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UTTERANCE-FINAL FREQUENCY AND AMPLITUDE CONTOURS IN THE PERCEPTION OF QUESTIONS IN SPANISH

By

Orlando Mariano Reyes-Cairo

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of the requirements for the degree of
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ABSTRACT

UTTERANCE-FINAL FREQUENCY AND AMPLITUDE CONTOURS IN THE PERCEPTION OF QUESTIONS IN SPANISH

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The study of Spanish intonation has been closely associated with studies of English intonation, both in England and in the United States. Consequently, the same theories have been applied to Spanish that were previously applied to English. A simple outline of the major theories of English intonation is provided as a background for this study, as is a review of works on Spanish intonation.

Most of the work done in Spanish-speaking countries has been concerned primarily with the "literary language," which, in Spanish, includes an artistically cultivated form of oral interpretation of literary works, with definite rules, and it is this style, rather than the conversational or colloquial style, that has been described. In the United States, more attention has been paid to the conversational level of Spanish intonation, but there is still a scarcity of acoustical studies in this area.

This study endeavors to contribute to the investigation

of Spanish intonation by exploring the correlation of utterance-final frequency and amplitude contours to the perception of interrogative signals in Spanish. The style analyzed is that of relaxed, spontaneous conversation. The corpus was gathered in six recording sessions involving two speakers each, and utilizing a total of eleven subjects. While the recordings were in progress, the speakers were unaware that they were being recorded. The subjects were all native speakers of Spanish who, with one exception, had been in the United States for no longer than three years. Out of the material recorded in these sessions, one hundred and thirty-eight utterances were isolated for study. These utterances consisted of eighty-seven questions and fifty-one non-questions.

The utterances in the corpus were studied in two different phases. One phase consisted of a listening test in which all the utterances were played to a total of twenty native Spanish speakers, many of whom knew hardly any English, who rated each utterance as a question, a non-question, or ambiguous. These judgments were then tabulated and each utterance was assigned to one of these three categories. The ambiguous utterances were eliminated and the remaining ones were kept for a correlation with the results of the other phase of the study, which was an acoustical analysis of the fundamental frequency and the amplitude contours of the final segments of those utterances judged to be questions or non-questions in the listening test.

ABSTRACT (continued)

In order to obtain a graphic representation of the frequency and amplitude, four different devices were used: the sound spectrograph, which provided broadband spectrograms and amplitude displays of the utterances; a pitch meter, which extracted the fundamental frequency of the voice input; a speech power detector; and a Mingograf, a four-channel graphic recorder which converts input voltages into ink traces on paper, and which provides a continuous pattern regardless of the length of the utterance.

A classification of the different patterns formed by the fundamental frequency and amplitude contours together with the stress pattern of the utterance-final segment yielded seventy-one different types. In these types, four basic frequency and amplitude contours can be observed. These contours may be described as "ascending," "descending," "convex," and "concave." A correlation of these contours to the judgments obtained from the listening test, both in a general sense and more specifically by the different countries represented by the different subjects used in this study, leads to the conclusion that the frequency and amplitude contours of the final segment of Spanish utterances are significant in distinguishing questions from non-questions, with increases of frequency and amplitude showing the highest correlation with judgments of question.

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I. INTRODUCTION

The study of intonation has become an active part of linguistic endeavors only in recent years. Although not necessarily neglected before (early studies with musical instruments of various kinds were conducted at the beginning of this century), the creation of more efficient and versatile instruments, such as the speech synthesizer (first appearing in 1939) and the sound spectrograph (developed in 1946), has brought about a considerable body of material on intonation from many laboratories and individual researchers. Most of the work carried out thus far has been in the field of English intonation, due, perhaps, to the great impetus gained by linguistics in this country within the last forty years, and to the vast resources available to the researcher, both in private industry and academic facilities. Yet, in spite of the great amount of data now available, complete theories of intonation are few, because a great many of the experimental studies available are of a restricted nature, and the task still remains to unify all these findings into a coherent statement on intonation in general.

Fundamental frequency and pitch, although related, are not synonymous, the first being a function of vocal cord vibration, and the second the perception of that acoustic stimulus. Both fundamental frequency and pitch are used as points of departure in descriptions of intonation. Pitch, being the perceptual aspect of intonation, was the only feature available for description until the use of instruments

made it possible to measure fundamental laryngeal frequency. Thus, fundamental frequency is the object of measurement in acoustic studies of intonation, as a rule, while pitch is analyzed in studies of perception.

The existing studies of intonation can be divided into three more or less distinct groups. The first group is composed of works using intonation contours in their descriptions, in an attempt to represent closely the movement of the frequency (or pitch) pattern. The second group includes works which set up a system of pitch levels which are said to have a phonemic function. The third group is formed by experimental studies which are not concerned with either one of the types of description just mentioned, but which quite often bring out results that bear directly on the theories that stand behind these descriptions.

It is not our purpose to give a detailed account of the work carried out on intonation, but rather to provide a simple outline of the major theories now available, and of some of the works which either explore different directions regarding the nature and function of intonation, or which bring out data in direct opposition to those theories. The first opposition can be found between descriptions by analysts who use contours and descriptions by analysts who favor levels. Another opposition is concerned with the function of intonation, with theoreticians who consider stress and intonation features independent of each other on the one side, and on the other side those who consider stress and intonation as different functions of the same feature, namely pitch.

Descriptions of intonation in terms of contours have existed since the first attempts at analysis. Intonation was compared to the melodies in music, and efforts were made to represent intonation by means of musical notation. Representative of this direction is the early work of Daniel Jones (1909), which is a study of gramophone recordings of English and French conversations and dramatic readings. By lifting the needle at certain intervals and noting the pitch at the point of interruption, Jones was able to trace intonation curves on a musical staff.

H. E. Palmer (1922) and Armstrong and Ward (1926) carried Jones' work further. Palmer made an analysis of English intonation in terms of "tone-groups," or groups of syllables clustered around a syllable of maximum prominence. This prominent syllable constitutes the "nucleus" of the group, with the preceding syllables constituting the "head" of the group, and the following syllables the "tail." He describes four "nucleus tones" for Southern English (British): falling, high-rising, falling-rising, and low-rising. Armstrong and Ward's analysis is also based on units with a prominent syllable, but they simplify their analysis to two basic patterns, which they call "tunes." In Tune I there is a rise to a prominent syllable followed by a fall that reaches a low level within the last stressed syllable. Tune II, while following the same general contour of Tune I, is followed by a rise after the last stressed syllable. If the final stressed syllable is also phrase-final, the pitch will rise within that syl-

lable. Most of the works on English intonation using contours follow Palmer to some extent, making modifications on or additions to the "tones" that he described.

The theories of intonation which employ contrastive levels have their origin in the now classic work of Leonard Bloomfield (1933). This work, which until recently permeated practically all recognized linguistic endeavors in this country, deals with intonation in a theoretical manner, advancing the theory of phonemic pitch in English. Bloomfield distinguishes phonemic pitch from other pitch phenomena of a non-distinctive nature, "as when we talk harshly, sneeringly, petulantly, caressingly, cheerfully, and so on."[1] According to his theory, there are the following phonemic pitches in English: three final pitches that contrast statements, yes-or-no questions, and supplement-questions (the last to be answered by a certain word or phrase, such as, What time is it?, or Did you see the show?). To these can be added a phoneme of "exclamatory pitch," used in conjunction with the three final phonemes, and a phoneme of "pause-pitch" or "suspension-pitch," used in contrast with the final pitches to indicate that the sentence does not end at a point potentially final.

Two other American linguists, Kenneth L. Pike (1945) and Rulon S. Wells (1945), independently of each other, but no doubt following Bloomfield's theories, arrived at analy-

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[1]Bloomfield 1933, 114.

ses of English intonation that postulated four phonemic pitch levels. Both Pike and Wells refer to sequences of phonemic pitches as morphemes. In both descriptions the meanings attached to these morphemes remain undefined, however. The numbering system is reversed in these two analyses. Wells' system uses 1 for the lowest level and 4 for the highest, while Pike uses 4 for the lowest and 1 for the highest. Pike's system, however, is more complex than Wells' in that it contains two pauses, a "tentative" one and a "final" one.

G. L. Trager and H. L. Smith (1951), reiterated Pike's and Wells' views on intonation:

> Extensive testing of spoken English material has convinced us of the correctness of the independent conclusions of Pike and Wells that there are four pitch phonemes in English. Our presentation of the supporting data will be in terms of this conclusion.[1]

They conclude that pitch is relative rather than absolute, and that it is "heard around a limited number of points rather than as a continuum."[2] Different non-distinctive, phonetic pitch levels can be grouped, as is the case with segmentals, into phonemes. There are, therefore, allophonic pitches. The pitch phonemes are, in order of increasing height, /^{1}/, /^{2}/, /^{3}/, and /^{4}/. Furthermore, certain sentence-terminal pitch movements are analyzed, and it is concluded that they are contrastive, and therefore phonemic. This conclusion is reached after an analysis of the following three modes of pitch behavior: a sustension

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[1]Trager and Smith 1951, 41.

[2]Trager and Smith 1951, 41.

of terminal pitch at the level preceding it ([¨]); a terminal rise from the preceding level ([+]); and a terminal fall from the preceding level ([-]). The following contrasts are reported: (1) between [¨] and [+] after [2], and (2) between [¨], [+], and [-] after [1]. The phonemic analysis of these contrasts yields the well-known terminal junctures, which are related as follows: [¨] = /|/, [+] = /‖/, and [-] = /#/. "These junctures are manners of terminating or going from parts of utterances."[1] At terminal points, any of the pitch phonemes can combine with any of the terminal junctures. To the four pitches and the three terminal junctures must be added a phoneme of internal juncture, /+/, which distinguishes between sentences like "At the little market near the corner" and "At the little market, near the corner," /+/ occurring at the point marked with a comma in the second sentence.

D. L. Bolinger has raised a number of objections against the pitch-level theories, feeling that "the proper phonemes of pitch are to be found not in position, but in direction: not high versus low, but up versus down."[2] In 1951 Bolinger published a critical analysis of the postulates in the Trager-Smith theory discussed above, judging that it "represents the most concise and logical refinement of the phonemic technique transferred to intonation levels,"[3] but remarking that

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[1]Trager and Smith 1951, 46.
[2]Bolinger 1949, 249.
[3]Bolinger 1951, 199.

his arguments apply as well to all other analyses which reduce intonation to four levels of pitch. Focusing on the statement by Trager and Smith that they were dealing with relative, not absolute pitch, Bolinger begins by wondering whether there may be an overlapping in a variety of situations, or whether the ranges of each of these phonemes are mutually exclusive. Declaring that "unfortunately we are not enlightened on how relative these relative pitches are supposed to be,"[1] he goes on to analyze both possibilities.

