

Focus and gender interactions and prosodic correlates

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This is an acoustic study of temporal and tonal correlates of focus in Greek and German as a function of female and male speaker gender. The main results indicate: (1) focus has a local tonal expansion in combination with a contextual tonal compression in both languages, (2) focus has segmental temporal effects in both languages, (3) the female tonal production is about 60% higher than the male tonal production in both languages and (4) there are significant interactions of the investigated variables of language, focus and gender with reference to tonal and temporal correlates.

1. Introduction

This paper is a report of tonal and temporal patterns in Greek and German as a function of the speaker's gender and focus. The main question concerns thus a fairly physiological aspect of prosodic production with reference to gender as well as a contrastive aspect with reference to focus production and language. Focus may have both local and global acoustic correlates in many languages (Botinis, 1989; Botinis, 1998; Botinis, Bannert & Tatham, 2000). The tonal range of a stressed syllable in focus may be locally expanded whereas, at a global level, the tonal range may be substantially compressed. The temporal correlates of focus, on the other hand, may not be constant and a stressed syllable of focus production may thus be longer than that of the neutral production, but this is not a constant pattern.

2. Experimental methodology

The Greek and German sentences “i 'mona/'sasa 'pije sto 'monaxo” and “Mona/Sassa flog nach Monaco” (Mona/Sassa flew to Munich/Monaco) were produced by five female and five male speakers, ten times each, fairly neutrally or either “Mona/Sassa” or “Munich/Monaco” in focus. Tonal measurements were taken at (1) *utterance tonal onset*, (2) *peak Mona f₀*, (3) *peak Munich/Monaco f₀*, and *utterance tonal offset* of “Mona” productions. Temporal measurements were taken for all four segments of “Sassa” productions. The speech material was analysed with Waveserfer and statistical processing was carried out with StatView.

3. Results

The results are presented in Figures and Tables in the following sections. The figures and the temporal data in Table 2 are based on linear data whereas Table 1 is based on logarithmic data for normalisation of intrinsic female and male tonal differences.

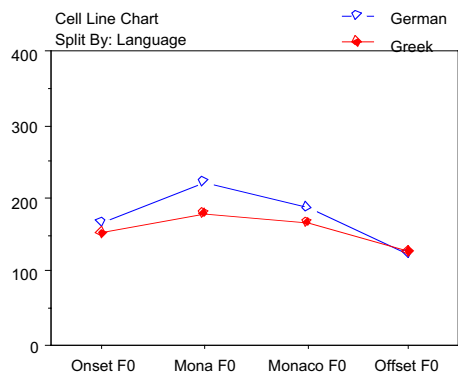


Figure 1a. Tonal measurements as a function of German and Greek.

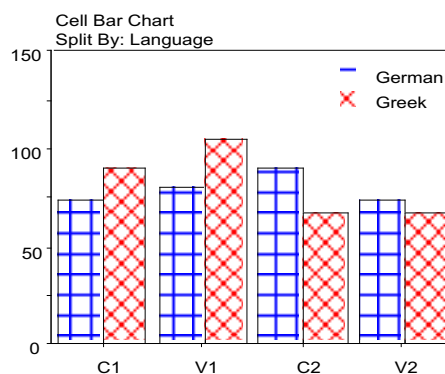


Figure 2a. Temporal measurements as a function of German and Greek.

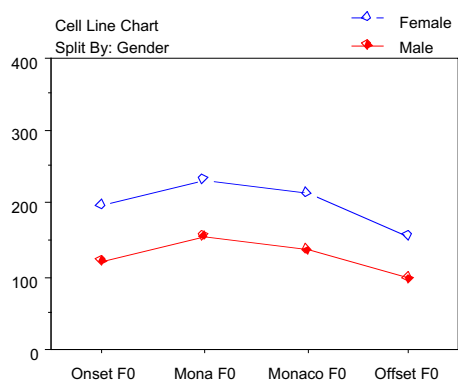


Figure 1b. Tonal measurements as a function of female and male speaker gender.

