



The role of intonation in emotional expressions

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Abstract

The influence of emotions on intonation patterns (more specifically F0/pitch contours) is addressed in this article. A number of authors have claimed that specific intonation patterns reflect specific emotions, whereas others have found little evidence supporting this claim and argued that F0/pitch and other vocal aspects are continuously, rather than categorically, affected by emotions and/or emotional arousal. In this contribution, a new coding system for the assessment of F0 contours in emotion portrayals is presented. Results obtained for actor portrayed emotional expressions show that mean level and range of F0 in the contours vary strongly as a function of the degree of activation of the portrayed emotions. In contrast, there was comparatively little evidence for qualitatively different contour shapes for different emotions.

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1. Introduction

This paper examines the contribution of intonation to the vocal expression of emotions. Over the past decades, this question has been addressed by many authors from different research backgrounds and is still a matter of sustained debate. A tradition, emerging from the linguistic approach to

the study of intonation contours, has claimed the existence of emotion specific intonation patterns (e.g. [Fonagy and Magdics, 1963](#)). However, the evidence offered for this notion consists mostly of selected examples rather than of empirical examination of emotional speech recordings. Efforts to describe/analyze the intonation of actual emotional expressions have been limited by the use of simplified descriptors, such as measures of overall pitch level, pitch range or overall rise/fall of pitch contours. Some authors have directly questioned the existence of emotion specific intonation patterns. [Pakosz \(1983\)](#), for instance, claimed that

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intonation only carries information about the level of emotional arousal. In this perspective, elements of the context in which the expressions are produced and/or information carried by other channels (typically facial expressions) are required to disambiguate specific emotion categories.

In the following paragraphs, more details on (1) the linguistic approach to the description/analysis of intonation and (2) some results obtained on the basis of empirical analysis of emotional speech are reviewed. The limits of those approaches for the study of the intonation of emotional speech are introduced; and, finally, the approach used in the study presented in this paper will be outlined.

1.1. *The linguistic approach to the description/analysis of intonation*

Various definitions of concepts such as *intonation* or *prosody* have been proposed by authors working on the analysis and description of nonverbal features of running speech. Cruttenden (1986, pp. 2–3), proposed the following definition:

“The prosody of connected speech may be analysed and described in terms of the variation of a large number of prosodic features. There are, however, three features which are most consistently used for linguistic purposes either singly or jointly. These three features are pitch, length, and loudness. [...] Pitch is the prosodic feature most centrally involved in intonation and it is with this feature that I shall be principally concerned in this book.”

As in the above citation, the definition of the term *intonation* generally includes aspects related to *pitch*, *length* and *loudness*; whereas, somewhat paradoxically, most authors focusing on *intonation* described and analyzed essentially *perceived pitch contours*. Transcriptions of pitch contours were first developed to account for linguistic functions of intonation, often with a didactic purpose. A great variety of transcription systems have been proposed over time. Thirty years ago, Léon and Martin (1970, pp. 26–32) distinguished, for instance, six forms of pitch transcription, including “musical transcriptions”, “transcriptions of pat-

terns of intonation” and “transcriptions representing levels of intonation”. More recently, different models have been proposed for the linguistic analysis and description of intonation (perceived pitch). A broad distinction can be made between *tone sequence models* (such as the Tones and Break Indices system, ToBI, Silverman et al., 1992)—which describe pitch as a sequence of (high/low) tones on specified targets—and *superpositional models*—which define the overall pitch contour as the superposition of hierarchically ordered components.

The most prominent superpositional model (Fujisaki, 1988), includes two components: a phrase component (i.e. a contour defined at the phrase level) and an accent component (i.e. local excursions superposed to the phrase contour). Superpositional models allow to account for phenomena such as global pitch declination or anticipation effects in the production of overall pitch contours. But, independently of the number and the quality of the components included, superpositional models remain relatively abstract. With respect to actual pitch contours, one or more component(s) need to be fixed according to a set of more or less arbitrary rules, allowing to define the other component(s). Furthermore, relationships between those relatively abstract components of pitch contours and linguistic or paralinguistic functions are difficult to specify.

In recent years, tone sequence models have been more extensively used than superpositional models for the description and analysis of linguistic intonation (perceived pitch). ToBI (Tones and Break Indices system, Silverman et al., 1992)—a pitch transcription system originally derived from the tone sequence model developed for the intonation of English by Pierrehumbert (1980)—has been adapted and used extensively for the description of perceived pitch in several languages. In this coding system contrastive tone values (high/low) are attributed to linguistically defined targets. Relative pitch levels (tones) are allocated to accented syllables (pitch accents) and to intonative boundaries (phrasal tones, final boundary tones).

Linguistic models of intonation rely, more or less explicitly, on linguistic segmentations of the speech flow and their primary purpose is to

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