If there are no limits to the range of variation of pitch phonemes, other than that at a given moment /2/ should be higher than /1/, /3/ higher than /2/, and so on, then it would be possible for an entire morpheme to be raised or lowered without affecting the overall relationship. Likewise, the pitch range could be broadened or narrowed. Then he goes on to say:

> It would follow that no pitch phoneme could be identified out of some context, and that a given absolute pitch could correspond to any of the four pitch phonemes.
>
> The consequences are embarrassing, for in any pitch morpheme keyed to fewer than four pitches, we could never tell which one or ones had been left out. There would be no way to distinguish 123 from 234, 121 from 232 or 242 or 343 or 131 or 141, and a morpheme consisting of but one pitch phoneme might be 1, 2, 3, or 4.[2]

Finding this lack of definition thoroughly unsatisfactory, Bolinger concludes:

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[1]Bolinger 1951, 199.

[2]Bolinger 1951, 199-200.

> Despite the real and admitted synonymy of 231 and 241, or of 3 and 4, we must therefore conclude that those who adopt the four-level analysis are not talking about purely relative tones, but about tones that may rove each in its own bailiwick but no farther.[1]

To test the second assumption (that the ranges of the different pitches are mutually exclusive), Bolinger conducted three different perceptual tests in which a group of subjects were asked to make judgments on different pitch versions of the same utterance. In introducing the third test, designed to test specifically whether the four-level, three-juncture analysis deals with the opposition question versus non-question satisfactorily, Bolinger states:

> The level-analysts have not equipped us with even a rough outline of what is essential in intonational meanings, much less a scale of importance for them. Until a tenable distinction is made, no analysis of intonation will be plausible that fails to account for any phonetic fact that reports an observed, objective, verifiable contrast.[2]

From these tests Bolinger concludes that "the basic entity of intonation is a pattern, not a pattern in the relatively abstract sense of grammatical recurrences, but in the fundamental, down to earth sense of a continuous line that can be traced on a piece of paper."[3]

The article ends with a note stating what Bolinger considers to be a primary requirement for an acceptable theory of intonation, and an observation on some linguists' inability

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[1]Bolinger 1951, 200.
[2]Bolinger 1951, 204-205.
[3]Bolinger 1951, 206.

or unwillingness, to consider certain obvious factors:

> A proper analysis of intonation must set the primary value on elements that make morphemes similar, not on elements that make them different: "231 and 241" (plus a note on synonymy) is less efficient than "rise-fall" (plus a note on pitch range), because the qualifying note in the latter can be generalized for all configurations and does not have to be repeated.
>
> Oddly, a fact that would delight any other kind of scientist--that semantic value is correlated with formal shape, the surest guarantee that the forms singled out are no accident--seems to strike many linguists completely on the blind side.[1]

Bolinger also explored the relationship of intonation and stress (1955), concluding that the location of the stress on an intonation curve affects the meaning of that intonation pattern, that, at least under some conditions, intonation and stress are integrated into morphemes, and that the nature of the relationship between intonation and stress "may be graphically shown as an intonational movement toward and away from the principal stress, with the stress riding on the intonation like a boat on a wave."[2]

Another series of experiments on the relationship of intonation and stress (1958), leads Bolinger to the postulation of three types of pitch accents, which are illustrated in Figure 1. Pitch A consists of a frequency movement down from the stressed syllable. Pitch B consists of a frequency movement up from the stressed syllable or up to the stressed syllable. Pitch C consists of a frequency movement down to the stressed syllable.

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[1]Bolinger 1951, 210.

[2]Bolinger 1955, 40.

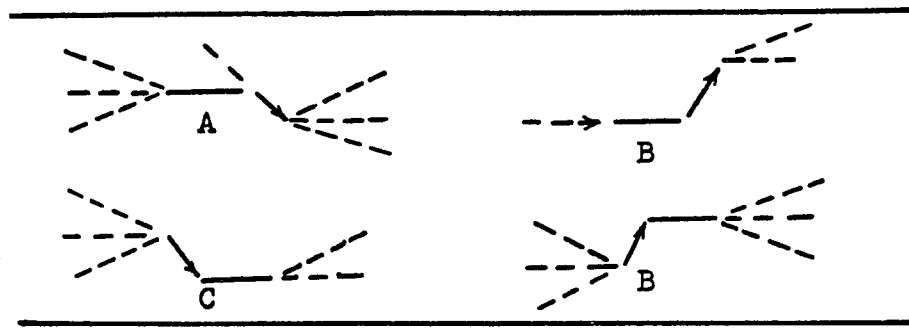


Figure 1. Three types of pitch accents after Bolinger, 1958, with the pitch movement indicated by broken line and arrows and the stressed syllable by a solid horizontal line.

Bolinger's theory of the role of intonation in the perception of stress has been supported by other experimental work, such as that of D. B. Fry (1958), who found that the direction of the frequency movement had a great influence on a subject's judgment of stress. It should be pointed out that the levels analysts consider stress as a function of loudness.

The interdependent roles of frequency and intensity in the suprasegmental features, at least as far as English is concerned, are further illustrated by the results of other experiments, such as that reported on by P. Denes and J. Milton-Williams (1962), in which they determined that intonation cues are carried by a pattern involving fundamental frequency, intensity, and duration.

A final comment on the inherent inadequacy of pitch level theories should be made in regard to the inability of linguists trained in this theory to transcribe intonation patterns consistently. Philip Lieberman (1965) reports on an experiment involving two linguists trained in the Trager--Smith system who were given the task of transcribing the intonation patterns of a number of

natural utterances. After the completion of this task, a certain length of time was allowed to elapse. Then, the same linguists were asked to transcribe the intonation of a number of synthesized utterances consisting of the amplitude and frequency patterns of the utterances first transcribed by the linguists superimposed on a steady [a] vowel sound. It was found that the transcription of the pitch levels and junctures of the synthesized utterances disagreed with that of the pitch levels and junctures of the natural sentences in about 50% of the cases. A comparison between the transcriptions of the two linguists for each set of utterances revealed a disagreement in 60% of the cases.

The existing studies of Spanish intonation also fall within the three groups discussed above. Contour analyses are mainly those made by native Spanish-speaking linguists, such as Tomás Navarro, who follows for his analyses descriptions like those of Palmer (1922) and Armstrong and Ward (1926). Pitch levels analyses of Spanish intonation, on the other hand, consist of studies made in the United States, mainly by American linguists such as J. D. Bowen, who follows the Trager-Smith system of phonemic transcription. There is also a third group of experimental analyses of a fragmentary nature.

Most of the work on Spanish intonation done by native speakers has been carried out without consideration of the differences between literary language and colloquial speech. A corpus obtained from reading out loud from literary works, the common practice of Spanish linguists (Navarro, 1918, 1944; Gili Gaya, 1924; Alonso, 1925), can be valid only for a canon-

ical form of speech.

In Spanish-speaking countries a great deal of emphasis is placed on the art of reading aloud. Lectura is a school subject which is likely to be included throughout all the years of elementary education. This is not reading with the objective of teaching the student to comprehend better the written language, but rather it is approached as an art of recitation or declamation. This appreciation of language as a verbal art is manifested by the interest of the general population in artists whose sole metier is the oral interpretation of poetry, some of whom become well known throughout the whole Spanish-speaking world. Naturally, this art has rules:

> LA LECTURA DE TEXTOS LITERARIOS.-- La pronunciación correcta exige que nos atengamos al buen uso en la articulación de los sonidos, en el enlace de las palabras y en los esquemas de entonación.
>
> El lenguaje literario es el idioma común, pero artísticamente cultivado tanto en la parte significativa como en la sonora. El lenguaje literario evita ciertas disonancias y malsonancias o cacofonías, y, sobre todo, atiende a la adecuada composición y partición de los períodos, con lo cual no sólo se da claridad al pensamiento sino que se obtiene un placer estético por la distribución armoniosa de las partes de un todo.[1]

And further:

> La entonación refleja y expresa la unidad de pensamiento.
>
> Por eso la entonación va formando figuras unitarias, unas veces de un solo miembro, otras de dos o de tres o de muchos más. Cuando la figura de entonación consta de varios miembros, éstos se complementan unos a otros musicalmente, y así reproducen con su conjunto unitario la unidad de pensamiento. La articulación de la entonación va subrayando la articulación del pensamiento.[2]

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[1]Alonso and Henríquez Ureña 1946, 188.

[2]Alonso and Henríquez Ureña 1946, 189.

When reading out loud, an educated native speaker of Spanish will resort to those forms of speech he was trained to use for this purpose.

The label "literary language," when applied to Spanish, does not, then, just refer to the written language as such, but, as already mentioned, it also refers to a specific, artistically cultivated, form of the spoken language. Studies of Spanish as a whole have until very recently been concerned with this aspect of the language. New orientations in American linguistics have focused attention on the conversational level of Spanish.

My own study endeavors to contribute to the investigation of Spanish intonation by exploring the correlation of utterance-final frequency and amplitude contours to the perception of interrogative signals. The style of speech analyzed is that of relaxed, spontaneous conversation.

Many Spanish interrogative patterns have syntactical cues (word order) or lexical cues (question words) in addition to the strictly acoustical signal. Since in these cases the function of the intonation pattern cannot be determined with any certainty, it has been necessary to limit the present study to those questions which differ from statements in intonation alone.

II. SURVEY OF LITERATURE ON SPANISH INTONATION

The first exhaustive study of Spanish intonation was published by Tomás Navarro in 1944. Although prior to this date Navarro had dealt with Spanish intonation at some length in a work on general Spanish phonology (1918), the appearance in 1944 of his Manual de entonación española marks the first attempt at a thorough classification and systematization of Spanish intonation. All other later works published in Spanish-speaking countries dealing with this subject avowedly follow Navarro's analysis. With two editions and several printings now in existence, this Manual is still considered the most authoritative source on Spanish intonation by native Spanish-speaking linguists and grammarians, with the exception perhaps of those doing work in the United States. For my present survey the second edition of 1948 has been used.

Navarro's primary concern in this work is the so-called "literary language"[1] of Spain. In his own words:

> Los materiales utilizados en este trabajo fueron reunidos en su mayor parte en España, en el medio y ambiente de los centros literarios y científicos de Madrid y otras ciudades. Además de los datos recogidos por observación directa, se han tenido en cuenta los materiales registrados en numerosas inscripciones quimográficas y en discos de gramófono. Han sido aprovechados especialmente los discos autógrafos del Archivo de la Palabra en Madrid. Estas series en que figuran escritores, profesores, artistas y académicos procedentes de diversas regiones, muestran de una parte la coincidencia en las formas tónicas, idiomáticas, de la lengua literaria, y de

[1] See pp. 11-13 of our study for both a definition and a discussion of "literary language" in Spanish.

