SOME GENERAL REMARKS ON DESIGNING LINGUISTIC MODELS OF INTONATION

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ABSTRACT

The main purpose of this contribution is to collect and put to discussion some general thoughts and ideas for the modelling of intonation. Two different aspects of this approach may be discerned: An interior aspect concerning the structuring and the elements of intonation models proper and an exterior aspect which focusses on intonation in a wider linguistic and non-linguistic context. Some notes of the perspectives on future research will round up my reflections.

1. INTRODUCTION

Surveying the development of linguistic intonation research of the last decades, one is somewhat surprised by the number and scope of all the research efforts. This is true of such areas as phonetics, general linguistics, psychology, and psychoacoustics.

Within the field of phonetics, a great number of descriptions of the Fo-movements in sentences of various languages have seen the light, and usually they are claimed to be models of intonation. In most cases, intonation equals the movements of fundamental frequency (Fo) or the succession of tones (pitch) throughout a linguistic utterance. As a rule, the linguistic specification of the input is not highly elaborated. Considering the universal dimension of human language, however, the largely differing and seemingly contradictory phonetic structure of the models is quite surprising. This is particularly true of languages that are very closely related to each other. The question arises of course if this diversity in modelling really reflects linguistic variation. We know

very well, though, that variation of Fo represents a rather simple system: for linguistic purposes, Fo either rises or falls within different ranges in certain segments and syllables. There may be different reasons for this variety of description which I do not want to discuss here. For a general perspective, I would like just to put forth some remarks. First, I will consider some interior aspects of intonation models and will commence with the area of phonetics proper. Second, I will turn to some exterior, linguistic and non-linguistic aspects. They should altogether be considered important because we ought not lose sight of the total range of our endeavours, namely studying language as the most significant and effective means of man's communication for social interaction in a given situation.

2. ASPECTS OF INTONATION MODELS

Starting from the numerous and diverse descriptions of intonation in the literature, some comments on the models will touch their structure and their parts.

2.1. Levels of description

No explication is required in order to understand why so many of the descriptions of intonation pertain to production, e.g. are speaker oriented. Given the Fo analysed rather easily from the acoustic signal, it appears relatively uncomplicated to put into rules the different movements of Fo as a consequence of linguistic parameters systematically varied and thus, step by step, generating an Fo-curve. Another motive for this approach is to be found in the synthesis-by-rule of a given language. First, synthetic speech had to

be made more natural and second, the method of rule synthesis itself in an interactive approach makes it possible to assess the formulation of the rules directly. This method of analysis-by-synthesis has also turned out very profitable for the development of intonation models.

Less numerous are listener oriented intonation models. It is quite understandable that models of production aim at generating the total variation of Fo - possibly undistorted by the influences of microprosody - throughout an utterance. Opposed to this, models of perception explicitly aim at the essentiel parts of the Fo-curve that are necessary and sufficient for the listener to identify some linguistic features. It might not be completely correct to maintain that listener oriented models of intonation are more important, revealing or simply more interesting than speaker oriented ones. However, we know very well that the Fo found in the signal and produced by the speaker shows a large amount of redundancy. Furthermore, it remains to be seen whether Fo alone, in fact, carries the responsability for the perception of melody of language or in what ways Fo interacts with other acoustic parameters in speech perception.

2.2. Macrointonation

Apart from some early attempts to describe intonation in continuous speech, most of the intonation models of the preceding years are based on the sentence representing the unit of analysis and description. This may, however, not only be considered a reflex of the corresponding unit of analysis of general linguistics of the last decades. From a methodological point of view, it appears quite advisable, especially when obeying the demand for a rigorous control of the variables chosen, to start investigating rather simple and manageable units. From this follows almost of necessity that test sentences, under the given conditions, cannot be spoken freely as in natural verbal communication but are read aloud from sheets of paper in the laboratory. Everybody who has investigated intonation (and prosody in general) has found themselves in a

situation where some informants had to be discarded because they were simply not able to produce the test sentences under the various conditions demanded.

Due to the limitation to one sentence (often syntactically and semantically simple), it appeared relatively easy to visualize the range of variation of Fo throughout an utterance using geometric means such as straight lines: base line and top line with certain declinations and focal lines, thus the tonal grid. Among the intonation models of hierarchical representation, however, one version is to be found which manages without any geometrical devices such as straight lines or higher functions. At the very beginning of the process of generating intonation step by step, the range of variation of Fo throughout the utterance is defined by Fo-levels that are related to significant points of the utterance. The dynamic nature of Fo-movements or pitch variation, at least in German, is expressed by a formula including the contribution of various phonetic and linguistic features.

The attempts to write rules and to present visually the intonation of sentences syntactically more complex and small texts lead to the development of the geometric framework of lines: direction and range of the grid were allowed to vary in accordance with varying syntactic, semantic, and pragmatic conditions. Future research with spontaneous speech will show us perhaps that the phenomenon of uniform declination may be a typical feature of sentences and prose read aloud. It may perhaps also teach us that models based on automatic and stereotype declension of Fo will have to be basically restructured.

As general linguists have turned to discourse, the general interest of many phoneticians, including prosodists, has turned to spontaneous, natural speech. Therefore, in a future not too far remote, we will, quite sure, learn more about the gross structuring of naturally spoken language. On this new route, the question concerning the tonal units larger than the stress group, e.g.

macrointonation (and macroprosody), will represent a concern of central significance.

