

Prosodic Marking of Grammatical Roles in Turkish Sentences

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Sentences are riddled with temporary ambiguities, yet adults process sentences in real-time and rarely misunderstand them. How are people able to do this, despite the daunting computational problems posed by considering many parses that are possible at any given point in a sentence? Most research on sentence processing has investigated the syntactic cues that people use to understand sentences. However, because these studies are generally conducted on fixed word order languages, they have typically found that people rely heavily on word order as a cue for “who did what to whom” in sentence processing. But how do people determine the meaning of sentences in free word order languages like Turkish, where word order is less predictive of a sentence’s meaning? One possibility is that sentences in free word order languages contain early probabilistic acoustic cues that allow people to predict the eventual parse of the sentence, thereby reducing the number of possible they must consider. This study investigates whether such acoustic cues for syntactic structure exist in spoken Turkish.

Turkish is generally considered to be a free word order language because, if a sentence’s object receives accusative casemarking (O_i), all 6 possible word orders (SOV, OVS, SVO, OSV, VSO, VOS) are grammatical. However, if a sentence’s object is not casemarked (O_o), only SOV and OVS word orders are grammatical. Because OVS sentences are rarer and more pragmatically marked than SOV sentences, we predicted that Turkish-speaking adults would prosodically mark OVS sentences relative to SOV sentences. Because object casemarking unambiguously indicates a noun is an object, we predicted that Turkish speakers would prosodically mark sentences that have non-casemarked objects.

METHOD. Seven native Turkish-speaking adults read aloud 4 types of sentences that were created by orthogonally crossing word order (SOV/OVS) and object casemarking (O_i/O_o). Each of the 4 sentence types appeared in 36 scenarios for a total of 144 sentences (see Figure 1). Scenarios were created by pairing two nouns with 36 verbs such that either noun was equally likely to be the agent of the sentence (e.g., the nouns “man” and “woman” were paired with “see”). Sentences were presented in pseudorandom order, and participants read sentences silently to themselves until they understood its meaning, and then read the sentence aloud in a clear and natural manner. Participants’ productions were recorded using a Shure SM10A microphone set to a sampling rate of 44.1 kHz. Morpheme boundaries were marked by hand and the mean amplitude, mean fundamental frequency (F0) and duration of each morpheme was determined using Praat (version 6.0.37, Boersma & Weenink, 2018).

RESULTS. Due to space limitations, we restrict our discussion to F0 because it is the primary acoustic cue for making a constituent prominent (e.g., topicalization). In the analyses, constituent’s root morphemes were numbered (e.g., SOV, S=1, O=2, V = 3). ANOVAs of mean F0 for all 4 sentence types with sentence structure and constituent number as fixed effects and subject as a random effect showed a significant interaction between sentence structure and constituent number, $F(6, 36) = 6.618$, $p < .001$. Planned comparisons of SO_oV and SO_iV sentences, and of O_oVS and O_iVS sentences revealed that there was a sharper drop in mean F0 in the transition from object to verb in sentences when objects were not casemarked (OVS: $F(1,6) = 28.475$, $p < .01$, see Figure 2; SOV ($F(1,6) = 10.859$, $p < .05$, see Figure 3). Post-hoc analyses confirmed that the difference in OV drop was the source of the interactions: For OVS sentences, the O-V drop was 19.1 Hz for O_oVS and 3.02 Hz for O_iVS ($t(501) = 3.987$, $p < .001$), and for SOV sentences, the O-V drop was 33.58 Hz for SO_oV and 10.32 Hz for SO_iV ($t(494) = 6.899$, $p < .001$).

DISCUSSION. The greater pitch-drop in sentences with non-casemarked objects compared to those with casemarked objects serves to mark prosodically that a non-casemarked noun is the object of the sentence. Turkish speakers may consciously or unconsciously be signaling to the listener that a hard-to-understand sentence is about to be uttered. If this is true, Turkish adults should have less difficulty understanding non-casemarked sentences when they are prosodically heavily marked.

	Object-marked	Object-unmarked
SOV	Boy girl-acc chased.	Boy girl chased.
OVS	Girl-acc chased boy.	Girl chased boy.

Figure 1. An example of four type of sentence for one scenario. All of the sentences mean “The boy chased the girl.”

