What did the mother do?’); (c) an all-focus domain encompassing the entire TP (answer to the question ‘What happened?’). This focus set is the straightforward result of the application of the nuclear stress rule (see discussion on the application of the nuclear stress rule in Greek in Alexopoulou 1999: 41; Baltazani 2003; Georgiafentis 2004: 239; Haidou 2006: 301; Gryllia 2008: 104).

- (6)
- | | | | | |
|------------|-----------------------------------|---|------------------|----------------|
| Focus set: | [_{TP} S [_{T'} | V | O [*]] |] |
| | (|) |) |) _F |
| | (|) |) |) _F |
| | (|) |) |) _F |

Furthermore, the SVO order can be realized with a nuclear accent on the subject, see (7). The subject in this configuration occupies an A-bar position that hosts focused material (see Tsimpli 1995, Alexiadou and Anagnostopoulou 2000: 176). The question is what are the properties of the landing site of this syntactic operation. Some authors claim that constituents in this A-bar position are interpreted as contrastively focused, while the in situ focus in (6) is not or is not necessarily so (see Tsimpli 1995, Alexopoulou 1999). This evidence may lead to the assumption that the functional projection at issue is inherently associated with a discourse feature, i.e., it is a FocP (=focus phrase) or a ContrP (=contrastive focus phrase) (see Tsimpli 1995, Georgiafentis 2004 for discourse-configurational accounts on the left periphery of Greek). There are many reasons against a discourse-configurational view of preverbal foci in Greek. Diagnostics of exhaustivity or contrast show that preverbal and postverbal narrow foci do not have different interpretational properties (see Haidou 2006: 291–295; Gryllia 2008: 43, 55). The intuition that preverbal focus is obligatorily contrastive is not empirically confirmed: crucially, preverbal focus occurs in answers to constituent questions (see Georgiafentis 2004: 244, Keller and Alexopoulou 2001: 349). In our view, the difference between utterances with a nuclear accent on the preverbal constituent and a nuclear accent in situ is that the former but not the latter define an unambiguous focus domain. This difference follows from the nuclear stress rule. In contrast to (6), the focus set in (7) displays a single option, namely the local interpretation of the nuclear accent (answer to the question ‘Who cooked the fish?’). Hence, the assumption that this effect is triggered by a discourse feature which is inherent part of the syntactic configuration is redundant. For these reasons, we assume that

the landing site of the A-bar movement is pragmatically underspecified and we label it as an FP (=functional projection).

- (7)
$$[\text{FP } \overset{*}{\text{S}} [\text{F}' \text{ V } \text{ O }]]$$

 Focus set: ()_F

Like the SVO order, the OVS order can occur with an initial or with a final intonational nucleus. When the nuclear accent falls on the subject constituent, the fronted object is necessarily interpreted as a topic and is clitic doubled, as illustrated in (8).⁵ This construction is known as clitic left dislocation (henceforth, CLLD).

- (8) *to psári to majírepse i*
 the(ACC) fish(ACC) CL.3.SG.N cook:AOR:3.SG the(NOM)
mitéra.
 mother(NOM)
 'The mother cooked the fish.'

The object constituent in (8) does not occupy the same position as the subject constituent in (6). While preverbal objects in CLLD require a topical interpretation, preverbal subjects do not do so. Left-dislocated objects constitute derivational islands to further extraction, while preverbal subjects allow for extraction (see Spyropoulos and Revithiadou 2007: 10–11). From these facts, we conclude that the object constituent in CLLD occupies the specifier position of a higher functional projection, presumably a CP (=complementizer phrase). The crucial point for our assumptions is that this projection is extrametrical, i.e., it is not visible for the metrical rules that determine the projection of nuclear accents on the hierarchical clause structure (see Szendrői 2001: 46 on Hungarian). This difference between subjects and objects in CLLD can be accounted for with reference to the prosodic entities that are licensed by the different syntactic projections. Constituents in spec,CP are mapped onto an independent higher-order prosodic entity, presumably an intonation phrase, which is not the case for preverbal subjects in the neutral configuration in (6) (this can be the case for contrastively topicalized subjects that occupy a higher position). This is in line with previous observations that preverbal subjects but not left-dislocated objects can be wrapped in a prosodic phrase with the verb under particular contextual conditions (see Revithiadou and Spyropoulos 2005, Spyropoulos and Revithiadou 2007: 7–10). The contrast can be explained by assuming that syntactic projections determine prosodic phrasing patterns and

5. There is a particular construction in which the OVS order with an accented subject does not involve a pronominal clitic labelled as 'topicalization' and occurring in restricted contexts (see a detailed account in Alexopoulou 1999).

that the projection of nuclear accents to higher focus domains cannot cross intonational phrases. The effects of the extrametricality are shown in the comparison between (9) and (6): the OVS order with a final accent allows for a local interpretation of the nuclear accent (answer to the question ‘who cooked the fish?’) or a focus domain that includes the verb (answer to the question ‘what happened to the fish?’) (see Alexopoulou 1999: 41) but not a focus domain that includes the left dislocated object.

- (9) Focus set: $[_{CP} O [_{C'} V S^*]]$
 $(\quad)_F$
 $(\quad)_F$

Finally, the OVS order with an initial nuclear accent is possible in a structure that is identical to (7). The pronominal clitic does not appear in this structure, as illustrated in (10). While the object in CLLD occupies the specifier position of the CP projection, the left peripheral object without CLLD occupies a lower position (spec-FP), which is not an argument position and may host subjects, objects or other constituents. Similarly to (7), this configuration only allows for the local interpretation of the nuclear accent (answer to the question *What did the mother cook?*), see (11) (see also Gryllia 2008: 104).

- (10) *to psári majírepse i mítéra.*
 the(ACC) fish(ACC) cook:AOR:3.SG the(NOM) mother(NOM)
 ‘The mother cooked the fish.’

- (11) Focus set: $[_{FP} O^* [_{F'} V S]]$
 $(\quad)_F$

The account of the projective properties of nuclear accents presented in this Section is based on the assumption that the accents we observe in phrase-final and non-final positions are instances of the same phonological entity. This means that the same realization of the nuclear accent can be interpreted either as the product of the nuclear stress rule or as the product of the rule of focus prominence (see Chomsky 1971, Jackendoff 1972). The limits of this generalization are the interpretational properties of nuclear accents that are discussed in Section 3.

