Perception of focus and word order variability in Greek

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Abstract

This is an experimental study of prosodic focus and syntactic word order interactions with reference to agent/recipient semantic relations in Greek. In accordance with one perception experiment, the results in morphology neutral context indicate: (1) listeners do not perceive agent and recipient semantic distinctions and (2) prosody and focus applications do not thus have any perception effect whereas (3) word order has a major interference effect.

Introduction

The present study investigates the perception of semantic relations with reference to agent and recipient specifications. In Greek, the syntactic elements S(ubject), V(erb) and O(bject) may in principle appear in any word order position. However, these syntactic elements may be dislocated at the left edge of a sentence, as a syntactic effect of focus application (Botinis et al., 2005; Nikolaenkova, 2013, 2011).

In addition to focus and word order, morphology and in particular casus declensions may have a syntactic function and related semantic distinctions in Greek. In the sentence, e.g. *[to a'ɣori ma'loni ti ɟi'neka]* "the boy is scolding the woman", the subject on the left edge is a masculine nominative and the object on the right edge is a feminine accusative. A focus application on the subject has usually only prosodic correlates (*to **a'ɣori** ma'loni ti ɟi'neka)* whereas a focus application on the object may have either prosodic correlates (*to a'ɣori ma'loni ti ɟ **i'neka**)* or both prosodic and syntactic correlates (*ti **ɟi'neka** ma'loni to a'ɣori)*. If the object of the latter sentence were the subject, the corresponding casus would be in nominative, i.e. *(i **ɟi'neka** ma'loni to a'ɣori)*. Thus, in Greek, casus declension is a major syntactic correlate whereas word order position shows a large variability and may be correlated with focus applications.

Either subject and object or both may be neutral with reference to casus. Thus, the sentence *[to a'ɣori ma'loni to ko'ritsi]* "the boy is scolding the girl", appears with casus neutralization as the nominative and accusative of neutral nouns have no morphological distinction. The object *[to ko'ritsi]* may move on the left edge when in focus, i.e. *[to **ko'ritsi** ma'loni to a'ɣori]*, whereas *[to ko'ritsi]* may also be a subject in focus, i.e. *[to **ko'ritsi** ma'loni to a'ɣori]*. In the former case the object *[to ko'ritsi]* has recipient function whereas in the latter case the subject *[to ko'ritsi]* has an agent function. In accordance with these examples, a major issue is raised with reference to agent vs. recipient relations and respective distinctions in speech perception.
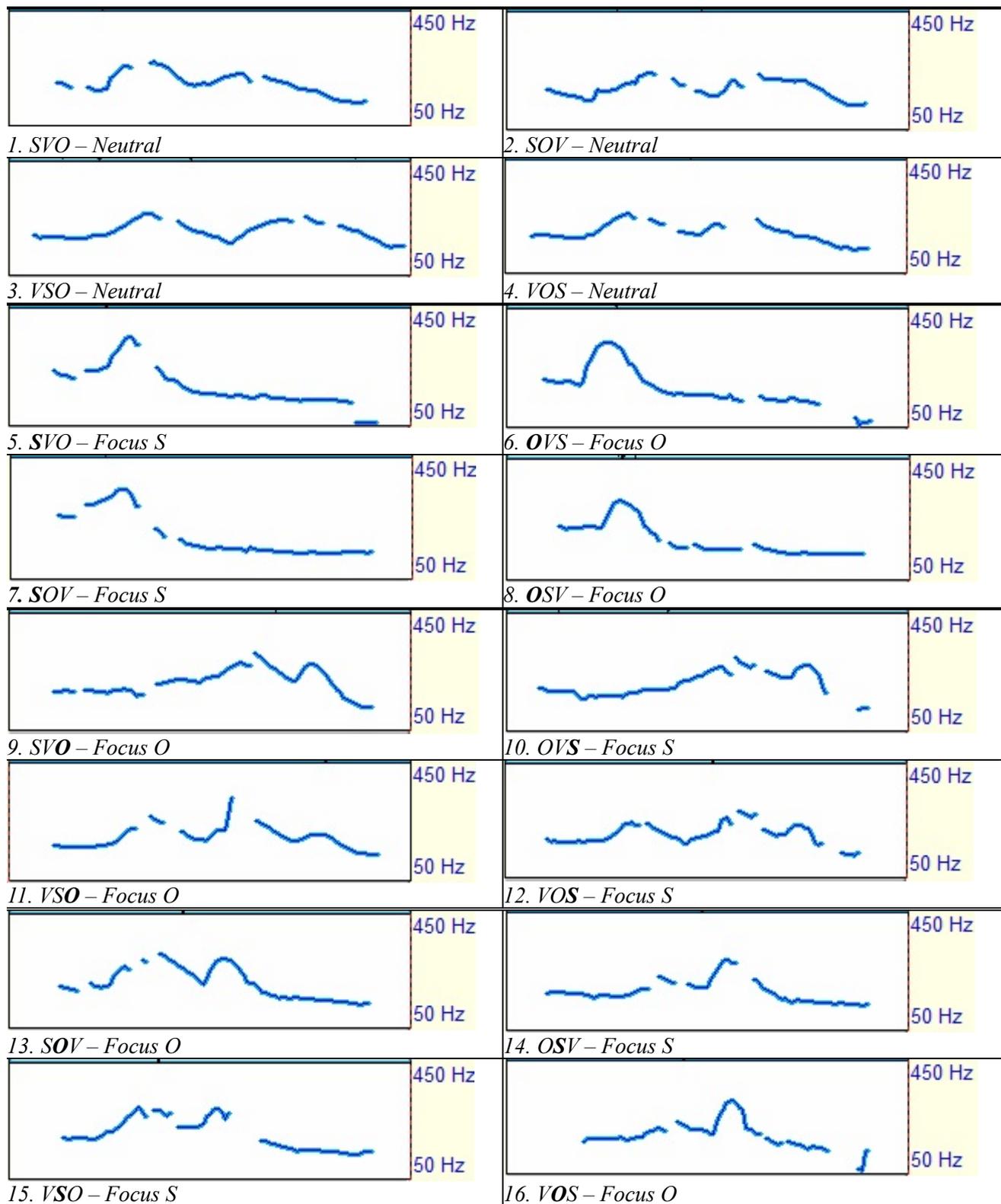
Experimental methodology