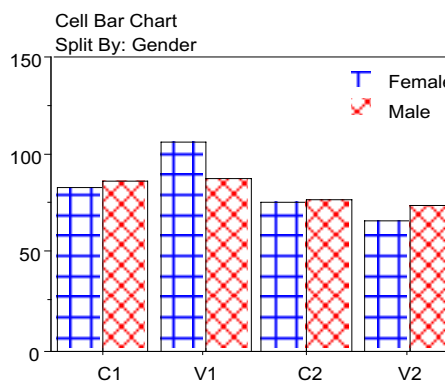


Figure 2b. Temporal measurements as a function of female and male speaker gender.

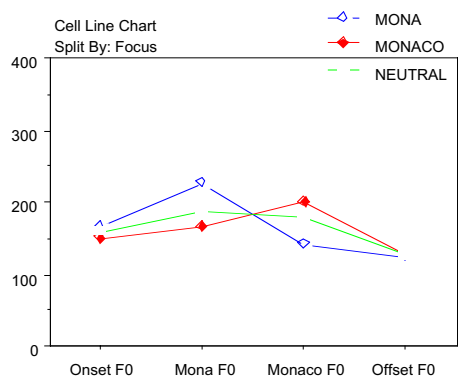


Figure 1c. Tonal measurements as a function of focus.

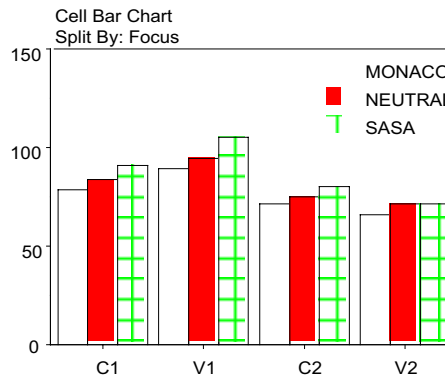


Figure 2c. Temporal measurements as a function of focus.

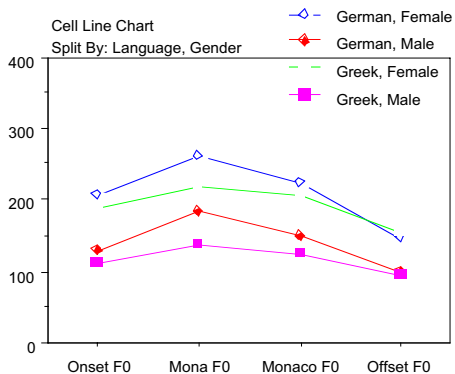


Figure 1d. Tonal measurements as a function of language and speaker gender.

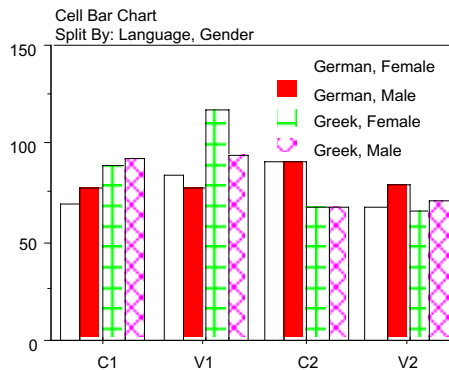


Figure 2d. Temporal measurements as a function of language and speaker gender.

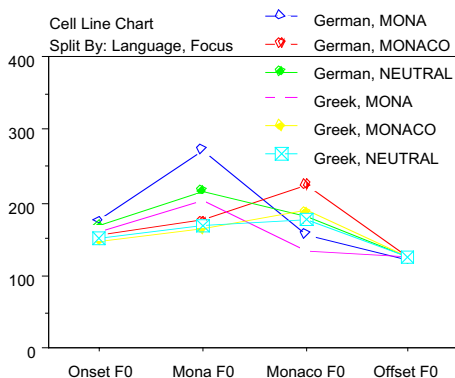


Figure 1e. Tonal measurements as a function of language and focus.

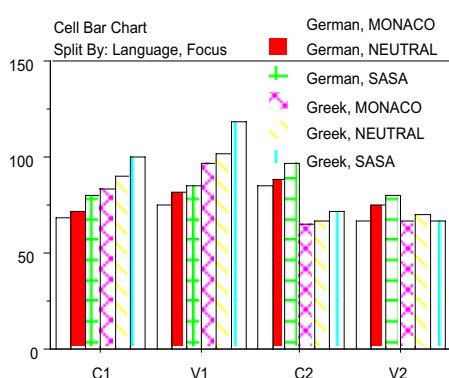


Figure 2e. Temporal measurements as a function of language and focus.