3. Interpretational property

There are two types of generalizations in the literature about the interpretational properties of nuclear accents. First, there are statements about the association of particular accentual realizations and truth-conditionally relevant

operators. A characteristic example is the assumption that a particular tonal realization of the nuclear accent evokes a contrastive interpretation. Second, we find statements about the association of certain tonal realizations with particular focus domains, e.g., narrow focus accents. Both types of observations are not independent from each other and in most cases their potential effects are not empirically disentangled.

It has been observed in several languages that there is a difference in the prosodic realization of nuclear accents in contrastive and non-contrastive contexts. This distinction is already discernible in perceptual generalizations (see, for instance, the observation that “high pitch on items of new information is thus different from that on contrastive items” in Chafe 1974: 118). Recent instrumental phonetic studies report two properties of the tonal realization that correlate with the concept of contrast (further differences relate to durational effects and effects on prosodic phrasing that are not examined in this summary). The first property relates to pitch scaling: the H-target of the nuclear pitch accent reaches a higher F_0 value in the contrastive than in the non-contrastive realization (see Steube 2001: 233 for German, Face 2002: 34 for Madrid Spanish; see several Italian dialects in Grice et al. 2005: 364; see also Genzel and Kügler 2010 that find a rising effect on H-targets and a lowering effect on L-targets in Hindi). The second property relates to the tonal realization of the nuclear accent that may be observed through the alignment of the F_0 maximum with the stressed syllable. For instance, Alter et al. (2001: 65) report a !H*+L– accent for new information focus and a L+H* accent for contrastive focus in German, and Gabriel (2006) reports that a contrastive nuclear accent shows earlier alignment in Argentinian Porteño Spanish.

Some studies report an accentual difference in the realization of narrow and broad focus (see Frota 2002: 127 showing that final nuclear accents in European Portuguese are realized as H+L* in broad focus or as H*+L/L*+H in narrow focus). However, it is not clear that the reference to focus domain in some languages and to focus type in some others reflects a genuine typological difference, because the effects of ‘±contrastive’ and ‘±local’ are not empirically disentangled in most cases. Contrastive focus is examined in narrow focus domains and non-contrastive focus is examined in broad focus domains (see for instance Alter et al. 2001 on German). One of the few studies that – at least partially – crosses the two factors is Baumann et al. (2007) on German, which finds evidence for a ‘broad > narrow > contrastive’ hierarchy in several phonetic dimensions (scaling, duration, vowel articulation). However, even in this study the theoretical possibility of contrastive broad focus is left out of consideration.

The fact that the ‘±contrastive’ and ‘±local’ options are not empirically disentangled is not accidental. Though these concepts are logically independent from each other, there is a pragmatic inference that a deviation from the default

intonational realization of the utterance implies a contrast to a proposition in the implicit or explicit common ground. This is reflected in the terminological practice of many authors to use the concept of “contrastive accent/stress” for any accentual deviation from the nuclear stress rule (see discussion in Bolinger 1961: 84). In the same vein, Engdahl and Vallduví (1996) assume that a non-final focus is associated with an instruction for replacing information in the common ground. The roots of this inference are to be found in the identificational nature of focus (see Kenesei 2006): the focus identifies a portion of the utterance to which the attention of the addressee is drawn. Drawing attention to a narrow focus domain motivates a pragmatic inference that this domain is contrasted to an alternative proposition that is part of the knowledge of the addressee.

Empirical studies on Greek prosody have established a distinction between alternative realizations of the nuclear accent. Arvaniti and Baltazani (2005: 87) assume a contrast between the nuclear accents H^* and $L+H^*$. The H^* accent corresponds to an F_0 -peak that is preceded by a small rise and signals broad focus (see also Baltazani and Jun 1999; Baltazani 2003). The $L+H^*$ accent corresponds to an F_0 -peak that is preceded by a noticeable dip and aligns with the middle of the accented syllable; this accent is found in narrow focus contexts (see also Arvaniti et al. 2006). Following the assumptions in Section 2, the two nuclear accents can only contrast in phrase-final positions in which a broad focus domain is possible. The possible focus domains of the SVO order have been examined in a production study by Gryllia (2008), who did not find local effects on the tonal realization of the focused object (see Gryllia 2008: 110).⁶ This finding is important since it shows that the tonal contrast is not obligatory in language production, i.e., there is at least a tonal realization that is possible for narrow and broad focus domains, as predicted by the assumptions in Section 2. The tonal contrast reported in Arvaniti and Baltazani (2005) indicates that Greek prosody displays the possibility to signal the narrow focus domain by a particular accent, i.e., a rising pattern within the stressed syllable. Following this account, there are at least two alternative realizations of the nuclear accent in (12), H^* and $L+H^*$. According to our native speaker intuition, the H^* realization equally allows for the continuations in (12a) and (12b). The $L+H^*$ realization is appropriate for the continuation in (12b), but evokes a bizarre interpretation in (12a), i.e., the intuition that all alternative individuals to Elena are not appropriate for Janis' age. These intuitions support the view that H^* corresponds to an underspecified realization of the nuclear accent, while the $L+H^*$ realization is associated with a local reading.

6. However, there are significant effects on the prenuclear accents, that create a perceivable difference between object focus and broader focus domains (see Gryllia 2008: 110, 120).

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- (12) *o* *jánis* *padréftike* *tin* *élena*,^{*}
 the(NOM) Janis(NOM) marry:AOR:3.SG the(ACC) Elena(ACC)
 'Janis married Elena, ...'
 a. { ... because he realized that he was already forty years old }
 b. { ... because she could understand his feelings. }

The next question is whether the two accents depend on the '±contrastive' distinction. Note that the intuitions in (12a–b) could also be accounted for if we assume that the L+H* option is a 'contrastive accent' signalling the contrast of the accented constituent to a salient alternative in discourse. In a production experiment comparing the tonal realizations of narrow focused constituents in contrastive and non-contrastive contexts, we obtained the following effect: (a) in phrase-initial focus, the contrastive contexts induced an average 5.8 Hz increase of the H-target in comparison to the non-contrastive contexts; (b) in phrase-initial and phrase-final focus, the contrastive contexts show a later alignment of the H-target with the syllable with respect to the non-contrastive contexts (see Georgakopoulos and Skopeteas 2010). A similar experiment reported in Gryllia (2008: 148–158) did not reveal any significant differences between new information and contrastive focus. This finding shows that the prosodic marking of contrastive constituents is not obligatory in Greek.