A set of 6 test sentences was designed, with all possible syntactic variability (SVO, SOV, OSV, OVS, VSO, VOS) crossed with 3 prosodic focus productions (focus on subject, focus on object, and neutral). The reference test sentence was *[to a'ɣori ma'loni to ko'ritsi]* (the boy is scolding the girl) with the above word order and focus application variability. The speech material was recorded at the Laboratory of Phonetics and Computational Linguistics of Athens University by 2 female speakers in their thirties, with standard Athenian pronunciation.

A set of 72 stimuli (6 syntactic structures × 3 focus productions × 2 nouns × 2 speakers) was organized in a random order and 10 native listeners participated in a close perception test. For each stimulus, listeners were asked to identify the agent. The stimuli were presented on a Matlab program (Mathworks, 2011) over Direct Sound headphones, and were played once the "Play Next" button was pressed. A prompt appeared on screen containing the two possible response buttons, which contained the words *"το κορίτσι"* (the girl) and *"το αγόρι"* (the boy), written in standard Greek orthography. Participants could press only one of them. A "Replay" button was also included in the prompt, which permitted three (3) repetitions maximum.

Results

Figures 1–16 show raw tonal curves of selected productions. The results of the perception experiment are presented in *Table 1* and *Figure 17*. Statistical analysis was carried out using the SPSS 19.0 (SPSS Inc., 2009) software package.

1. SVO – Neutral

2. SOV – Neutral

3. VSO – Neutral

4. VOS – Neutral

*5. **S**VO – Focus S*

*6. **O**VS – Focus O*

*7. **S**OV – Focus S*

*8. **O**SV – Focus O*

*9. SV**O** – Focus O*

*10. OV**S** – Focus S*

*11. VS**O** – Focus O*

*12. VO**S** – Focus S*

*13. S**O**V – Focus O*

14. OSV – Focus S

*15. V**SO** – Focus S*

*16. V**O**S – Focus O*

Figures 1–16. Raw tonal curves of selected productions with different syntactic and focal conditions produced by a female speaker