> otra la firme persistencia del sello personal dentro del marco uniforme de la entonación ordinaria y corriente.[1]

Navarro extends this consistency in the use of the literary language to the intonation of Spanish in the New World.

> Entre las clases instruídas, las inflexiones moderadas del tono, la proporción de medidas en la composición de los grupos fónicos y el orden general de los elementos melódicos de la palabra ofrecen en todos los países de Hispanoamérica caracteres esencialmente semejantes, los cuales coinciden a su vez con las líneas fundamentales de la entonación española.[2]

Navarro was apparently well acquainted with the literature on intonation available in European countries, such as the book by Palmer (1922) already mentioned. He comments on the similarity between Palmer's "falling," "high rising," and "low rising" tones and his own "tonemas de cadencia, anticadencia y semianticadencia," which will be described further on. Navarro's alignment with the British phoneticians of the time, who described intonation in terms of contours, can be discerned in the following passage:

> El movimiento melódico del lenguaje tampoco puede ser representado de manera adecuada por medio del pentagrama y de los signos musicales.[3] Se le representa con más exactitud mediante trazos rectos y curvos, los cuales por su posición y dirección den idea aproximada de los movimientos de la voz.[4]

In his discussion on the relationship of intonation and stress, Navarro concludes that in the isolated word the for-

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[1]Navarro 1948, 11.

[2]Navarro 1948, 12-13.

[3]Possibly a reference to the work carried out by Daniel Jones (1909), with which Navarro was acquainted. [Footnote added.]

[4]Navarro 1948, 19.

mer is subordinated to the latter.

> El elemento esencial en la estructura prosódica de las palabras es en español el acento dinámico o de intensidad. En la simple enunciación de la palabra aislada, fuera de relación sintáctica, el tono sigue a la intensidad con regular correspondencia. La sílaba fuerte de la palabra es al mismo tiempo la sílaba tónica, es decir, la que se pronuncia con mayor altura de tono. Las sílabas débiles, anteriores o posteriores a la que lleva el acento fuerte, se pronuncian en tono relativamente grave.[1]

However, he states later:

> Dentro de la frase, la palabra no tiene entonación propia. Las diferencias de estructura melódica entre las palabras agudas, graves o esdrújulas, desaparecen en la línea musical de la oración. Hay, sin embargo, ciertos puntos de esta línea, en que el tono y la intensidad, como se verá al analizar la forma de la unidad melódica, mantienen su correspondencia. De un modo general en la serie sucesiva de los núcleos silábicos de una frase, el tono en español se eleva más o menos sensiblemente en las sílabas fuertes y desciende en las inacentuadas.[2]

Navarro defines the basic intonation unit, which he terms unidad melódica, as "la porción mínima de discurso con forma musical determinada, siendo al propio tiempo una parte por sí misma significativa dentro del sentido total de la oración."[3] As an example of what he means by unidad melódica he gives: "Por el fondo de la calle || pasaban en cuadrillas los soldados," which is divided into two of these units.

He goes on to say that the division of the phrase into melodic units does not always occur at a fixed place. Even the same phrase will at different times contain more or fewer me-

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[1]Navarro 1948, 25.
[2]Navarro 1948, 27.
[3]Navarro 1948, 38.

lodic units. These units are separated by pauses. Those who possess "la base indispensable de cultura, sensibilidad y conocimiento del idioma para comprender sin dificultad el texto de que se trate" will normally agree to a surprising degree on the divisions made. However, "la unidad absoluta no constituye el caso más frecuente."[1] As to its length, the melodic unit in Spanish ranges normally from five to ten syllables, with a higher incidence of units seven and eight syllables long. Here Navarro mentions the fact that the predominant length in the old poems is the metric unit of seven or eight syllables. These metric units have become the basis of Spanish popular poetry.

Navarro distinguishes four types of Spanish intonation: entonación enunciativa, the intonation of statements; entonación interrogativa, the intonation of questions; entonación volitiva, the intonation of "imperative" utterances; and entonación emocional, the intonation of utterances with the attributes of emotion. Basic to this categorization are the entonación enunciativa and the entonación interrogativa, both of which can be further modified by the entonación emocional and the entonación volitiva.

In general,

> En la entonación enunciativa las inflexiones de la voz afectan sobre todo al principio y al fin de las unidades melódicas. El cuerpo central de la unidad enunciativa, apoyado en sus sílabas acentuadas, se desarrolla ordinariamente en la zona del tono normal.[2]

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[1]Navarro 1948, 44.

[2]Navarro 1948, 61.

This cuerpo de la unidad enunciativa is defined as the syllables counted from the first stressed one to the one immediately preceding the next stressed one. During the pronunciation of this segment in Spanish, in utterances of the type entonación enunciativa, the tone is maintained at a relatively uniform level. Regarding the function of this segment, as well as of the initial one, Navarro states, "La forma y desarrollo del tono en el principio y cuerpo de la unidad ofrecen menos valor significativo que idiomático. El valor expresivo de la unidad enunciativa depende sobre todo de su inflexión final."[1] The significant element from the linguistic point of view is that comprised by the final syllables, beginning with the last stressed one. This final segment may follow one of five tone patterns, which Navarro calls tonemas.

> El tonema final sella el carácter fonológico de la unidad en que se halla. Los cinco tonemas que constituyen la terminación de las unidades enunciativas ofrecen los rasgos siguientes:
>
> Tonema de cadencia: Terminación grave, a unos ocho semitonos aproximadamente por debajo de la línea del cuerpo del grupo. Expresa la terminación absoluta de la frase enunciativa. En elocución enfática el descenso alcanza y hasta sobrepasa a veces la octava inferior.
>
> Tonema de anticadencia: Terminación alta a cuatro o cinco semitonos por encima del cuerpo del grupo. Constituye el fin de la rama tensiva,[2] factor de papel esencial en el relieve predicativo y en el contraste y oposición de conceptos, cima máxima en la línea musical de la oración enunciativa.

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[1] Navarro 1948, 69.

[2] The frase enunciativa, according to Navarro, is formed by two segments: the first, or prótasis, stimulates and calls for attention, the second, or apódosis, completes the thought responding to the interest created. The first part is the rama tensiva, the second, the rama distensiva. [Footnote added.]

> Tonema de semicadencia: Terminación descendente, menos grave que la de la cadencia, a tres o cuatro semitonos por debajo del cuerpo de la unidad. Expresa el concepto o proposición en serie semántica, la aseveración insegura, la idea insuficientemente definida.
>
> Tonema de semianticadencia: Terminación menos alta que la de anticadencia, dos o tres semitonos sobre el nivel medio de la unidad. Corresponde a unidades interiores de sentido continuativo y señala oposiciones y contrastes de carácter secundario.
>
> Tonema de suspensión: Terminación en el mismo nivel que el cuerpo de grupo. Aunque la uniformidad tónica no sea matemáticamente exacta, su impresión es la de una interrupción de la voz sin elevación ni descenso apreciables. Expresa el sentido incompleto, el corte de la idea pendiente de continuación.[1]

The different "melodic units" resulting from these five patterns are referred to as sintonemas, and are compared to the "tunes" used in English to describe a similar intonational unit.[2]

The general characteristics of the entonación interrogativa are the following. It ends with rising pitch, and it is composed of three parts: the initial unstressed syllables, which are pronounced with rising pitch, in contrast to those of the entonación enunciativa, which are pronounced with a uniform lower tone; the "body" of the interrogative unit, which generally has a falling contour, although in special cases the contour may rise; and a final segment. This final segment may either fall from the level of the last stressed syllable, or rise up to the level of the last stressed syllable, which is also phrase final, or rise up to the level of the last stressed syllable and then fall to the end of the

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[1]Navarro 1948, 69-70.

[2]Presumably a reference to the work of Armstrong and Ward (1926).

phrase. These terminal contours correspond to the tones Navarro calls elsewhere descendente, ascendente, and circunflejo, respectively. Navarro further emphasized the difference between the enunciative and interrogative categories by saying that, "la entonación enunciativa y la interrogativa se distinguen entre sí por la diferente disposición de sus líneas melódicas--horizontal en la primera y oblicua en la segunda--en la parte de la unidad de entonación que constituye precisamente el eje o centro de su base idiomática."[1]

The interrogative unit is rather complex:

> El grupo melódico interrogativo presenta en español numerosas formas. No consiste simplemente como suele creerse en una línea de tono medio terminada con elevación de la voz. Tampoco consiste en una variedad de inflexiones sin molde ni medida, inspiradas por las circunstancias de cada momento. La multiplicidad de sus manifestaciones se reduce en líneas generales a los tipos siguientes:
>
> Unidad de interrogación absoluta: Tono descendente en el cuerpo del grupo e inflexión final ascendente. Se emplea como forma simple en las preguntas de una sola unidad y como grupo final en las de varias unidades.
>
> Unidad de interrogación relativa: Tono relativamente alto y sostenido en el cuerpo de la unidad y terminación circunfleja. Se emplea como unidad independiente o como grupo final en preguntas en que se presume la contestación.
>
> Unidad de interrogación aseverativa: Inflexión descendente en el cuerpo del grupo y nuevo descenso aun más marcado en la terminación. Se usa como unidad independiente o final en los casos en que el sentido de la pregunta se inclina a la afirmación y de manera más general cuando las frases empiezan con pronombre o adverbio interrogativo.
>
> Unidad de interrogación intensificativa: Movimiento ascendente en el cuerpo del grupo y terminación aguda. Corresponde a las preguntas de sentido reiterativo y en especial a las que dentro de ese mismo carácter envuelven cierto valor de exclamación.
>
> Unidad de interrogación continuativa: Tono descendente en el cuerpo del grupo, como en la unidad

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[1] Navarro 1948, 137.

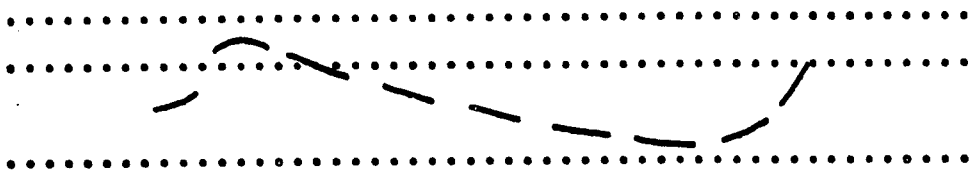
> de pregunta absoluta, e inflexión final circunfleja más reducida y más baja que la de la pregunta relativa. Sirve en general para las unidades no finales en preguntas de varios grupos.[1]

Of the different patterns created by combinations of the different interrogative units, the most significant for this study are the ones Navarro labels preguntas absolutas, preguntas relativas, and preguntas aseverativas. Preguntas absolutas are those which question "sin tener idea de lo que haya de ser la contestación. Son preguntas que se pueden contestar con sí o no."[2] They are characterized by a rise in pitch of the first stressed syllable above the average height that this syllable would obtain in the entonación enunciativa. This rise is followed by a gradual drop down to the last stressed syllable or to the one immediately preceding it. The final contour in these questions always rises. This rise reaches a point slightly lower than that obtained at the beginning of the phrase. If the phrase ends in a stressed syllable, the rise takes place gradually, but not creating just a higher tone separated from the rest of the contour. See the illustration of this type of question in Figure 2a.