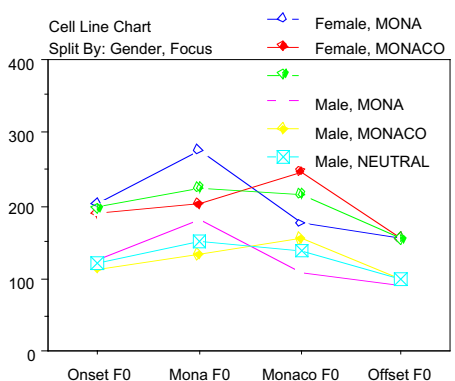


Figure 1f. Tonal measurements as a function of speaker gender and focus.

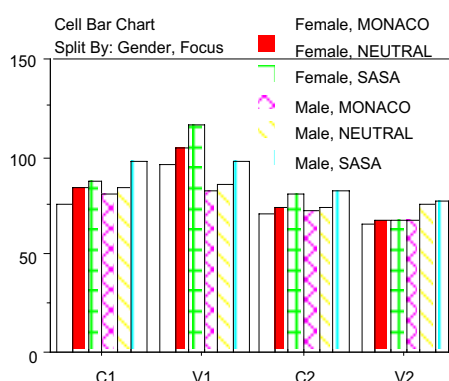


Figure 1f. Temporal measurements as a function of speaker gender and focus.

Table 1. Statistical analysis of the results with reference to tonal productions (see text).

| Variables | Tonal onset | Peak Mona f_0 | Peak Monaco f_0 | Tonal offset |
|---------------------|-------------------|--------------------|--------------------|-------------------|
| Language | $F=22, p<0.0001$ | $F=252, p<0.0001$ | $F=87, p<0.0001$ | NS |
| Gender | $F=954, p<0.0001$ | $F=1043, p<0.0001$ | $F=1206, p<0.0001$ | $F=603, p<0.0001$ |
| Focus | $F=12, p<0.0001$ | $F=239, p<0.0001$ | $F=236, p<0.0001$ | NS |
| Language* Gender | NS | $F=6, p<0.01$ | $F=9, p<0.002$ | $F=7, p<0.006$ |
| Language* Focus | NS | $F=37, p<0.0001$ | $F=14, p<0.0001$ | NS |
| Gender *Focus | NS | NS | NS | NS |

Table 1. Statistical analysis of the results with reference to temporal productions (see text).

| Variables | C1 [s] | V1 [a] | C2 [s] | V2 [a] |
|---------------------|------------------|-------------------|-------------------|------------------|
| Language | $F=81, p<0.0001$ | $F=208, p<0.0001$ | $F=342, p<0.0001$ | $F=8, p<0.003$ |
| Gender | $F=7, p<0.0005$ | $F=63, p<0.0001$ | NS | $F=18, p<0.0001$ |
| Focus | $F=15, p<0.0001$ | $F=25, p<0.0001$ | $F=19, p<0.0001$ | $F=4, p<0.009$ |
| Language* Gender | NS | $F=20, p<0.001$ | NS | NS |
| Language* Focus | NS | $F=3, p<0.02$ | NS | $F=3, p<0.04$ |
| Gender *Focus | NS | NS | NS | NS |

4. Discussion

Language, gender and focus tonal productions were found significant for (utterance) tonal onset and word peak f_0 but hardly for (utterance) tonal offset (gender productions are however significant). Significant interactions were also found, most importantly between language and speaker gender as well as language and focus with reference to word peak f_0 (see Table 1). Temporal productions were also found significant as a function of language, gender and focus whereas significant interactions were mostly evident with reference to vowel segment productions (see Table 2).

5. References

- Botinis, A. (1989) *Stress and Prosodic Structure in Greek*. Lund University Press.
- Botinis, A. (1998) Intonation in Greek. In *Intonation Systems: A Survey of Twenty Languages* (D. Hirst & A. Di Cristo, A., editors), pp. 288-310. Cambridge University Press.
- Botinis, A., Bannert, R. & Tatham, M. (2000) Contrastive tonal analysis of focus perception in Greek and Swedish. In *Intonation: Analysis, Modelling and Technology* (A. Botinis, editor), pp. 97-116. Dordrecht: Kluwer Academic Publishers.