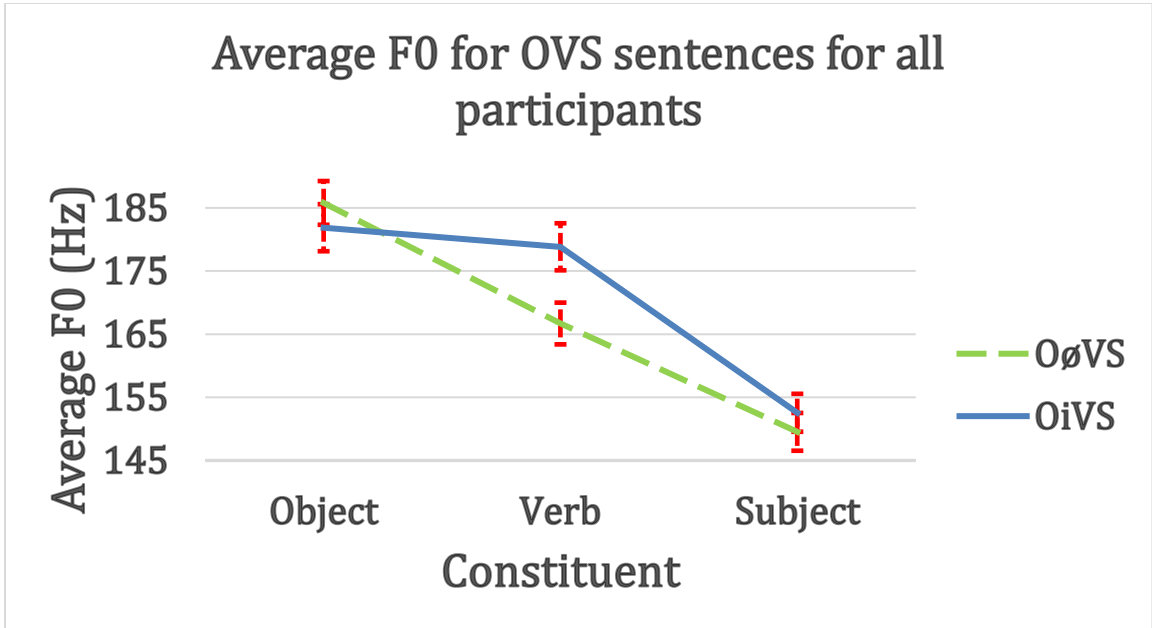


Figure 2. Average fundamental frequency for of $O_{\emptyset}VS$ and O_iVS sentences.

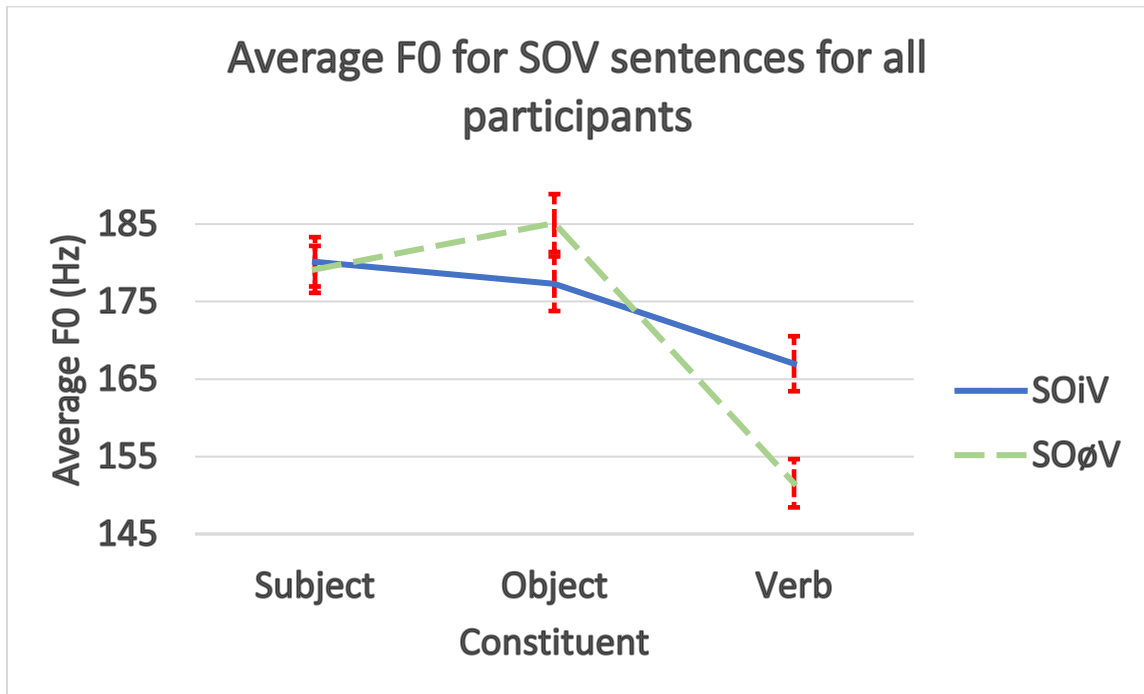


Figure 3. Average fundamental frequency for $SO_{\emptyset}V$ and SO_iV sentences.