Hence, the facts in this summary create a complex empirical situation. There is a distinction between two realizations of the nuclear accent, H* and L+H*, such that the latter option correlates with a narrow focus domain. There is evidence that contrastive contexts have an effect on the alignment of the tonal target indicating that the rise to the H-target is more frequently realized within the stressed syllable (hence, corresponds to a bitonal L+H* accent) and an additional effect on the pitch scaling that suggests that the H* is upstepped in the contrastive context. A further issue that suggests an interpretable difference is that the contrast between H* and L+H* may also be found in non-phrase final words that do not allow for a broad focus reading (see examples in Section 4). However, these facts are not enough to empirically establish the claim that this tonal event is properly associated with contrastive focus for two reasons: first, we know that there is substantial variation in the realization of the nuclear accents in different contexts, which is reflected in the fact that some empirical studies do not report any significant difference at all. Second, the reported observations do not refer to the semantic extension of this tonal event. It is likely that the same effects on the accentual realization also occur in order to highlight salient information or to express the speaker's emotional involvement to particular portions of the utterance (e.g., surprise), etc., i.e., there is no reason to assume that the contrast to salient alternatives in discourse is a necessary condition for the occurrence of the phonetic effects at issue. The effects of intonational possibilities on interpretation do not imply the association of prosodic

entities with semantic operators since they may well be the result of pragmatic inferences that arise from the distribution of accentual prominence in the utterance (see further discussion in Baltazani 2002: 200, Féry 2006; see similar considerations about the syntactic expression of contrastive focus in Zimmermann 2008). Thus, we conceive the contrast at issue as a distinction between an unmarked (H*) and a marked (L+H* and concomitant upstep of the H-target) realization of the nuclear accent. The empirical study reported in Sections 4–6 examines whether these tonal realizations affect the projective properties of the nuclear accents.

4. Method

The aim of the empirical study presented in this section is to examine whether the projective properties of the nuclear accents interact with the alternative tonal realizations in Greek. In order to examine this interaction, we performed an experiment on the intuition of contextual felicity. Our experimental approach follows a well-established paradigm in comprehension studies on sentential prosody (see Birch and Clifton 1995, Keller and Alexopoulou 2001, Féry and Stoel 2006; Skopeteas, Féry, and Asatiani 2009, among others). The informants were presented a written question on the screen, as exemplified in (13a). After 2 seconds, they were auditorily presented an answer to this question (through headphones). The answer was articulated with a nuclear accent either on the object or on the subject constituent, as illustrated through the underlined constituent in (13b) and (13c) respectively. The speakers were instructed to estimate to what extent the way the answer was formulated was appropriate in the context at issue and to express their judgment on a 1 (it does not fit) to 7 (it fits) scale by pressing the corresponding computer key. Judgments were saved within a time window of 5 seconds from the end of the auditory stimulus.

- (13) a. Visual stimulus
ti *majírepse* *i* *mitéra?*
 what(ACC) cook:AOR:3.SG the(NOM) mother(NOM)
 ‘What did the mother cook?’
- b. Auditive stimulus, SVO
i *mitéra* *majírepse* *to*
 the(NOM) mother(NOM) cook:AOR:3.SG the(ACC)
psári.
 fish(ACC)
 ‘The mother cooked the FISH.’

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c. Auditive stimulus, SVO

i *mitéra* *majírepse* *to*
 the(NOM) mother(NOM) cook:AOR:3.SG the(ACC)
psári.
 fish(ACC)
 ‘The MOTHER cooked the fish.’

The experiment examined four factors that were established through manipulations of the question and the answer:

- (14) a. FOCUS DOMAIN (3 levels): projective, congruent, non-congruent;
 b. WORD ORDER (2 levels) of the answer: SVO, OVS;
 c. ACCENT TYPE (2 levels): unmarked (H*), marked (L+H* and up-step of the H-target);
 d. ACCENT PLACEMENT (2 levels): initial (first argument), final (final argument).

The factor FOCUS DOMAIN examines three possible focus domains of the answer. The critical question is whether the accent can be projected to a higher domain, that contains the accented constituent and further material. Our stimuli contain utterances with a V, a S, and an O. The appropriate context for testing the projective properties of a nuclear accent on the object, such as (13b), is a question that licenses a VP-focus domain, see (15a). When the nuclear accent falls on the subject as in (13c), the appropriate context to examine the projective properties of the accent is a question licensing a focus domain that contains the verb and the subject constituent, see (15b). Hence, the projective possibility of nuclear accents will be examined in focus domains containing the accented constituent and the V. We do not examine maximal focus domains (i.e., answers to the question ‘What happened?’), since they are not appropriate for OVS utterances in Greek (see discussion in Section 2 and compare the focus sets in (6) and (9)).

- (15) a. Context licensing a V+O (VP) focus domain
ti *ékane* *i* *mitéra?*
 what(ACC) do:AOR:3.SG the(NOM) mother(NOM)
 ‘What did the mother do?’
 b. Context licensing a V+S focus domain
ti *éjine* *me* *to* *psári?*
 what(NOM) happen:AOR:3.SG with the(ACC) fish(ACC)
 ‘What happened to the fish?’

In order to estimate the felicity of the projective interpretations of the nuclear accent, we compared this effect with two narrow focus options. The first narrow focus option corresponds to the local interpretation of the nuclear accent,

i.e., to a focus domain that only contains the accented constituent. When the nuclear accent falls on the object, as in (13b), the local interpretation of the accent is congruent with a context licensing object focus, see (13a). The same configuration is non-congruent with a context licensing subject focus, see (16).

- (16) Context licensing a S focus domain (non-congruent with (13b))

pjos *majírepse* *to* *psári?*
 who(NOM) cook:AOR:3.SG the(ACC) fish(ACC)
 'Who cooked the fish?'