2.3. Parts of the model: tonal elements

Intonation models contain linguistically and prosodically motivated basic elements. Reviewing the models, many questions arise with reference to the various parts of the models: What is the theoretical status of (word-) accent and focus accent? Wherein lies the difference? Are there languages without (word-)accent and focus accent? Does the sentence have a tonal component of its own as expressed in the hierarchically designed models? What is the status of sentence final and non-sentence final phrase boundary tones? What do the macroprosodic units actually look like in their tonal dimension? Are emphasis and contrast to be considered independent unities? What are the projections of feelings and attitudes onto Fo? How can we define these tonal elements, what function do they have, how can we specify them in the linguistic structure of the input? An approach which draws a sharp line of demarcation between universal and language specific units should also, and just for these questions, give significant and new insights. For just this respect, equal and different features in the models ought to be discerned clearly.

2.4. Aims and methods of description

It may easily be seen that intonation models are qualitatively and quantitatively different in their explicitness, they may be exclusively pure intonation models or they may be integrated in a comprehensive model of prosody. Generative production models of intonation are best understood as instructions to a machine to derive, step by step, the matching Fo-curve for a given sentence with clearly defined parameters. Seen in this perspective, this method is excellently suited, as mentioned earlier, to test elements and steps of the intonation algorithm by the direct feedback of the produced speech signal. Intonation models, however, as all models of (parts of) man's verbal communication, also have a broader aim. At best, the intonation model will reflect the manifold processes in man, at the same time speaker and listener, that are active during linguistic communication on the psychological, neurological, physiological etc. levels. Such a model would contribute greatly to the understanding of human communication; it might also be able to explain, in a natural way, why intonation looks and functions exactly as it does, in universal and language specific respect, as it is observed and described in all its variation and, at the same time, its systematicity.

There is some evidence from different sources today that it may indeed be justified to posit intonation (and prosody) at a primary level of language processing models. Rather than assigning a proper Fo-curve to a fully developed segmental sentence structure late in a linear model, prosodic and tonal structures, at a highly abstract and basic level, should be established in a parallel processing model. As a consequence of this, individual segments should be elaborated at a more peripheral level. Thus in a framework of basic prosodic macrostructures, phenomena like tempo, accent distribution (deaccentuation), focussing, emphasis etc., segmental reductions of time and spectrum, and omissions would be accounted for in a quite natural way.

3. ASPECTS OF LINGUISTIC INTONATION

Even if, for different reasons, Fo of linguistic utterances is modelled in isolation, very soon a stage will be reached where more than Fo alone is called for. By now it appears as a matter of fact that prosody, and especially intonation, is strongly intermingled with other parts and components of communication. Intonation, in fact, seems to exert a key function in communication. This is especially true in direct relation to semantics and pragmatics with respect to focussing.

3.1. Interdependence of intonation and other parts of language

Today we have realized that there are strong relationships between intonation, considered as an independent structure of utterances, and syntax, morphology (word structure) and semantics, and furthermore, pragmatics. As a good challenge, applying the approach of bridging gaps between disciplines, the different linguistic threads could be tied together. Within the field of phonetics, a first and preliminary attempt has been made to look at the interplay of the temporal and tonal components of a prosody model consisting of just these two dimensions. As an outlook, it has been proposed to widen the perspective of the phonetic realm of prosody by also treating, besides the dimensions of time and Fo, voice quality and intensity in some kind of parallel processing of bottom-up and top-down information.

This aim appears almost overwhelming when all aspects of intonation and all its linguistic relationships are considered in spontaneous speech and in discourse. However, as intonation does function in this verbal context, the description and the explanation of the linguistic totality, nevertheless, has to be realized as our utmost and long-standing aim.

3.2. Interdependencies of intonation and the outer world

One aspect of intonation that up to now has not obviously been investigated within the framework of an integrated model is its relationship to the world outside the linguistic code. From this outer world we can observe the expression of various non-linguistic features such as e.g. joy, vexation, anger, refusal, persuasion; intimacy etc. Furthermore, when these paralinguistic features are concerned, pragmatics, psychology, and social relations between interlocutors come into play.

When intonation research has progressed that far and has successfully produced knowledge of this whole area, we, as phoneticians, will then have approached our real aim: the modelling of linguistic communication, including intonation, as the expression of man's social being and comprehension.

4. SOME PERSPECTIVES OF FUTURE RESEARCH

Fortunately it can be stated that intonation and prosody are receiving more and more significance. Last not least, this is shown by the large number of contributions concerning prosody to this congress. Given this platform, will it at present be able to say something about the future of intonation (and prosodic) research? To my opinion, some lines of development seem quite obvious and some points of discussion may be suggested.

Designers of intonation models of different languages will soon discover the necessity and appropriateness to try to reach a more uniform terminology and manner of construction of their models. In order to achieve this, a phase of comparative consideration within a typological perspective might bring fruitful results. In spite of the existence of various schools of describing intonation with their seemingly different theories and systems, it should be possible, from a universal point of view, to treat, among others, accent and tone languages within a common framework of intonation.

Further important steps in the development of the actual intonation research, I suppose, are the concentration on the perceptual aspect of intonation and, of course, the investigation proper of intonation in natural discourse. The question concerning macrointonational units in spontaneous speech will be of prominent significance because these units constitute the basic elements of a good model.

As intonation is closely interrelated with various linguistic and non-linguistic areas and these areas, by their form of organisation, belong to different disciplines, it will become of outstanding significance that phoneticians will learn to cooperate with researches of intonation of other areas. Well-meant attempts lately have also shown that such an integrated approach will require mutual good will, patience, and also skill and aptitude from all people involved.