The purpose of the pregunta relativa "se reduce a veces a cerciorarse de algo respecto a lo cual se cree poseer alguna idea. El que hace la pregunta prevé más o menos lo que ha de ser la contestación."[3] This type differs from the abso-

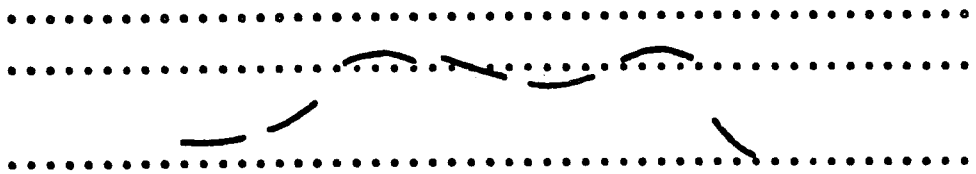
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[1]Navarro 1948, 139-140.
[2]Navarro 1948, 141.
[3]Navarro 1948, 145.



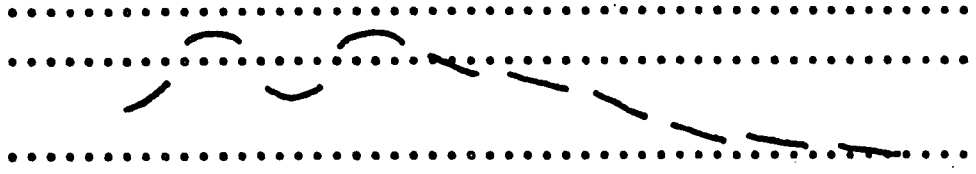
¿Es-tán de- ci- di- dos a se-guir?

a. Pregunta absoluta.



¿Con-que están di-vor- cia-dos?

b. Pregunta relativa.



¿Ver-dad que fue muy bue- no con- ti- go?

c. Pregunta aseverativa.

Figure 2. Three interrogative patterns after Navarro, 1948.

luta in that its "body" does not fall gradually toward the last stressed syllable, but rather drops slightly and then continues evenly. The most striking difference, however, occurs in the last stressed syllable, whose contour is of the rise-fall variety (circunflejo), as illustrated in Figure 2b.

The pregunta aseverativa is described as follows:

> Es corriente la pregunta aseverativa cuando el hecho de que se trata se considera tan natural que la interrogación parece casi excusada, o cuando se propone algo a una persona en la confianza de que lo ha de aceptar, o cuando se encomienda a alguien un encargo dando por supuesto que lo ha de cumplir. La expresión se aproxima en estos casos al tono de la certidumbre. Queda sin embargo un resto de inseguridad que es lo que con la pregunta aseverativa se trata de desvanecer.[1]

The pregunta aseverativa is characterized by a drop at the end of the phrase. Its interrogative nature is brought out by the height reached at the beginning, greater than for the entonación enunciativa, and in the gradual drop of the contour. Furthermore, the final drop does not reach as low a point as that reached in a statement (see Figure 2c).

Spanish scholars have subsequently carried out work on Spanish intonation within the framework of Navarro's description. This holds true for work of a more experimental nature, such as that of Samuel Gili Gaya (1924), who used the kymograph in an attempt to gather instrumental data, and that of María Josefa Canellada (1941), who compared the intonation patterns of twelve illiterate peasants from the region of Extremadura, in Spain, with those of a man of moderate educa-

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[1]Navarro 1948, 151.

tion from Madrid.

Most of the work on Spanish intonation done in the United States follows the level rather than the contour theories. There are exceptions, however, such as Pierre Delattre's attempt (1963) to combine levels and contours in a description of the intonation of English, German, Spanish, and French. By means of spectrographic analysis, whereby the lower frequency portions of spectrograms were amplified by a factor of ten, Delattre obtained contours from utterances from recordings by native speakers. A typical shape was arrived at for three categories: "minor continuation," "major continuation," and "finality." Spanish was found to be characterized by a series of directional changes represented by straight lines (see Figure 3).

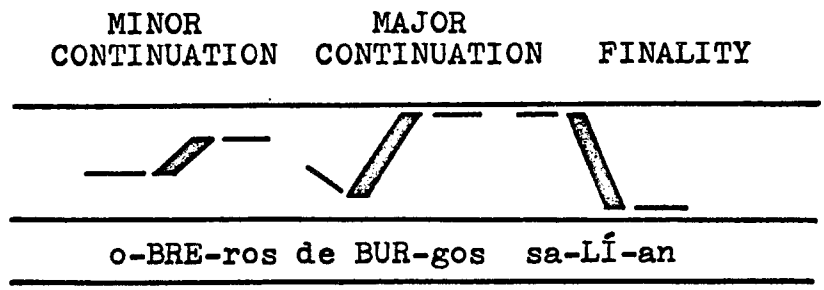


Figure 3. Spanish intonation shapes, after Delattre, 1963.

Rises and falls take place within the stressed syllables. Finality is announced before the last stressed syllable by the high level of the preceding unstressed one.

The following four studies are representative of the descriptions of Spanish intonation in terms of levels, the first two by followers of Pike, and the second two by fol-

lowers of Trager and Smith.

Ann Anthony (1948) presents a preliminary analysis of Spanish intonation in terms of Pike's system. She posits four distinctive pitch levels, numbered 1-4, as in Pike's system, from the highest down. Her corpus is composed of a number of questions elicited from only one informant. The four levels are relative, rather than absolute, "with the distance between levels fluctuating,"[1] the distance between levels 2 and 3 being closer than that between 2 and 1, and 3 and 4. She reports that the different types of question under analysis yielded one feature in common: they contained a 4-1 rise starting on the last stressed syllable in the sentence. This pattern is described as being the "normal, matter-of-fact question pattern, regardless of the grammatical structure involved."[2] Any deviation from this pattern will effect a change in meaning or express a specific emotional attitude.

> The informant said that ¿Dónde 'vives? with the 2-4 falling contour sounded like a spoiled child, accustomed always to having what she wanted. ¿Dónde has es'tado? with the 2-4 falling contour sounded like "a woman who henpecks her husband." Both of these reactions suggested an aggressive attitude, expressed by the intonation pattern alone.[3]

It is interesting to note, however, that, when recording some of the material, Anthony's informant used the 2-4 contour for the question ¿Cómo se dice esta palabra?, but upon hearing the recording she wished to change it to the

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[1]Anthony 1948, 25.
[2]Anthony 1948, 26.
[3]Anthony 1948, 28.

4-1 pattern, which suggests that the informant was, at least in some measure, influenced in her choice by considerations other than her normal, automatic responses. The contrast between the "normal" question with the 4-1 pattern and the more "agressive, abrupt, or impolite" equivalent with the 2-4 contour is, furthermore, found not to be operative in the case of the question, ¿Qué es esto?. Both intonations, when used with this question, were judged by the informant to be equal as to their meaning or attitude.

Anthony raises one more point in regard to the distinctiveness of these question patterns. Not only do we find that both patterns are equally acceptable for occurrence with the category "question," but also, "it should not be assumed that the intonation patterns which have been discussed here occur exclusively with questions. The same falling and rising contours occur with other types of utterances."[1]

Ethel Wallis (1951) reports on the results of a study which attempts to prove that stress is the most important prosodic feature related to Spanish intonation. "Stress seems to have a 'gravitational attraction' for the other two prosodemes [length and pitch] and to form the backbone of the rhythmic system which characterizes Spanish."[2] For her analysis she used the speech of Mexicans residing in or close to Mexico City, including professors at the National University. "In all cases the examples given are from normal, everyday

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[1]Anthony 1948, 30.

[2]Wallis 1951, 143.

speech, recorded under natural conditions."[1] Her basic tenet is that pitch can be predicted in Spanish from the stress pattern. Using Pike's system of four levels (4 for the lowest, 1 for the highest), she asserts that levels 2 and 3 are the ones normally used in conversation, stress occurring on level 2. Level 1 is used to emphasize or to express surprise or questions. Level 4 indicates finality, and is also used for contrast and emphasis. Spanish, as opposed to English, which is characterized by waves and curves, presents highly serrated contours, with stresses at each peak.

Two different styles of speech are discussed, that of ordinary conversation, in which content words have an accent on pitch-level 2, and a lecture or oratorical style, where often an alternate-stress pattern is used, with every other syllable normally on pitch-level 2: "Fué su pri´mera ´obra
3 2 3 2 3 2 3
´termi´nada." The position of these alternate stresses is
2 3 2 4
determined by counting back from the lexical stress preceding a pause. Only adverbs formed from adjectives do not follow this pattern. If an adverb has two lexical stresses in contiguous syllables, the lexical pattern is preserved. Predominant in Spanish intonation is the "beat" of the rhythm units. "Once the placement and intensity of the 'beat' or stress are determined, the other prosodemes of length and pitch, for much of the spoken language, seem to follow."[2]

J. D. Bowen (1956) compares Spanish and English intona-

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[1]Wallis 1951, 143-144.