In sum, the factor FOCUS DOMAIN contains three levels. The level 'projective' is the target manipulation that is expected to show whether an accentual pattern may have a projective reading (V+O focus domains for accented objects and V+S focus domains for accented subjects). The level 'congruent' involves a narrow focus domain that exactly corresponds to the local interpretation of the nuclear accent (O focus question for accented objects and S focus question for accented subjects). In the experimental design, this level is a control condition that provides us with a positive baseline for the estimation of the effects of the projective level. The level 'non-congruent' is a narrow focus on the non-accented constituent (S focus question for accented objects and O focus question for accented subjects). This condition is expected to establish a negative baseline showing the effect of non-congruent dialogues on the intuition of contextual felicity.

The factor WORD ORDER contained two levels: the SVO order in (13b) and the OVS order illustrated in (17a–b). A complication arises in utterances with a fronted object and a final nuclear accent (see discussion in Section 2). Since the early definite object does not carry nuclear stress, it has to be left dislocated and accompanied by a clitic, as exemplified in (17b). The realization without a clitic has been shown to negatively affect acceptability (see Keller and Alexopoulou 2001: 348). In order to avoid this effect that is irrelevant for the factors examined in this experiment we used clitic left dislocated sentences for the condition OVS with an accented subject.

- (17) a. OVS
to *psári* *majírepse* *i*
 the(ACC) fish(ACC) cook:AOR:3.SG the(NOM)
mitéra.
 mother(NOM)
 'The mother cooked the FISH.'
- b. OVS
to *psári* *to* *majírepse*
 the(ACC) fish(ACC) CL.3.SG.N cook:AOR:3.SG

i mitéra.
 the(NOM) mother(NOM)
 ‘The MOTHER cooked the fish.’

The factors ACCENT TYPE and ACCENT PLACEMENT relate to the prosodic realization of the answer. The target utterances were recorded by the authors (each of them performed half of the items) as illustrated in the following. In Fig. 1, the nuclear accent is a H* on the final constituent. The prefinal constituents bear the L*+H accent which is the default realization of prenuclear accented syllables (see Arvaniti et al. 1998, 2000; Arvaniti and Baltazani 2005: 86). Furthermore, we assume a boundary tone L% aligned with the final syllable in declaratives (see Arvaniti and Godjevac 2003; Arvaniti and Baltazani 2005).

Fig. 2 illustrates the L+H* realization of the final nuclear accent. The H-target is preceded by an initial dip and is aligned with the middle of the stressed syllable. Additionally, this accentual realization reaches a higher pitch level than the H* accent.

The levels of ACCENT TYPE were crossed with the levels of ACCENT PLACEMENT. Fig. 3 illustrates the same sentence with an initial nuclear accent H*. The postnuclear accents are pitch compressed. Our recordings do not involve deaccenting of the postnuclear material, even though postnuclear pitch

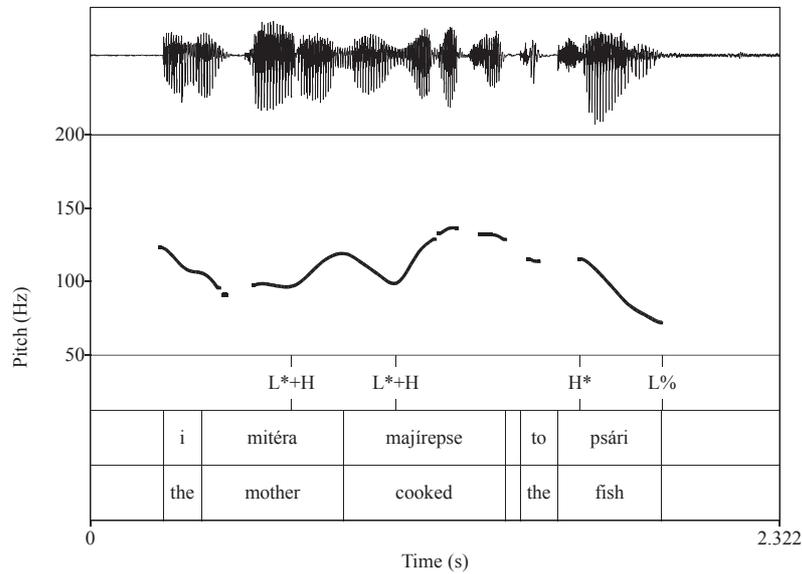


Figure 1: Prosodic realization of SVQ (H*), see glosses and translation in (5)

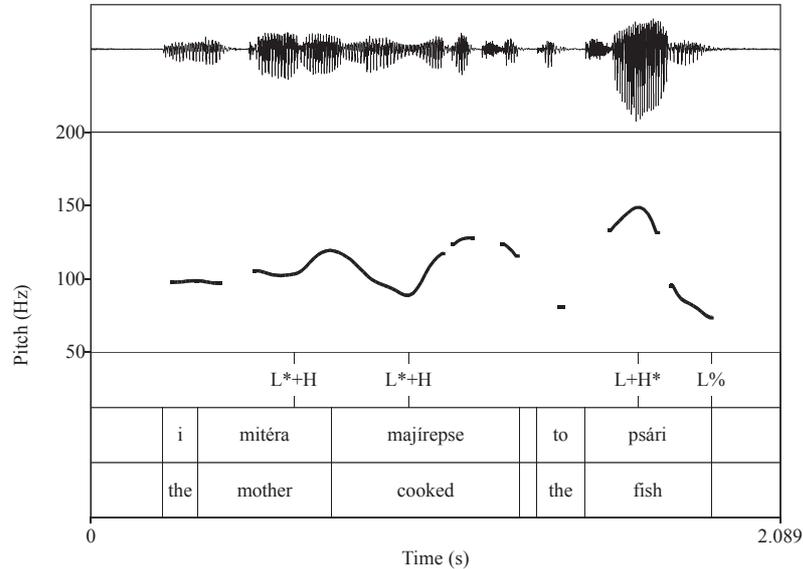


Figure 2: Prosodic realization of SVQ (L+H*), see glosses and translation in (5)

accents are optional in Greek (see Arvaniti 2009). However, we avoided utterances with complete deaccenting of the postfocal material in order to exclude the possibility that the difference between early and final accents in our results is due to frequent deaccenting of the postnuclear domain.

Finally, Fig. 4 illustrates an initial L+H* nuclear accent. This tonal realization is a rise realized within the stressed syllable. The postnuclear material is pitch compressed – similarly to Fig. 3.