As shown in *Figures 1–4*, the neutral productions have a regular tonal structure, according to which stressed syllables of lexical words are as a rule associated with local tonal commands which are aligned with respective stress group boundaries. The final stress groups have however a suppressed tonal structure, as a result of utterance finality. Focus productions (*Figures 5–16*), on the other hand, are associated with extended tonal variability: (a) speech material in focus has a local tonal range expansion, (b) speech material out of focus

undergoes deaccentuation and (c) speech material out of focus undergoes major tonal compression. These three ways may operate simultaneously or in combinations in variable linguistic domains. As noted in many previous production studies (e.g. Botinis et al., 2000; Botinis et al., 2005; Chaida, 2010; Nikolaenkova, 2010, 2013), focus productions seem to have constant tonal correlates which operate independently from syntactic, although both tonal and syntactic structures may function complementary with reciprocal reinforcement for focus structures and focus distinctions. Thus, regardless semantic interpretations, the basic tonal characteristics of focus are the same with respect to focus position, i.e. there are great similarities between the following groups of utterances: *(i)* SVO-Focus S, OVS-Focus O, SOV-Focus S, OSV-Focus O (*Figures 5–8*), with focus on the 1st word; *(ii)* SVO-Focus O, OVS-Focus S, VSO-Focus O, VOS-Focus S (*Figures 9–12*), with focus on the 3rd word; *(iii)* SOV-Focus O, OSV-Focus S, VSO-Focus S, VOS-Focus O (*Figures 13–16*) with focus on the second word.

With regards to perception, generalized Estimating Equations (GEE) analysis was used, in order to conduct the equivalent of a repeated measures ANOVA. The logistic linking function was used and each of the two repetitions (one per speaker) was treated as a repeated measurement. Focus syntax, and speaker were within-subjects factors; participant and stimulus were a between-subjects factor.

Table 1. Results for the identification of the agent in each utterance, with respect to syntactic structure and prosodic focus.

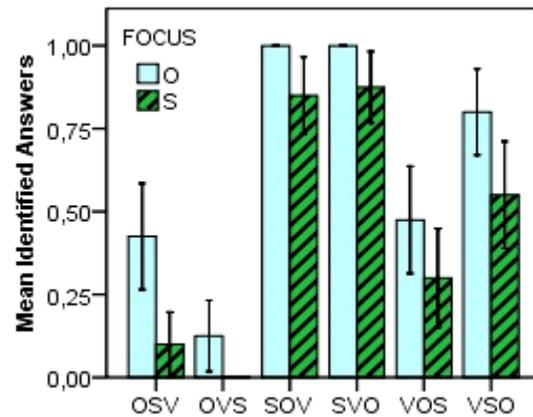| Syntax - Focus	Identification (n)	Identification (%)	SD
SVO - FOCUS S	35/40	88%	.335
SVO - FOCUS O	40/40	100%	.000
SOV - FOCUS S	34/40	85%	.362
SOV - FOCUS O	40/40	100%	.000
OSV - FOCUS S	4/40	10%	.304
OSV - FOCUS O	17/40	43%	.501
OVS - FOCUS S	0/40	0%	.000
OVS - FOCUS O	5/40	13%	.335
VSO - FOCUS S	22/40	55%	.504
VSO - FOCUS O	32/40	80%	.405
VOS - FOCUS S	12/40	30%	.464
VOS - FOCUS O	19/40	48%	.506

Figure 17. Mean results for the intended identification of the agent in each utterance, with respect to syntactic structure and prosodic focus (placed either on the object or on the subject).

In general, syntax (Wald χ^2 (5) = 10673,843, $p < .0001$) had a highly significant main effect, with SVO and SOV structures prevailing in identification (94% for SVO, 93% for SOV, 68% for VSO, 39% for VOS, 26% for OSV, 6% for OVS).

Focus (Wald χ^2 (1) = 5076,080) had a highly significant main effect, with a higher identification of utterances with focus on the object (64% for Focus O, 45% for Focus S).

Furthermore, a highly significant main effect of the interaction between syntax and focus was noted (Wald χ^2 (5) = 4299,466, $p < .0001$).

The highest identification results regarding the agent correspond to all syntactic structures, where the agent is placed in the beginning of the sentence, regardless focus placement, i.e. 100% for SVO-Focus O, 100% for SOV-Focus O, 88% for SVO-Focus S, and 85% for SOV-Focus S. The results for SVO-Focus O and SOV-Focus O were highly significant regarding the interaction between syntax (word order) and focus (Wald χ^2 (1) = 1384,470, $p < .0001$, and Wald χ^2 (1) = 1445,804, $p < .0001$, respectively). On the other hand, there were very low identification rates for OVS-Focus O (13%), OSV-Focus S (10%), and OVS-Focus S (0%).