[2]Wallis 1951, 146-147.

tion. In regard to his description of Spanish intonation, he states, "I should like to present a system for defining and analysing Spanish intonation without here attempting to verify or justify the entire analysis."[1] The notation he uses is that of the Trager--Smith system of description. Bowen describes the conditions of studies of Spanish intonation at the time of his article:

> The analysis of intonation in Spanish has been handled in the past, on those relatively rare occasions when anything at all was said about it, in terms of contours. These were only vaguely defined changes in pitch level, without a definite notion of what the pitches were, or exactly where the changes occurred. Indeed, the number of significantly different pitch levels was not even determined so that the basic counters of the system were not available to the analyst.[2]

Furthermore, he adds, the use of "a series of arrows showing direction and general point of pitch change"[3] was too impressionistic to allow for a systematic description. Because of this, he goes on to say, intonation has not been recognized as an important part of the language system. Bowen's criticism is, perhaps, true of the pedagogical literature in this country, but certainly not of the work published in the Spanish-speaking world, where sections on intonation using Navarro's analysis were included in didactic works long before the publication of Bowen's article.[4] In Bowen's opinion, the

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[1]Bowen 1956, 30.
[2]Bowen 1956, 30.
[3]Bowen 1956, 30.
[4]Besides the work being carried out in Spain, Latin American scholars gave intonation an important role in their descriptions of Spanish, for instance, in the well known grammar by Andrés Bello (1951), and the already mentioned work by Alonso and Henríquez Ureña (1946).

analysis of intonation as part of the phonemic system was made possible by two discoveries, " and they were discoveries, not inventions or gimmicks."[1] These are juncture, and the distinction between what Henry Lee Smith, Jr. calls "vocal qualifiers" and the significant phonemic features of intonation. Accordingly, Bowen's system is described as follows:

> Our investigations at the Foreign Service Institute have convinced us that Spanish intonation can be described by assuming two stresses (weak /ˇ/ and strong /ˊ/.), three pitches (low /1/, mid /2/ and high /3/),[2] and three terminal junctures (rising /↑/, falling /↓/, and sustained /|/). The rising and falling terminal junctures fade into silence and affect the level of the preceding pitch; the sustained juncture marks the termination of intonation phrases which are not utterance final.[3]

Variations in pitch occur only on the "strong stressed" syllables, and on the first and last syllables with weak stress in a phrase. It is interesting to note that, in discussing the differences between English and Spanish patterns of intonation, Bowen warns that a substitution of the English /4/ for the Spanish /3/ in a Spanish sentence "<u>may</u> be interpreted as annoyance."[4] Other substitutions may render Spanish utterances "overemphatic," "not just inappropriate," but "downright ridiculous for a normal intelligent person to say," or "very abnormal and mechanical."[5] One would expect, however, that true substitutions of "phonemic" entities would effect more basic changes in meaning, going beyond style and attitude.

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[1] Bowen 1956, 30.

[2] It should be noted that here, in accordance with the Trager--Smith system, the lowest pitch is marked /1/, and the highest /3/. [Footnote added.]

[3] Bowen 1956, 31.

[4] Bowen 1956, 33.

[5] Bowen 1956, 33-34.

Bowen does not discuss the actual range of the different pitch phonemes. As far as meaning is concerned, he discusses four patterns: /1211↓/, /1231↓/, /1222↑/, and /1111↓/. The first pattern is used with statements and information questions. The second with yes-no questions, especially if they anticipate an affirmative answer, and is also used by intimates in familiar conversation. The third pattern normally occurs with yes-no questions. The fourth occurs "with vocatives and other sentence modifiers, always occurring after another pattern with a sustained juncture."[1] The following examples have been selected from those given in the article for purposes of illustration:

1 2 1 1↓
Había múchos.

1 2 3 1↓
¿Había múchos?

1 2 2 2↑
¿Había múchos?

2 31 | 1 1 1 1↓
Buénos días, señór Pinéda.

1 2 31↓
¡Está aquí!

In the example, "¡Está aquí!" the last two pitches "are both heard on the final stressed syllable ... which justifies the analysis of a /1211↓/ pattern on:

1 2 11↓
Está aquí.

even though the last two numbers, since they occur on the same pitch level, are heard as only one."[2] If this is the case,

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[1]Bowen 1956, 32.
[2]Bowen 1956, 32.

2 31 | 1 1 1 1↓
then the second contour in, Buénos días, señór Pinéda. where the numbers represent the same pitch level also, would be a monotonic utterance. This monotonic five-syllable utterance, paralleled in his second example, 1 2 11 | 1 1 1 1↓ Estóy bién, múchas grácias. as well as the glide within the last syllable of, 1 2 31↓ ¡Está aquí! would seem to be most unnatural for Spanish, the last example being quite typical of English. In fact, further on Bowen warns:

> In Spanish, however, he [the English-speaking student] must be taught not to say:
>
> 2 32↓
> *Adiós. [A pattern typically English]
>
> or
>
> 3 22↑
> *Adiós. [A falling contour with rising intonation?]
>
> but rather:
>
> 1 21↓
> Adiós.[1]

In terms of the Trager--Smith analysis, the first and third patterns of Adiós would be synonymous, unless Bowen is speaking of absolute levels, rather than relative, a fact he does not state. As may be seen, the imprecisions of the levels analysis applied to English are here carried into the area of Spanish intonation.

R. P. Stockwell, J. D. Bowen, and I. Fuenzalida (1956) present a more detailed analysis of Spanish intonation than that by Bowen alone (1956). Stockwell, Bowen, and Fuenzalida add a phoneme of internal open juncture ("plus juncture").

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[1]Bowen 1956, 34-35.

> This plus juncture has no physical reality beyond a distributional one.... In one sense it is no more than a convenient transcriptional device, but like other segmental phonemes it brings together a set of phonetically different but functionally identical data.[1]

It is this phonological feature that accounts for the difference in certain dialects between [eŋágᵚuas] en aguas, and [enágᵚuas] enaguas. In further elaboration we find:

> ... [#] was defined as meaning retardation of tempo with drop in pitch level, accompanied by gradual ceasing of phonation if followed by [...]. [...] means pause of indeterminate length. This set of phonetic phenomena we assign to the terminal juncture /↓/, which we label terminal fall. It can occur at any pitch level and contrasts with two other sets of phonetic data. The first of these other sets is transcribed phonetically with [‖], defined to mean retardation of tempo with sharp rise in pitch level, accompanied by abrupt ceasing of phonation if followed by [...]. [‖] is assigned phonemically to /↑/, which we label terminal rise. It can occur at any pitch level and contrast with /↓/ and with one other set of phonetic data. This third set is indicated phonetically by the symbol [=], defined to mean retardation of tempo with no change in pitch level, accompanied by abrupt ceasing of phonation if followed by [...]. [=] is assigned phonemically to /→/, which we label terminal level. There is some difficulty in stating through how much of the preceding utterance the retardation occurs, but in our observation it does not appear to go back beyond the last strong stress.[2]

In regard to pitch, we find the following statement:

> There are only four distributional positions in which it is possible for any pair of utterances to contrast with respect to pitch level: (1) immediately after silence or terminal juncture, i.e. simultaneous with the first syllable of the phrase, using the term at this level to mean 'utterance-partial between two terminal junctures or between silence and terminal juncture'; (2) immediately before terminal juncture; (3) at any strong-stressed

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[1]Stockwell, Bowen, and Fuenzalida 1956, 644.

[2]Stockwell, Bowen, and Fuenzalida 1956, 652-653.

> syllable within the phrase; (4) at a weak-stressed syllable that immediately precedes the last strong-stressed syllable before a terminal juncture. In each of these positions in uncolored utterances there are three levels of contrasting pitch. These are assigned to three pitch phonemes: low /^{1}/, mid /^{2}/, and high /^{3}/. Each has allophones distributed complementarily with respect to (1) silence and the terminal junctures and (2) the other pitch phonemes which occur before and after within the same phrase or contour.
>
> ... The lowest allophones of each pitch phoneme occur before /↓/. The next lowest appear after silence (i.e. after [...]). The mid-ranges of each pitch phoneme occur within the span of utterance that is not contiguous with either terminal juncture or silence. The highest allophones occur before /↑/.[1]

To these features must be added three stresses: strong /ˈ/, medial (secondary) /ˌ/, and weak (unmarked); and also a number of "vocal qualifiers" and "vocal differentiators." The vocal qualifiers are: (1) overloudness vs. oversoftness, (2) overhigh vs. overlow, (3) overfast vs. overslow, (4) overtense (rasp) vs. overlax (openness), (5) drawling vs. clipping, (6) spreading vs. squeezing, and (7) overvoicing (as with an inebriated speaker) vs. devoicing (whisper). The vocal differentiators are: crying, breaking (of three types: "laughing or giggling, rhetorical with emotion, and quavering or tremolo, which is in effect incipient breaking"[2]), chanting, nasalization, and falsetto. Finally, a residue class is mentioned which includes the interjections that turn a statement into a question ("... ¿eh?"), and those which are uttered during hesitations, to which must be added a glottal stop, which occurs "before word-initial vowels, after word-final

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[1]Stockwell, Bowen, and Fuenzalida 1956, 655.

[2]Stockwell, Bowen, and Fuenzalida 1956, 664.

vowel nuclei, and simultaneous with stops in utterances where there is strong emphasis and where several vocal qualifiers are present, such as overloud, overtense, and overhigh."[1]

The case for phonemic pitch levels in this work is open to the same attacks as that in all other pitch level analyses.[2] It is interesting to note, however, that the authors seem to be dubious about the morphemic status of sequences of pitch phonemes, which they choose to call "intonation patterns," stating: "Whether or not such a sequence of suprasegmental elements is a morph remains to be demonstrated on the morphological level of analysis."[3]

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[1]Stockwell, Bowen, and Fuenzalida 1956, 665.

[2]See our review of the articles by Bolinger (1951) and Lieberman (1965) in Chapter I of this study.

[3]Stockwell, Bowen, and Fuenzalida 1956, 661.

III. THE EXPERIMENTAL PROCEDURE

The first phase of the experiment was concerned with the acquisition of a reasonably large number of questions from native speakers of Spanish, under conditions that would produce the noise-free recordings essential for the acoustic analysis. The utterances to be analyzed were to be taken from natural, unrehearsed conversations. In order to minimize the overlapping of utterances common in natural conversation, the number of speakers participating in each recording session was limited to two.

A corpus fulfilling these conditions is, at best, difficult to obtain in the artificial conditions of a recording session. Inexperienced persons become anxious in the presence of a microphone, and have a tendency to lapse into canonical forms of speech. They also become constrained in their ability to express themselves freely. In order to avoid artificiality and still be able to obtain noise-free recordings, the decision was made to effect a harmless deception: the participants were told that due to the complexity of the recording equipment it would be necessary to use some time to adjust levels and other readings on the instruments, so as to equalize their voices and to obtain a recording of the highest quality. The rather imposing interior of the anechoic chamber helped to create this impression of complexity. Next, the participants were instructed to feel free to converse while the adjustments were being made, as it was necessary for the technicians to hear their voices. They

were asked, however, to avoid moving their heads away from the microphone or shuffling in their seats, since this would require the technician to take more time for his adjustments. They would be notified when the actual recording was to begin. Needless to say, they were being recorded all along. That the deception brought forth the desired results can be easily determined by the nature of the recorded material, which shows that the subjects were totally at ease and not worried about guarding the topic of their conversation. Finally, they were informed that the recording had in fact taken place, and their permission was secured for the material to be used, with the guarantee that it would be put to no other use than for a scientific study. Prior to the recording session, the subjects were told that the purpose of the recordings was that of gathering data on spoken Spanish; they were not aware that intonation was the specific aspect of the study.