Full permutation of the four factors in (14) gave ($3 \times 2 \times 2 \times 2 =$) 24 experimental conditions that were implemented on 24 items with varying lexical material (see Appendix). The experimental material was distributed in eight different experimental sessions, in a way that each session contained each item in a different permutation of the form of the answer (i.e., a particular configuration of the factors WORD ORDER, ACCENT PLACEMENT and ACCENT TYPE). This configuration of each item was presented three times, each time in a different context (factor FOCUS DOMAIN). Hence, each experimental session contained ($3 \text{ contexts} \times 24 \text{ items} =$) 72 trials and resulted to 3 repeated observations of each experimental condition per speaker. No fillers were used.⁷ The

7. The use of fillers in an experiment with 72 target items would expand the number of tasks, which affects the reliability of the judgments. Based on this reasoning, empirical studies that

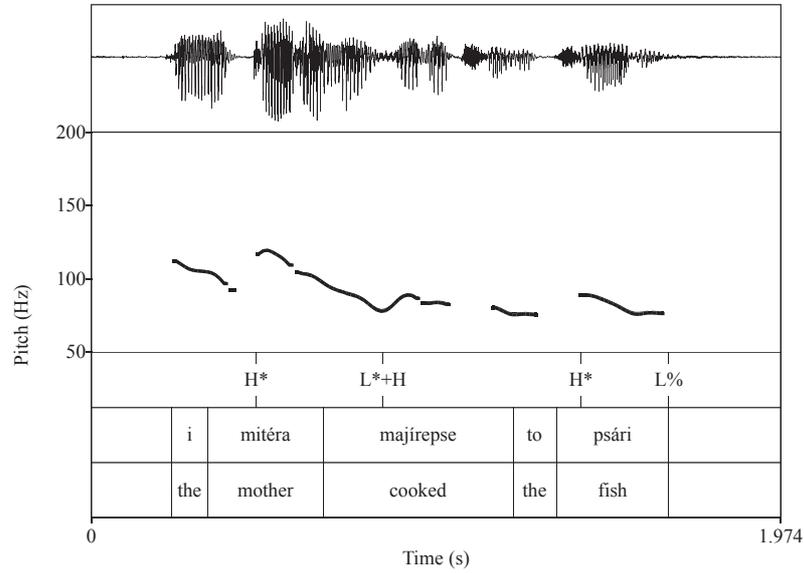


Figure 3: Prosodic realization of SVO (H*), see glosses and translation in (5)

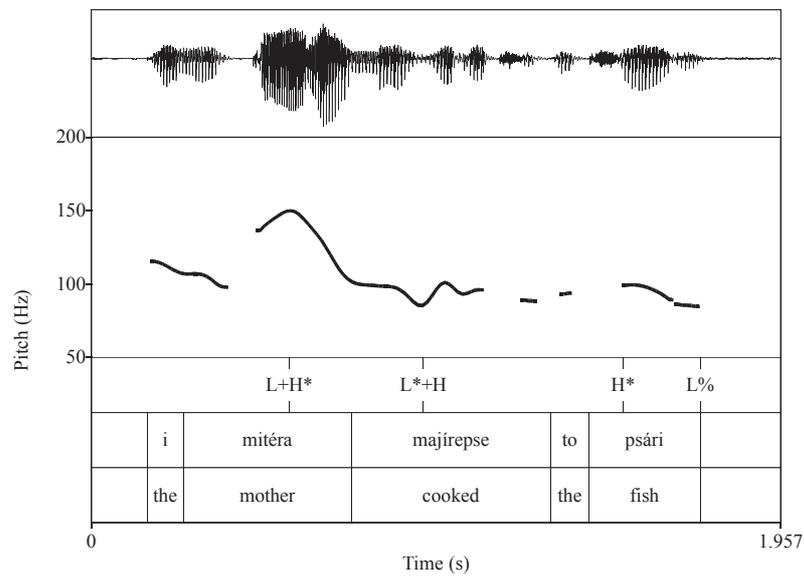


Figure 4: Prosodic realization of SVO (L+H*), see glosses and translation in (5)

72 target utterances were randomized for each performance in three blocks of 24 question/answer pairs that contained a single occurrence of each item and each condition. The presentation and randomization of the experimental sessions was performed through the DMDX software. Each of the eight experimental sessions was performed by three native speakers (8 sessions \times 3 speakers per session = 24 speakers in total). All speakers were inhabitants of Athens and linguistically naive (18 women, 6 men; age range: 18–31, average: 24). Each speaker was presented 72 question/answer pairs, which results to a total of (24 speakers \times 72 trials =) 1728 trials.

5. Results

In a small number of tasks, judgments are missing because the native speaker did not select a valid value (1 to 7) within the time window. Hence, the valid dataset contains 1591 judgments (92 % of the tasks). Missing values are spread within all the experimental conditions (14 conditions display 1 to 6 missing values, 10 conditions display 7 to 11 missing values). The means and standard errors of the valid judgments per condition are presented in Table 1.

A repeated-measures analysis of variance reveals a significant main effect of all factors: WORD ORDER (SVO, OVS), pro subjects $F_1(1, 23) = 25.4$, $p < .001$, pro items $F_2(1, 23) = 13.1$, $p < .001$; ACCENT PLACEMENT (initial, final), $F_1(1, 23) = 57.2$, $p < .001$, $F_2(1, 23) = 119.8$, $p < .001$; ACCENT TYPE (H*, L+H*), $F_1(1, 23) = 40.5$, $p < .001$, $F_2(1, 23) = 188.7$, $p < .001$; FOCUS DOMAIN (projective, congruent, non-congruent), $F_1(2, 22) = 239.8$, $p < .001$, $F_2(2, 22) = 650.1$, $p < .001$. The interaction effect of the four factors is not significant in either analysis (pro subjects/pro items). In the following, we split the data in smaller comparisons in order to observe the patterns of interaction of the examined factors.

In the conditions involving a H* realization of the nuclear accent, we expected to find evidence that the nuclear accent may be projected to the higher layer of the constituent structure, see Fig. 5. The interaction between WORD ORDER, ACCENT PLACEMENT, and FOCUS DOMAIN in the conditions with H* nuclear accent is statistically significant ($F_1(2, 22) = 20.9$, $p < .001$, $F_2(2, 22) = 13.2$, $p < .001$). Utterances with an initial nuclear accent are only felicitous in the congruent local interpretation (both in SVO, left panel, and OVS, right panel of Fig. 5), while utterances with a final nuclear accent have

consider a large number of experimental conditions frequently do not use filler items (see, e.g., Keller and Alexopoulou 2001). The only possible alternative would be to distribute the experimental conditions in smaller experiments. However, the consequence of this option would be that the obtained results could not be evaluated in a single analysis pro speaker, i.e., it should account for possible effects of the independent speaker samples.

