

Prosody in read aloud text: relation with information status, content type and boundary strength

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Abstract

In two short stories three text characteristics have been implemented independent of each other: information status, content type, and boundary strength. Thus, each characteristic could be assessed for its unique effect on prosody. Both stories were read aloud by ten speakers. No effects were found for pitch range and articulation rate, but pause duration did vary systematically with each of the text characteristics. Effects ranged from small for information status to moderate for content type, and large for boundary strength.

Key words: narrative, text characteristics, prosody, pause duration

Introduction

Research on text prosody has focused on various prosodic features of sentences in relation with their position and function in a text (see e.g. den Ouden, Noordman and Terken, 2008). It has not settled the issue, however, whether effects are real or spurious, that is, does a specific text characteristic exert an influence on its own, or because it happens to coincide with another characteristic actually being the effective one? In this paper we report a study in which, independent of each other, three text characteristics were assessed for their effect on prosody.

Text characteristics

Three text characteristics have been shown to affect prosody: information structure (van Donzel, 1999), message content (Swerts, Krahmer, Theune and Weegels, 2002), and text organization (den Ouden, 2004). Although some use these terms interchangeably, they represent different perspectives on a text as we show here with the texts read aloud in the study.

Information structure is signaled by referential continuity. Does a sentence give information on a referent mentioned in the sentence directly preceding or on some other referent? Box 1 shows how successive sentences switch between both possibilities, denoted [*same*] and [*other*].

Message content is defined as the global meaning or gist of a paragraph. Stories are constructed from four basic content types (see Box 2). They start with some background information (*state*) that leads to a challenging situation (*outcome*). This takes story characters into a sequence of episodes

in which they want things (*goal*), try to realize them (*attempt*), and experience that they have either failed or succeeded (*outcome*).

Box 1. Illustration of referential continuity (either [same] or [other]).

..... (11) Recently, a businessman had a promising contact with a Columbian (12) He [same] could buy pure cocaine at a low price (13) The police [other] wanted to take advantage of this contact (14) They [same] decided to place a trap for the mafia (15) They [same] wanted to strike drugs traffic very hard (16) Crime in the street [other] had to be pushed back (17) The police [other] formed a team of detectives (18) That [same] had a number of officers infiltrate

Box 2. Illustration of content types (for each instance the serial number and content of the central sentence, and serial numbers of surrounding sentences).

State	(6)	Circle Island has a shortage of water	1-10
outcome	(11)	Recently, a scientist discovered a cheap method of water treatment	11-12
goal	(14)	The farmers decided to build a canal straight across the island	13-16
attempt	(18)	They lobbied a few senators to join	17-21
outcome	(23)	The senate, however, voted against	22-24
goal	(26)	A smaller canal had to be build	25-27
attempt	(28)	The construction of the smaller canal started	28-30
outcome	(33)	The canal project had failed	31-34

Text organization is scored as boundary strength: the distance between adjacent sentences in terms of the hierarchical structure of the text like the one depicted in Figure 1. Boundary strength is *absent* for short distances (e.g., from 9 to 10), *weak* and *moderate* for longer distances (e.g., from 4 to 5 and 12 to 13), and *strong* for long distances (e.g., from 16 to 17; for details on scoring, see den Ouden, 2004, p.25).

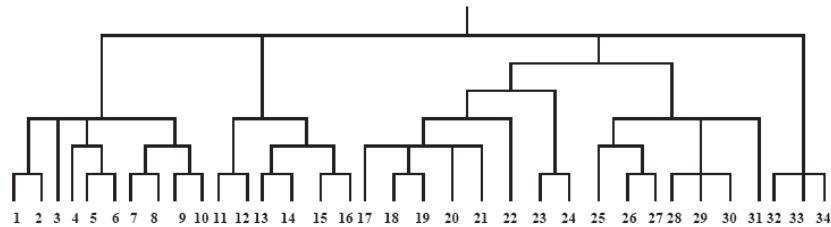


Figure 1. Structure underlying the experimental texts.

Research questions

Does each of the three text characteristics affect prosody independent of the other two? And if so, how much do they differ in their effect sizes?

Method

Material

Experimental texts were Thorndyke's (1977) *Island* classic on a political issue and a newly written story on drug crime. Both texts were 34 sentences long. They differed in their contents, but shared the hierarchical structure presented in Figure 1. Each sentence was scored for Information Status (it started with a referent mentioned in directly preceding sentence, or it did not), Content Type (it was part of a paragraph informing on a state, goal, attempt, or outcome), and Boundary strength (its distance from the directly preceding sentence in the hierarchical structure was scored as either absent, weak, moderate, or strong). Within a story each of the text characteristics was distributed sufficiently even, both in number and position. They occurred independent of each other with one exception: strong boundaries tended to coincide less often with a 'same' referent. This trend was too weak to be of any influence on the results.

Procedure

Ten speakers participated (5 men, 5 women). They prepared both texts and then read them aloud (with a third structurally different text read aloud in between the two). Three prosodic features were measured of each sentence: duration of preceding pause, pitch peak and articulation rate. For each prosodic feature repeated measures anova's were run with Gender and Speaker as nested within-factors, with Story and one of the three text characteristics as between-factors, and with the other two text characteristics as covariates. Effect size was determined with partial eta-squared (η^2).

Results

Pitch peak and articulation rate showed no significant main effects, but pause duration did: for Information Status ($F(1,60)=3.27$, $p=.07$, i.e., tested one-sided $p<.05$, $\eta^2=.05$), Content Type ($F(3,56)=3.06$, $p<.05$, $\eta^2=.14$), and Boundary Strength ($F(3,56)=10.13$, $p<.001$, $\eta^2=.35$). Table 1 presents mean pause durations for the three text characteristics. All effects occurred independent of Gender and Story; there were no significant interactions. The effects on pause duration differed in size: small for Information Status, medium for Content Type, and large for Boundary Strength. To illustrate the magnitude of the differences Table 1 also presents the difference of each score from the overall mean pause duration (718 msec).

Table 1. Pause duration in relation with text characteristics (first line: score in absolute figures, second line: score relative to overall average of 718 msec).

Information Status		ContentType				Boundary Strength			
same	other	state	outcome	goal	attempt	absent	weak	moderate	strong
685	746	653	694	767	775	660	696	738	948
-33	+28	-65	-24	+49	+57	-58	-22	+20	+230

Discussion

When carefully controlled for confounding effects in the design both of the experimental texts and the statistical analyses, each of the three text characteristics, that is, information status, content type and boundary strength, appears to have a discernable effect on pause duration independent of the other ones. Linguistic theorizing on text prosody and computational generation of artificial speech will have to consider these three text characteristics simultaneously to gain a full understanding of human speech and an adequate mimic in text-to-speech systems.

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