The data were gathered in six recording sessions of approximately fifteen minutes, with a total of eleven speakers. All the participants were native speakers of Spanish who, with only one exception, had been in the United States for no more than three years. Eight of them were students at Purdue University, the two female participants were wives of students, and one, the oldest, was a professor of Spanish. They were all educated speakers of Standard Spanish from different countries in Latin America. Their ages ranged from 17 to 60 years.

All the recordings were made at Purdue University (through the courtesy of the Department of Speech and Audio-

logy), in an anechoic chamber, with an Ampex tape recorder-reproducer, model AG350, at a speed of 7.5 ips. The microphone used was a Bruel & Kjaer type 4131, with a cathode follower type 2612 and associated power supply type 2801, close to normal incidence. As used, the microphone is flat ± 1 dB from about 50 Hz to close to 10 kHz.

After the recording, it was necessary to isolate those portions of the utterances which were relevant to the proposed analysis. There were 138 such pieces included in the initial selected corpus, consisting of eighty-seven questions and fifty-one non-questions added on the basis of different criteria. Of the latter, six were statements lexically and syntactically identical with questions actually in the corpus, hence question and non-question could be considered to constitute minimal pairs. One other non-question (Palta.) was considered to be close enough to one of the questions (¿De palta?), and the two were tentatively included as a quasi-minimal pair. Of the remaining non-questions, eleven were the "either" segment of "either... or" questions. The remainder were thirty-three assorted non-question utterances, a few of which were segments preceding tag questions, the rest being simply non-questions added to provide a frame of reference for comparison of the intonation of utterances judged to be questions, or non-questions included because thay had a rising intonation at the end, which seemed to relate them to utterances with an interrogative type of intonation.

The corpus as a whole had a great variety of syntactic patterns, ranging from monosyllabic utterances to complex sentences.

All subsequent instrumental work was carried out at the Phonetics Laboratory of the University of Michigan, which services both the Department of Linguistics and the Department of Computer and Communication Sciences.

In preparation for the acoustic analysis of the corpus, broad-band spectrograms and amplitude displays were obtained for each utterance by means of a sound spectrograph. The particular device used was a Kay Sona-Graph 6061-B. For the purpose of measuring frequency it was decided to use, not the narrow-band spectrogram, but a pitch meter, developed at the Michigan Phonetics Laboratory by McKinney (1965). This pitch meter, having as its output a voltage that varies about one-half a volt per one hundred hertz (cycles per second), extracts the fundamental frequency from the voice input. The advantage of using the pitch meter is twofold: it provides both an instantaneous display of the frequency contour and a continuous graphic pattern in the case of long utterances.

The output of the pitch meter was converted into an ink trace on paper using one channel of a four-channel Mingograf, a graphic recorder that converts input voltages into ink traces through an ink-jet galvanometer. A second channel of the Mingograf was used to obtain a graphic recording of the speech power. For this purpose, the second channel was connected to a speech power detector developed by Peterson and McKinney (1961). The voice signal enters a full wave rectifier and goes on to a logarithmic ampli-

fier through a low pass filter. The output of the speech power detector was converted into a second ink trace, synchronous with the fundamental frequency trace.

An oscillogram of the microphone output was obtained through a third channel of the Mingograf. This oscillogram was used in addition to the broad-band spectrograms to aid in the segmentation of the graphic traces of the recorded utterances. Finally, a time pulse was recorded by means of the fourth channel. Figures 4 and 5 illustrate, respectively, the visual representations of the same utterance as recorded by the Mingograf and the sound spectrograph.

The Mingograf tracings show a variation that reaches between 5 and 10% below or above the actual frequency reading. In other words, a recorded 110 Hz could in actuality lie anywhere between 90 and 110 Hz. This variation is not considered detrimental for the purposes of this study, since absolute measurements are not essential. The values obtained still describe the shape of the curve. The variation simply makes it slightly deeper or shallower.

The next step was to locate the phonemes of each utterance with respect to time. Here the broad-band spectrograms and the amplitude displays (which were done simultaneously, with the broad-band spectrogram occupying the lower half of the paper and the amplitude display directly above and synchronized with it) were extremely helpful. The phonetic duration of each pho-

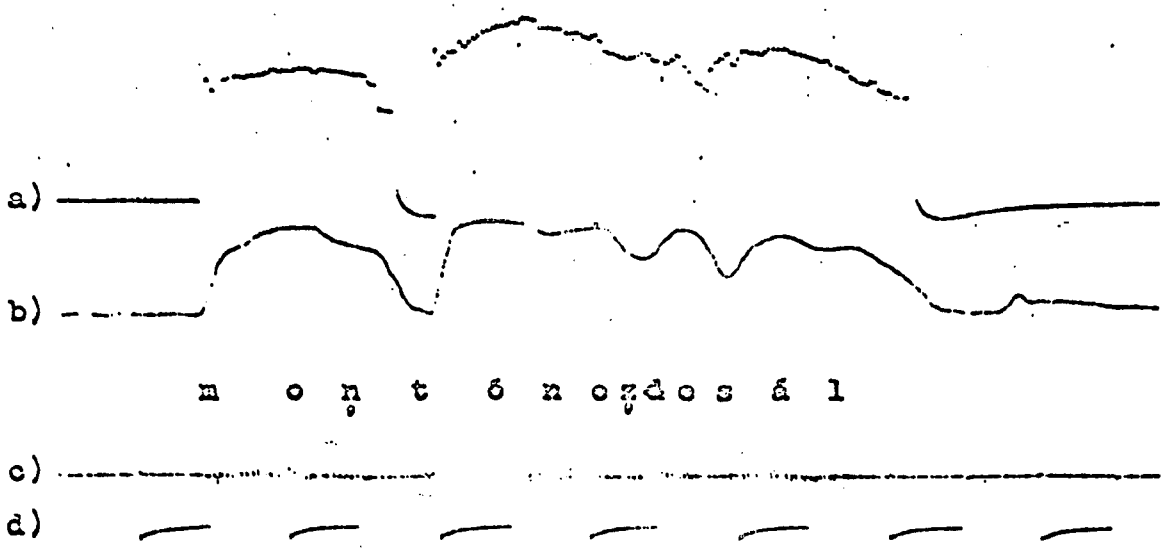


Figure 4. Mingograf recording: a) frequency display, b) amplitude, c) oscillogram, d) time pulse.

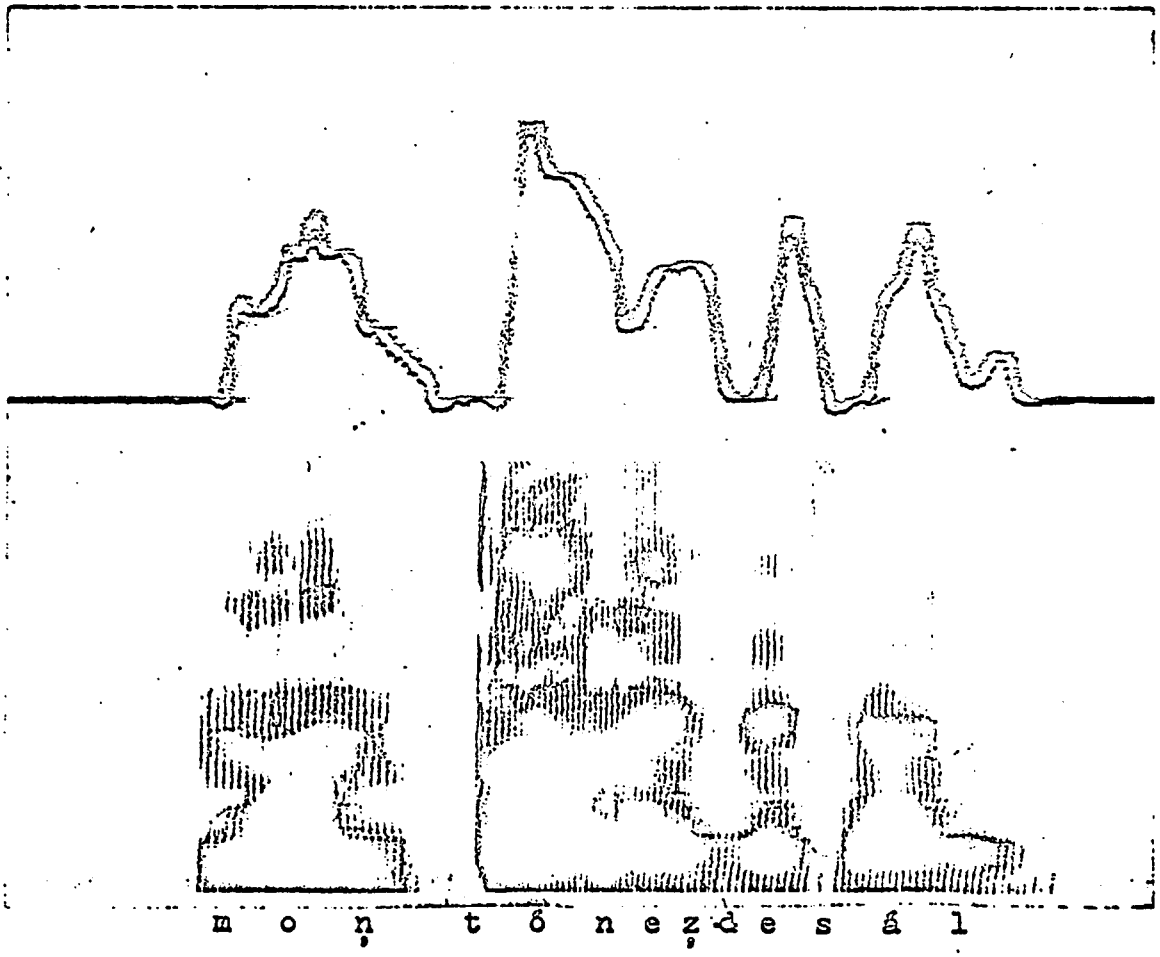


Figure 5. Broadband spectrogram with amplitude display.

neme was determined and the utterance was segmented so as to allow the correlation of fundamental frequency and amplitude with the proper syllables. The same procedure was then applied to the Mingograf recordings. In these, segmentation was simplified by matching the peaks and troughs of the amplitude displays on the spectrograms and the mingograms. In addition, the oscillogram provided some indication of the border of voiced segments, duration of silences, etc.

The decision had been made to consider, for the purposes of this study, the segment pivoting on the last stressed syllable of each utterance, including the syllable preceding the last stressed one, and all syllables following up to the end. The inclusion of the pre-stressed syllable was thought essential in providing a frame of reference for determining the height of the stressed syllable. This utterance-final segment was plotted, for each utterance, in the form of a graph in which the syllables were separated by vertical lines. This procedure yielded utterance-final segments composed of from two to four syllables. Three degrees of height were arbitrarily chosen to segment the height of the contours obtained from the Mingograf. The frequency line was placed directly above the amplitude line and matched with it along the horizontal plane in terms of syllables, as illustrated in Figure 6.