Table 1: Means of judgments per condition (SE = standard error of the mean)

Word Order	Accent Placement	Focus Domain	Accent Type			
			H*		L+H*	
			mean	SE	mean	SE
SVO	initial (S)	+congr. (S)	6.78	.08	6.30	.18
		–congr. (O)	2.80	.22	2.13	.20
		projective (V+S)	3.77	.21	2.64	.19
	final (O)	+congr. (O)	6.22	.14	5.80	.20
		–congr. (S)	5.55	.17	3.68	.25
		projective (V+O)	6.31	.10	4.81	.23
OVS	initial (O)	+congr. (O)	6.46	.12	6.10	.18
		–congr. (S)	2.54	.21	2.70	.21
		projective (V+O)	3.84	.21	3.34	.21
	final (S)	+congr. (S)	6.62	.09	5.80	.20
		–congr. (O)	3.88	.21	3.06	.21
		projective (V+S)	5.21	.18	3.13	.19

in both orders an increase in the felicity of the projective interpretation, which confirms the predictions of the nuclear stress rule in Section 2. This asymmetry is statistically reflected in the significant main effect of ACCENT PLACEMENT ($F_1(1, 23) = 85.9, p < .001, F_2(1, 23) = 115.1, p < .001$) and the interaction between ACCENT PLACEMENT and FOCUS DOMAIN ($F_1(2, 22) = 78.7, p < .001, F_2(2, 22) = 116.9, p < .001$). Additionally, there is a significant main effect of FOCUS DOMAIN ($F_1(2, 22) = 138.4, p < .001, F_2(2, 22) = 216.1, p < .001$), which is also expected since this factor involves the contrast between a congruent and a non-congruent local readings.

The challenging finding is the difference between the two word orders, SVO and OVS, which is reflected in the significant main effect of WORD ORDER ($F_1(1, 23) = 28.4, p < .001, F_2(1, 23) = 17.6, p < .001$), as well as in the interactions between WORD ORDER and FOCUS DOMAIN ($F_1(2, 22) = 6.9, p < .01, F_2(2, 22) = 6.3, p < .02$) and between WORD ORDER and ACCENT PLACEMENT ($F_1(1, 23) = 8.2, p < .01, F_2(1, 23) = 9.2, p < .01$). These significant effects are not predicted by the focus sets implied by the nuclear stress rule in Section 2. The main source of these effects is the fact that the SVO order with a final nuclear accent (i.e., on the object) achieves a high degree of felicity in all examined contexts, while the OVS order with a final nuclear accent (i.e., on the subject) reveals large differences between the exam-

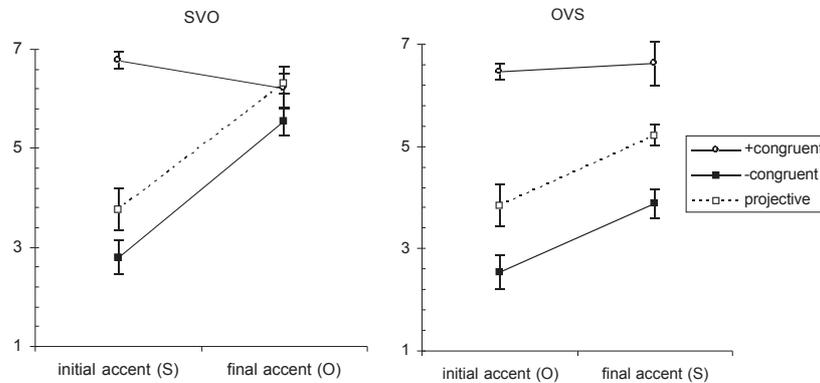


Figure 5: Accent type: H* (Y-bars: confidence intervals at a 5% error level)

ined contexts. Tests of within-subjects contrasts in the SVO order with a final nuclear accent reveal that the difference between the congruent (6.22) and the non-congruent options (5.55) is statistically significant ($F_1(1, 23) = 7.2$, $p < .01$, $F_2(1, 23) = 13.2$, $p < .001$); there is no significant difference between the projective (6.31) and the congruent interpretations (6.22). In the OVS order with a final nuclear accent, the three examined focus domains differ significantly from each other: congruent (6.62) > projective (5.21) ($F_1(1, 23) = 33.8$, $p < .001$, $F_2(1, 23) = 48.1$, $p < .001$) and projective (5.21) > non-congruent (3.88) ($F_1(1, 23) = 14.8$, $p < .001$, $F_2(1, 23) = 23.4$, $p < .001$). Though both orders involve a significant difference to the non-congruent conditions, the effect size of these differences is not the same: in the SVO order, the means' difference between the congruent and the non-congruent contexts has a value of $(6.22 - 5.55 =) .77$, that corresponds to a small effect size (partial $\eta^2 = .24$ pro subjects, .37 pro items), while in the OVS order the same difference has a value of $(6.62 - 3.88 =) 2.74$ that corresponds to a larger effect size (partial $\eta^2 = .81$ pro subjects, .83 pro items).

Since the L+H* realization of the nuclear accent is found by Arvaniti and Baltazani (2005) in narrow focus contexts, we expected to find evidence that this nuclear accent will not have the projective property we observed for H* in Fig. 5. The obtained judgments for L+H* are plotted in Fig. 6. The interaction between WORD ORDER, ACCENT PLACEMENT, and FOCUS DOMAIN in the conditions with L+H* is again significant ($F_1(2, 23) = 23.4$, $p < .001$, $F_2(2, 23) = 30.9$, $p < .001$). In contrast to the findings for H*, the main effect of WORD ORDER and the interaction effect between WORD ORDER and FOCUS DOMAIN are not significant (both pro speakers and pro items). The