Neutral productions were 100% identified and are thus excluded from the *Table* and *Figure* above.

Discussion

The results of the present study indicate that syntactic structure, and word order in particular, has a major interference effect on the perception of agent vs. recipient semantic relations and respective specifications.

It is evident that the identification of the agent is highly correlated with the first word of an utterance, which is in accordance with the very high identification rates of respective productions, i.e. 100% for SVO-Focus O, 100% for SOV-Focus O, 88% for SVO-Focus S, and 85% for SOV-Focus S. The placement of the subject and thus the specification of the agent in the beginning of a sentence is the most neutral syntactic structure in Greek. On the other hand, an SVO canonical syntactic structure is the norm taught in schools and grammar textbooks as a rule, which constitutes a significant educational and social interference.

The dominance of the SVO syntactic structure in neutral contexts in Greek has been proposed, in accordance with a series of results in earlier experimental studies (Nikolaenkova, 2013). In a written experiment, students of linguistics at Athens University were asked to set up simple sentences consisting of a wide set of different words with variable morphology, scattered in a random order in a piece of paper. The results of this written experiment suggested an overwhelming SVO syntactic structure. In an oral experiment, another group of students were presented with animated pictures on a computer screen in an agent vs. recipient context and were asked to read aloud what they were seeing with a simple sentence. Much like the results of the written experiment, the results of the oral experiment also suggested an overwhelming SVO syntactic structure.

In contrast to high identification rates with reference to S-leading syntactic structures and respective agent correlations, other word order structures resulted in low identification rates, such as OVS-Focus O (13%), OSV-Focus S (10%), and OVS-Focus S (0%). These results indicate that there is a strong perception bias of word order and agent semantic correlations. The results also suggest that when other linguistic factors, in the first place morphology and prosody, are neutralized, the interpretation of spoken utterances is mainly based on word order syntactic structures.

Focus productions have a variety of language structure correlates, including prosodic, morphological and syntactic ones. This is in accordance with the high functional load and semantic distinctions which focus distinctions are associated with. On the other hand, focus applications have very high identification rates in a variety of different linguistic contexts, including interactions with different sentence types (Chaida, 2010; Nikolaenkova, 2013).

A dislocation of the Object and thus the recipient at sentence beginning as a result of focus application has different perception effects in different contexts. If the Object is casus marked, high identification rates are achieved (Nikolaenkova, 2013). If, however, the Object is morphologically neutral, i.e. neutral nouns in Greek, the dislocation of the Object results to semantic ambiguity, according to which the neutral S-leading syntactic structure prevails. Thus, there is no perception distinction between Object in focus vs. Subject in focus at sentence beginning.

The results of this study indicate that prosodic focus, syntax and morphology have a variety of interactions with reference to semantic relations and the interpretation of spoken utterances in Greek. In particular, morphological variability may be a decisive factor with distinctive functions in syntactic structures and semantic relations across different linguistic contexts.

Acknowledgements

References

Botinis, A., Y. Kostopoulos, O. Nikolaenkova & Ch. Themistocleous. 2005. Syntactic and tonal correlates of focus in Greek and Russian. In: A. Eriksson & J. Lindh (eds.), *XVIII National Phonetics Conference FONETIK 2005 Proceedings*, 99–103.

Chaida, A. 2010. *Production and Perception of Intonation and Sentence Types in Greek.* PhD thesis, University of Athens.

Nikolaenkova, O. 2013. *Multifactor analysis of Greek and Russian sentence.* PhD Thesis. Athens: University of Athens.

Nikolaenkova, O., A. Chaida & A. Bakakou-Orphanou. 2011. Focus perception of syntax and intonation in Greek. *7th AISV National Conference*, Università del Salento, Lecce.

Nikolaenkova, O. 2010. Perception of tonal focus in Greek. In: A. Botinis (ed.), *3rd ISCA Workshop ExLing* 2010 *Proceedings,* 121–124.

Proceedings of Fonetik 2013

The XXVIth Annual Phonetics Meeting
12–13 June 2013, Linköping University
Linköping, Sweden

Studies in Language and Culture
no. 21

Robert Eklund, editor

Linköping University