

It is well established that prosody is involved in many interfaces, from phonology (Nespor & Vogel 1986) and syntax (Selkirk 1984), to pragmatics (Pierrehumbert & Hirschberg 1990) and sentence processing (Schafer 1997), but the relation between prosody and logical scope is more controversial (cf. Jackendoff 1972, Büring 1997, Baltazani 2002). This paper argues that the prosody-scope interface has a complex yet coherent structure that has hitherto gone unnoticed. The studies reported use a novel language production method and examine a variety of operators, including negation and three quantifiers.

Subjects saw 192 sentences containing two of four different operators (“every”, “a”, “a few”, and “not”), such as “Every circle hits a square”. Pictures representing both potential scope readings accompanied each sentence, and one was designated as the target. Subjects were instructed to read aloud each sentence verbatim, but to communicate the target picture rather than the non-target. Each sentence was presented twice (non-consecutively), alternating targets, to provide a fully-crossed design. Several acoustic parameters were analyzed, including operator duration and sentence-final pitch contour.

We performed ANOVAs using the factors Scope (wide vs. narrow) and Context Operator (the other operator in the sentence), for each acoustic measure, and for each operator. For the measure of operator duration, Context Operator interacted significantly with the Scope of each quantifier (for *every* – $F_{(2, 372)} = 3.04$, $p < 0.05$; for *a few* – $F_{(2, 372)} = 4.12$, $p < 0.05$; and for *a* – $F_{(2, 372)} = 3.40$, $p < 0.05$). This demonstrates that scope creates prosodic differences, and that the magnitude and direction of these differences depend on the identity of both operators in the sentence.

Planned contrast analyses revealed a strikingly coherent picture. In summary, if we posit the hierarchy in (1) and the rule in (2), we can fully describe the pattern of operator duration for all three quantifiers.

- (1) **Quantifier Hierarchy:** *every* >> *a few* >> *a*
- (2) **Scope-Prosody Correspondence Rule:** If quantifier A scopes over quantifier B, increase the duration of A if B is higher on the hierarchy, but decrease the duration of A if B is lower.

That is, “a” lengthens when it takes wide scope, “every” *shortens* when it takes wide scope, and “a few” lengthens when it scopes over “every” but shortens when it scopes over “a.”

One hypothesis is that prosody is used to reflect unexpected or dispreferred readings. In a follow-up experiment, subjects rated how well each sentence fit the target. Results show very significant interactions (all p 's < 0.0001) that mirror the same structure as the prosodic patterns reported above, strongly suggesting that expectations are playing an important role. Interestingly, the findings show that subjects use longer durations to mark expected rather than unexpected readings. This has important implications for theories of prosodic function.

This paper shows that the prosody-scope interface has a more complex structure than previously known, and it demonstrates that expectations play an important role in that structure. These findings are important contributions to our understanding of both the processing of scope and the function of prosody in production.