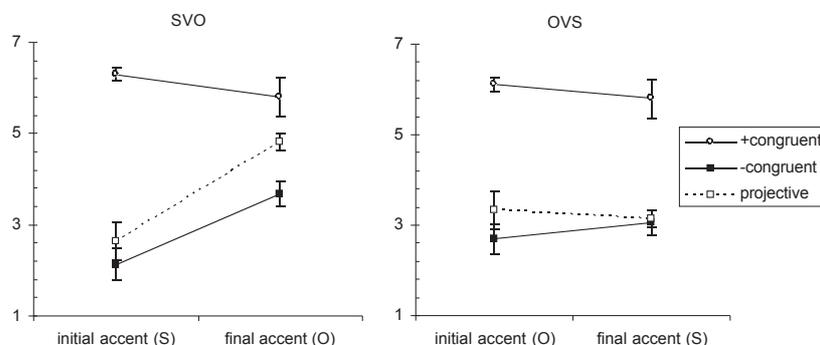


Figure 6: Accent type: L+H* (Y-bars: confidence intervals at a 5% error level)

factor FOCUS DOMAIN has a significant main effect that reflects the large difference in felicity between congruent interpretation on the one side and non-congruent and projective interpretations on the other ($F_1(2, 23) = 220.5$, $p < .001$, $F_2(2, 23) = 500.7$, $p < .001$). The main effect of ACCENT PLACEMENT is also significant ($F_1(1, 23) = 11.1$, $p < .01$, $F_2(1, 23) = 20.7$, $p < .001$), which probably reflects the positive influence on the felicity of the final placement of the nuclear accent in the SVO order. This view is supported by the significant interaction between ACCENT PLACEMENT and WORD ORDER ($F_1(1, 23) = 20.3$, $p < .001$, $F_2(1, 23) = 18.9$, $p < .001$) and the significant interaction between ACCENT PLACEMENT and FOCUS DOMAIN ($F_1(2, 23) = 37.6$, $p < .001$, $F_2(2, 23) = 29.1$, $p < .001$).

The crucial question is whether the L+H* realization has an impact on the projective property of the nuclear accent. Comparing the OVS order in both accent types (see the right panels of Fig. 5 and Fig. 6), we observe that the expected interaction applies in the final accent placement: a final nuclear accent is interpreted as more felicitous with a projective reading in the H* realization than in the L+H* realization. A repeated-measures analysis of variance on these data points (final accent placement in the OVS order) reveals a significant main effect of ACCENT TYPE ($F_1(1, 23) = 27.9$, $p < .001$, $F_2(1, 23) = 56.7$, $p < .001$), a significant main effect of FOCUS DOMAIN (congruent vs. projective: $F_1(1, 23) = 115.3$, $p < .001$, $F_2(1, 23) = 163.9$, $p < .001$; projective vs. non-congruent: $F_1(1, 23) = 7.1$, $p < .01$, $F_2(1, 23) = 14.8$, $p < .001$) and a significant interaction between ACCENT TYPE and FOCUS DOMAIN (congruent vs. projective: $F_1(1, 23) = 15.9$, $p < .001$, $F_2(1, 23) = 19.4$, $p < .001$; projective vs. non-congruent: $F_1(1, 23) = 9.9$, $p < .004$, $F_2(1, 23) = 11.8$, $p < .002$). In the SVO order, we observe that the L+H* nuclear accent has a negative

effect on the felicity of the projective domain (VP focus) in comparison to the same domain with a H* nuclear accent, which is in line with our hypothesis, but an increase in the felicity of the VP-focus in this order is visible in Fig. 6 too. Our hypothesis is confirmed by the fact that these data points (final accent placement in the SVO order) reveal a significant interaction between ACCENT TYPE and FOCUS DOMAIN ($F_1(2, 23) = 22.7, p < .001$, $F_2(2, 23) = 23.8, p < .001$) (along with two significant main effects: ACCENT TYPE $F_1(1, 23) = 30.8, p < .001$, $F_2(1, 23) = 56.8, p < .001$, FOCUS DOMAIN $F_1(2, 23) = 23.4, p < .001$, $F_2(2, 23) = 52.8, p < .001$). Finally, comparing the conditions that involve an initial accent shows that the same data pattern (congruent > projective > non-congruent) generally holds in both word orders and is not influenced by the accent type.

6. Discussion

Our findings show a clear difference in the projective property of early and final nuclear accents. While final accents can generally project in a subset of the examined possibilities, as it may be seen in the felicity of the projective interpretation, initial accents do never do so (in both orders and accentual options examined in this study). This finding confirms the hypothesis that the nuclear stress rule applies in Greek (see Section 2) and is similar to previous experimental findings in English (see the data reported for arguments in Gussenhoven 1983).

The aim of our empirical study was to examine the interaction between the *projective properties* of nuclear accents and the *interpretational properties* of the different tonal realizations of these accents. The empirical confirmation of our hypothesis is the significant interaction effect between ACCENT TYPE and FOCUS DOMAIN in both word orders (only for final accent placement). We found that the H* and L+H* contrast when realized on final constituents, such that the latter accent favours a local reading. This evidence leads to a refinement of the previous observation of Arvaniti and Baltazani (2005), who report that H* signals broad focus (see Section 3). According to the native speaker intuitions reported in the present article, the H* is ambiguous between a local and a projective focus domain, while the bitonal L+H* nuclear accent only has the local interpretation, see (18). Furthermore, our stimuli with initial nuclear accents show that both accents may occur in non-phrase final contexts, in which case the alternative tonal realizations do not contrast, since only the local reading is possible.

- (18) H* → ± local
 L+H* → + local

Previous studies either assume a ‘±contrastive’ distinction or a ‘±local’ distinction for similar tonal alternations in several languages (see Section 3). Our empirical findings relate only to pure manipulations of the focus domain. Hence, the obtained differences between early and final accents as well as the differences between H* and L+H* are independent from semantically relevant operators such as ‘±contrastive’. This is in line with the assumptions of previous research on Greek intonation (see Arvaniti and Baltazani 2005, Gryllia 2008), but against studies on Greek syntax that account for the preverbal focus in terms of an obligatory ‘contrastive focus’ (see discussion in Section 2). Our evidence shows that utterances with a preverbal focused constituent or with an L+H* accent do not require a contrastive context. We do not deny the intuition that these utterances may be judged as ‘contrastive’ when considered out of context, but we claim that this interpretation is the expected result of a pragmatic inference that is motivated by the identificational properties of narrow focus (see Section 3).