Of the two displays, the one showing the frequency contour resembles the actual tracing obtained from the Mingograf to a greater extent than does the display of the amplitude line. In the case of the frequency line, the curves were straightened out, so to speak, to facilitate their drawing.

The resulting contour, however, remains very similar to that of the actual Mingograf tracing. This is not true of the amplitude display used in the graph. Figure 7 shows the frequency and amplitude tracings obtained from the Mingograf corresponding to the utterance plotted in Figure 6. It can be observed that the nature of certain sounds will cause a drop in frequency and amplitude, which is reflected in the Mingograf tracings by a drop in the contour at the point where such sounds occur. The sounds in question, as far as the frequency is concerned, are voiceless in nature. These voiceless sounds create an abrupt, vertical drop in the frequency line. In the case of the amplitude, however, the occurrence of less intense sounds, and specially of fricatives and stops, will cause the Mingograf trace to fall in a more gradual way, not nearly so abruptly as in the case of the frequency line. Notice the troughs caused on the amplitude tracing by the sounds [s] and [r] in Figure 7. Because of this variation due to the articulation of the different sounds, it was decided to measure only the peak amplitude attained by each syllable and to link one peak to another with a straight line for a better visual effect.

In preparation for the following phase of this study, which was a listening test intended to determine how the utterances were heard when out of context, the utterances were placed into a random order by means of a table of random numbers. Following the procedure used by Grundstrom (1966) for a similar study of French intonation, a test tape was prepared which contained all the utterances separated by pauses.

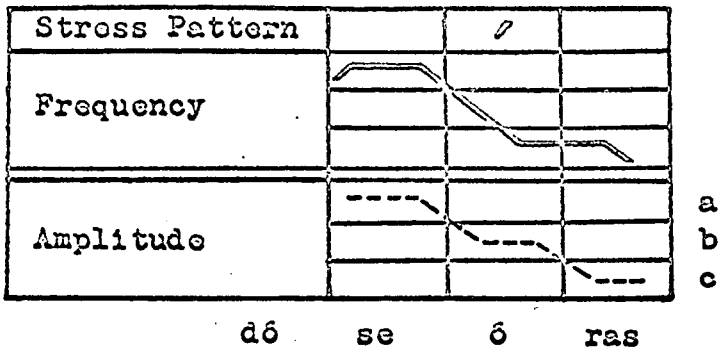


Figure 6. Example of graph used to classify utterances.

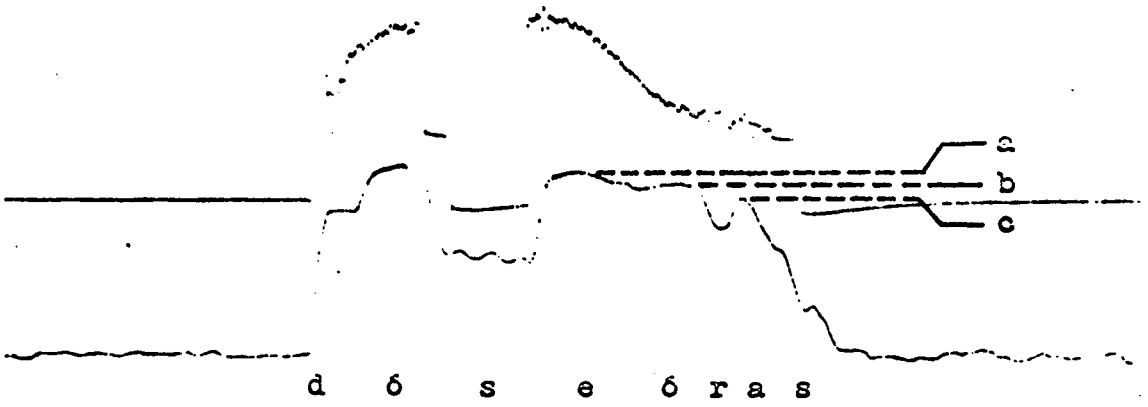


Figure 7. Pitch and speech power tracings from Mingograf corresponding to the utterance illustrated in Figure 6: a) highest amplitude peak, b) medium amplitude peak, and c) lowest amplitude peak.

The timing problem was simplified by splicing in leader tape of the appropriate length to create a pause four seconds in length. Each subject in the listening test was provided with the written text of the utterances so that he might be aided in understanding them. This written text did not contain question marks. A set of instructions explained the purpose of the test and directed the subject to rate each utterance as to whether he thought it to be a question, not a question, or ambiguous.

Twenty subjects participated in this phase of the experiment. They were all educated native speakers of Standard Spanish, from both Spain and Latin America. Many of the subjects were students at the English Language Institute at the University of Michigan, with hardly any knowledge of English. They were both male and female, and of ages ranging between 17 and 43 years.

Each utterance was scored according to the number of judgments of question, non-question, and ambiguous, and the results were tabulated. A judgment in favor of question was assigned a value of +1, a non-question judgment a value of -1, and ambiguous judgments a value of 0. The scores of the twenty judgments received for each utterance were totaled. The total for each utterance was ranged along a scale going from -20 to +20. This scale was then divided into three parts, so that any utterance occupying a position from +10 to +20 was considered to have been judged a question; utterances occupying any position from -10 to -20 were considered to have been judged non-questions; those in the middle, between +9

and -9, were considered ambiguous.

The ambiguous utterances were thereafter disregarded, and the further examination was concentrated upon those which were clearly judged to be questions or non-questions: there remained fifty-two of the former, and twenty-seven of the latter.

After this final winnowing of the utterances, a study was made to determine what correlations could be established between the frequency and amplitude shapes found in the final contour of each utterance and the judgment received by that utterance in the listening test.

Since the subjects participating in the initial recordings and also those employed in the listening test came from a number of different Spanish-speaking countries, it was decided to investigate the possible correlations between those utterances spoken by subjects from a specific country and the judgments these utterances received from the listeners from the same country. The results of the general correlations and those obtained by the countries were then compared and a number of conclusions were drawn.

IV. RESULTS OF THE EXPERIMENT

Before analyzing the corpus obtained for this study, certain preliminary observations should be made. The inversion of the position of the subject and verb in Spanish is usually considered to be one of the devices available in this language for signalling questions. However, such an inversion occurs frequently also with statements: it is a common stylistic device in prose writing and, perhaps even more, in poetry, where this syntactic device allows for greater freedom of rhythm and fulfillment of meter requirements.

In the corpus for this study it was found that of the seventeen questions which had a stated subject and verb, all of which could just as well have been formulated with subject and verb inversion, only four did so. It is also interesting to note that two statements had subject and verb inversion. Both questions and statements were spoken by a number of subjects, and do not, therefore, reflect any personal preference on the part of a given speaker.

A number of the utterances segmented from the recordings paired off into what might be considered utterances with a minimal contrast. By this is meant that one of them was intended as a question and the other (in one case two others) as a statement. One speaker uttered either a question or a statement, and the other echoed with the opposite category. Such minimally contrastive units are used by linguists to determine the phonemic or morphemic status of segmentals or groups of segmentals, respectively. It was

thought that in a case such as this, that is, where two or more utterances have the same morphological and syntactic structure, it would be valid to assume that the distinctive factor would be differences in intonation. Therefore, the first analysis made was that of these utterances. Chart I shows the results of this analysis. The rating for each utterance was obtained in the manner already described in the discussion of the experimental procedure. The status of the utterances in the context of the dialogues, that is, whether they were intended as questions or non-questions by the speakers, can be ascertained by the punctuation used, and then compared with the perceptual judgment of the majority of the listeners, which is shown in the next column. With the exception of the utterances in Group 6, all other utterances within a given group were produced one immediately after the other and in the order listed.

The results of this first analysis fail to show any correlation between the actual contextual status of the utterance and the judgment of the subjects participating in the listening test. Utterances which in the context of the dialogue functioned as questions were rated in the listening test as either ambiguous or non-questions, with only one correct identification, the first utterance of Speaker 11 in Group 6. Those utterances which functioned as non-questions in the context of the dialogues show a much greater agreement with the listeners' judgments. Only the second utterance by Speaker 11 in Group 6 was judged a question. However, this

CHART I

LISTENERS' JUDGMENTS OF
UTTERANCES CONSTITUTING MINIMAL PAIRS

Group	Speaker	Utterance	Judgment
1	7	¿Cinco cuartos?	Ambiguous
	6	Cinco cuartos.	Non-question
2	8	Un poquito más caro.	Non-question
	9	¿Un poquito más caro?	Non-question
3	10	Pol favol.[1]	Non-question
	11	¿Pol favol?	Ambiguous
	10	Pol favol.	Non-question
4	11	¿De la mañana?	Non-question
	10	De la mañana.	Non-question
5	11	¿Doce horas?	Ambiguous
	10	Doce horas.	Non-question
6	11	¿De palta?	Question
	11	Palta.	Question

[1]This utterance is an imitation of the pronunciation of Por favor by Speaker 10's small daughter.

closer correlation loses its significance in the light of those questions judged to be non-questions by the listeners. Such a judgment erases all trace of consistency.

Attention was then focused on a number of items which had received a 100% agreement in judgments arising from the listening test. The items involved are fourteen which functioned as questions in the context of the dialogues, and two which functioned as non-questions. Of the questions, twelve were judged as such in the listening test, while the remaining two received non-question judgments. Of those questions correctly identified, three were constituted by the first part of "either... or" questions which had been segmented for the listening test. Only one of these three was naturally terminated at this point in the dialogue, the rest had been completed with the "... or" segment, which was then removed. The two non-questions were correctly identified in the listening test. Chart II shows these utterances, their contextual status, and the judgments obtained from the listening test.