Discourse-configurational accounts on Greek syntax claim that preverbal focus is obligatorily contrastive while postverbal focus may optionally be contrastive (see discussion in Section 2). This difference can be used as evidence for the view that the specifier position occupied by the preverbal focus is part of a functional projection that bears the feature [contrastive focus]. Our findings involve a similar asymmetry with respect to the focus domains of these options. Preverbal focus is unambiguously narrow, while postverbal focus is ambiguous between a narrow and a higher focus domain. The question is whether this empirical situation confirms the hypothesis that a feature [focus] is inherent to the left peripheral syntactic configuration. It is crucial that our results relate to the focus domain (and to a semantically relevant concept such as ‘contrastive’). The asymmetry of the focus domains is fully predicted by the nuclear stress rule, hence the assumption of a discourse-related feature in the syntax is redundant.

The differences between the SVO and OVS orders in our data are not predicted by the nuclear stress rule (see Section 2): (a) the projective interpretation of the H* accent reaches a higher level of felicity in the SVO order; (b) the projective interpretation of the L+H* accent is felicitous only in the SVO order. These observations lead to the hypothesis that a factor beyond the nuclear stress rule is involved in our data, namely the influence of (syntactic/prosodic) markedness. The markedness asymmetry between SVO and OVS comes from the fact that the SVO is the preferred word order in Greek. A parallel markedness asymmetry holds between initial and final accent placement: following the nuclear stress rule, an accent on the embedded constituent is the default accentual pattern. Evidence that the accentual structure of broad contexts is considered felicitous in more contexts than other accentual structures is reported

in Féry and Stoel (2006).⁸ Our data shows that the configuration of the canonical order with the unmarked accentual pattern, i.e., SVO order with a final nuclear accent, has an increase in felicity across contexts. The tonal distinction has the predicted effect (L+H* is less felicitous than H* in the projective condition, SVO, final accent configuration), but this effect is cumulated with a positive effect of the unmarked syntactic and prosodic pattern on the intuition of contextual felicity.

The empirical proof for this speculation is that similar effects on contextual felicity are observed for the non-congruent options. We may observe in Fig. 5 and Fig. 6 that the non-congruent options are more felicitous when the accent is final (unmarked prosodic pattern) and are even more felicitous in the SVO order (unmarked syntactic pattern). This finding is not new in our data. A similar finding is reported in Keller and Alexopoulou (2001: 370): non-congruent patterns with a final nuclear accent are judged to be more felicitous than non-congruent patterns with an early nuclear accent. The source of this asymmetry is the fact that the contextual felicity is the product of a set of factors including markedness differences in the involved structures.

7. Conclusions

The major contribution of this study to the mapping of prosody to syntax is the observation that a particular tonal realization of the nuclear accent in Greek (L+H*) does not have the projective properties of default nuclear accents (H*). The effect of this tonal realization is to draw the attention of the hearer to the accented constituent, which motivates a local reading of the nuclear accent. This contrast between alternative tonal realizations is manifested in utterance-final nuclear accents. Nuclear accents on non-final constituents necessarily have a narrow focus reading and the alternative tonal realizations do not have an effect on the interpretation.

Beyond this result, we found an interaction of the rules that map prosody to syntax with syntactic and prosodic markedness. In particular, our results show that the configuration that occurs in broad focus contexts (SVO order with a final nuclear accent) is judged to be felicitous across contexts and independently of the tonal realization of the nuclear accent. This effect replicates the empirical findings of previous experimental studies (Keller and Alexopoulou 2001; Féry and Stoel 2006). This phenomenon is not predicted by theories of prosody-syntax mapping, in particular through the several versions of the nu-

8. On the basis of acceptability data, the authors formulate the “unmarked prosodic structure hypothesis”, that predicts our data pattern: a prosodic structure adequate in a broad focus context can be inserted successfully in more contexts than a marked prosodic structure.

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clear stress rule. Its presence in experimental studies suggests the need of richer models in order to account for this type of data.

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Appendix

- (1) Ο σερβιτόρος άναψε το κερί.
‘The waiter lighted the candle.
- (2) Ο αρχιτέκτονας έχτισε το σπίτι.
‘The architect built the house.
- (3) Ο παππούς έφαγε την πίτα.
‘Grandpa ate the pie.
- (4) Ο ψαράς έπιασε την πέστροφα.
‘The fisherman caught the trout.
- (5) Ο ζυρωρός πλήρωσε τον ζωγράφο.
‘The concierge paid the painter.
- (6) Ο αγρότης τάισε τις αγελάδες.
‘The farmer fed the cows.
- (7) Ο κηπουρός πότισε τα λουλούδια.
‘The gardener watered the flowers.
- (8) Ο κυνηγός κυνήγησε το ελάφι.
‘The hunter hunted the deer.
- (9) Ο Λεωνίδας έκλεψε τα αμύδαλα.
‘Leonidas stole the almonds.
- (10) Η μητέρα μαγείρεψε το ψάρι.
‘The mother cooked the fish.
- (11) Ο Πέτρος νοίκιασε το μηχανάκι.
‘Peter rented the motor-bike.
- (12) Ο εκατομμυριούθος νοίκιασε την έπαυλη.
‘The millionaire rented the villa.
- (13) Η μάγισσα μάζεψε τα βότανα.
‘The witch picked the herbs.
- (14) Ο ληστής χτύπησε τον σκύλο.
‘The thief hit the dog.

- (15) Η γιαγιά στόλισε το δέντρο.
'Grandma adorned the tree.
- (16) Η Άννα έκοψε το ψωμί.
'Anna cut the bread.
- (17) Ο Λεωνίδας πούλησε το βιβλίο.
'Leonidas sold the book.
- (18) Ο κλέφτης έκλεψε το δαχτυλίδι.
'The thief stole the ring.
- (19) Ο πατέρας χαίδεψε τον σκύλο.
'The father caressed the dog.
- (20) Η Λίζα έφαγε τα μανιτάρια.
'Lisa ate the mushrooms.
- (21) Ο κατάσκοπος σκότωσε τον πολιτικό.
'The spy killed the politician
- (22) Η Μαρία κουβάλησε το καλάθι.
'Maria carried the basket.
- (23) Ο σκύλος έθαψε το κόκκαλο.
'The dog buried the bone.
- (24) Η Εύα έπλυνε το παντελόνι.
'Eva washed the trousers.

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