The rest of the utterances analyzed included those items which received less than 100% agreement, but which rated above +9 or below -9. This group was composed of thirty-eight items which functioned as questions in the context of the dialogues, and twenty-five items which functioned as non-questions. Of the questions, twenty-nine were identified as such, while nine were judged to be non-questions; of the contextual non-questions, eighteen were correctly identified and the remaining seven were judged to be questions. Chart III lists these

CHART II

UTTERANCES WHICH RECEIVED JUDGMENTS
WITH 100% AGREEMENT IN THE LISTENING TEST

Utterance Number	Utterance (Punctuation Indicates Contextual Status)	Listeners' Judgment
36	¿El chicle?	Non-Q
39	¿Pero le dieron la cátedra en propiedad?	Q
45	¿Él es colombiano?	Q
62	¿Español?	Q
66	¿A vos te han mandado ese papelito, la tarjetita del Selective Service?	Q
71	¿Te vas para allá todavía?	Q
75	¿Y Ernesto?	Q
84	¿Tú compras?	Q
88	Para soltar una bomba nuclear.	Non-Q
95	¿Eso lo dan en Summer School, hombre?	Non-Q
108	¿Ustedes se escribían con ellos siempre?	Q
110	¿Usted quería jugar con la Verónica y la esta... y la gorda?	Q
111	¿Ustedes... eh... comen mucha yuca en... en...?	Q
116	Es una persona muy hábil.	Non-Q
130	¿Como César?	Q
135	¿Él es americano?	Q

CHART III

UTTERANCES WHICH RECEIVED RATINGS OF FROM +10 TO +19 AND FROM -10 TO -19 IN THE LISTENING TEST; THEIR CONTEXTUAL STATUS AND LISTENERS' JUDGMENTS (Q=Question, N-Q=Non-question)

Utterance Number	Contextual Status	Listeners' Judgment	Utterance Number	Contextual Status	Listeners' Judgment	Utterance Number	Contextual Status	Listeners' Judgment
2	Q	Q	52	Q	Q	94	Q	N-Q
4	Q	Q	54	Q	Q	98	Q	Q
11	Q	N-Q	55	Q	Q	99	Q	N-Q
12	Q	N-Q	56	Q	Q	102	N-Q	N-Q
15	N-Q	N-Q	58	Q	Q	103	Q	Q
17	Q	Q	60	Q	Q	105	Q	Q
27	Q	Q	63	N-Q	N-Q	107	N-Q	N-Q
28	Q	Q	64	Q	N-Q	109	N-Q	N-Q
32	Q	Q	65	N-Q	N-Q	112	Q	N-Q
33	Q	Q	69	Q	N-Q	113	N-Q	N-Q
35	Q	N-Q	72	Q	Q	115	N-Q	Q
37	Q	Q	73	N-Q	Q	119	N-Q	N-Q
38	Q	Q	77	N-Q	N-Q	120	N-Q	Q
40	N-Q	N-Q	78	Q	Q	121	N-Q	N-Q
41	Q	N-Q	79	N-Q	N-Q	122	N-Q	N-Q
42	N-Q	N-Q	80	N-Q	Q	123	Q	Q
44	N-Q	N-Q	82	N-Q	Q	124	N-Q	N-Q
46	Q	Q	83	Q	Q	125	Q	Q
47	Q	Q	86	N-Q	N-Q	126	N-Q	Q
48	Q	Q	90	Q	Q	133	N-Q	N-Q
49	Q	Q	91	Q	Q	134	N-Q	Q

utterances by number, as they appear in Appendix A, together with their contextual status and the judgments received in the listening test.

The classification of the different patterns of fundamental frequency and speech power used in this study hinges on the position of the last stressed syllable of each utterance. The decision as to where the stress was to be placed was made as a preliminary step on the basis of the normal occurrence of the stress in citation form, disregarding those forms which normally do not occur stressed in combination with other words, such as prepositions, the definite article, etc. An analysis of the frequency and speech power patterns obtained yields some interesting results in this regard.

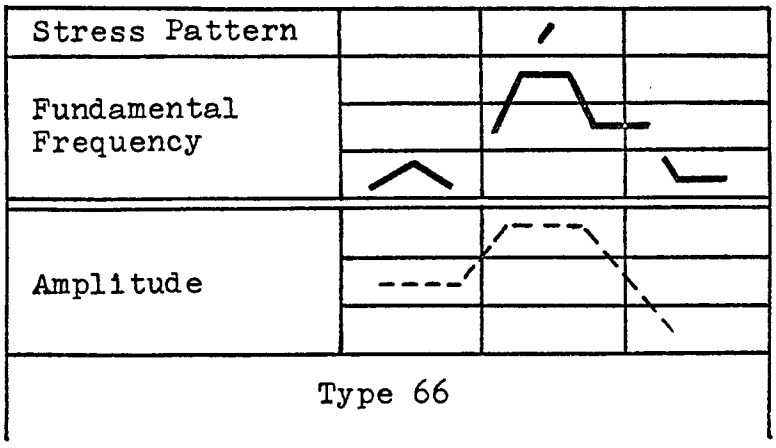
A group of linguists consider stress as primarily related to speech power, whereas another group relates stress primarily to variations in frequency. An attempt to correlate fundamental frequency, speech power, and stress for this study produced the following results.

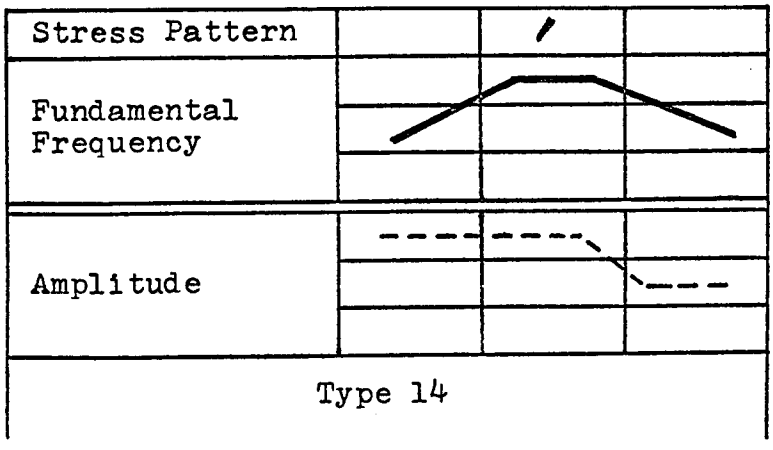
After an analysis of all the utterances involved, it was found that a few utterances showed the same fundamental frequency, amplitude, and stress pattern as some of the other utterances. These utterances were, therefore, grouped together into one representative type. Further analysis of the different combinations of fundamental frequency, amplitude, and stress patterns yielded a number of different combinations, which were classified into distinct types. A total of seventy-one types emerged from the foregoing procedure, each type being different from the others as regards the position of the

stress, or the fundamental frequency contour, or the amplitude pattern. (See Appendix B for an illustration of all types.)

As it turned out, there was a great variation in regard to the relative position of the frequency and amplitude lines at the point of normal stress. It was found that of the total seventy-one types, twenty-four showed peaks in the contour of both of these parameters at that point. Basically, three patterns of movement occur within this group (see Figure 8): the frequency or the amplitude rises from the syllable preceding that considered to be stressed up to the stressed syllable and down again on the following syllable; or the frequency or the amplitude follows a level line from the pre-stressed syllable to the stressed one and then falls toward the post-stressed syllable; or, finally, the frequency or the amplitude rises toward the stressed syllable and remains at the same level to the end of the utterance.

Only four types showed a reverse contour from that found in the preceding group. They are represented by three basic movements which are illustrated in Figure 9. The remaining forty-three types show combinations of these contours, or consist of contours which either rise throughout the syllables isolated for study, or fall all throughout, as in Figure 10. Thus we find that peaks or troughs in the frequency or amplitude curve do not always concur at the place where the stress is normally expected. If the frequency peaks, or, for that matter, the amplitude peaks, are to be considered as stress signals, stress in Spanish does not always occur in natural speech at the same place as in citation forms. In a great





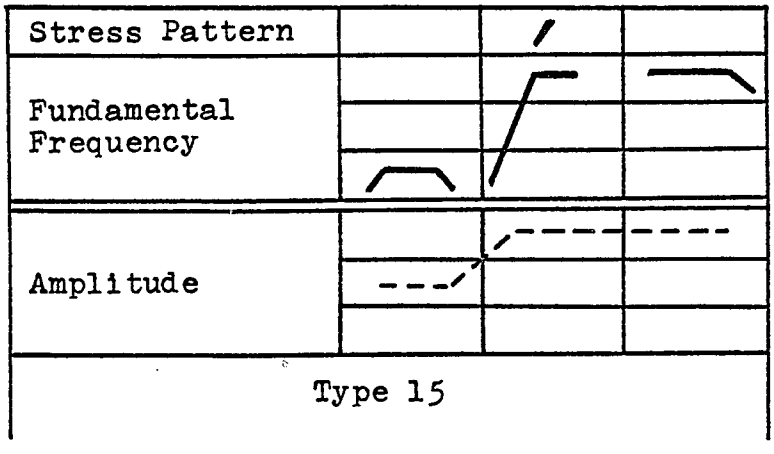
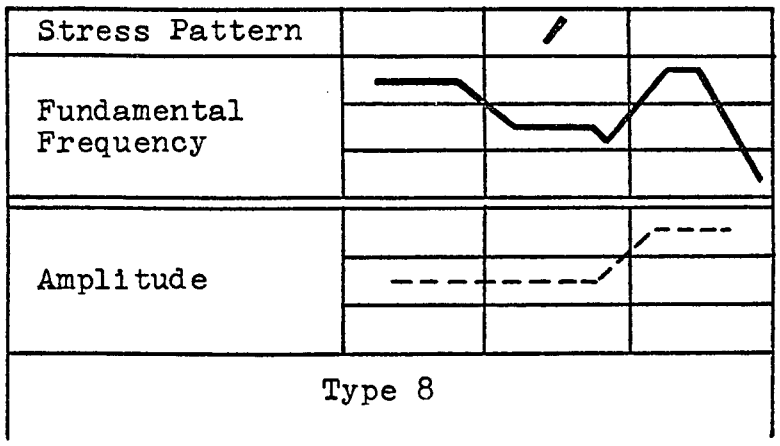
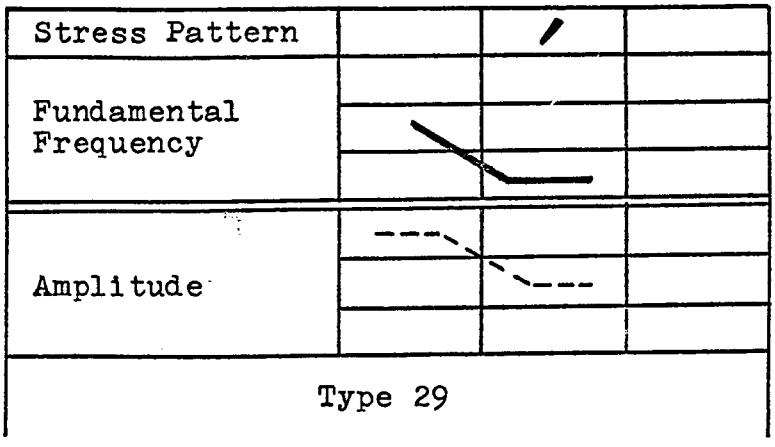


Figure 8 . Representative types of frequency and amplitude movements with peaks at stressed syllables.





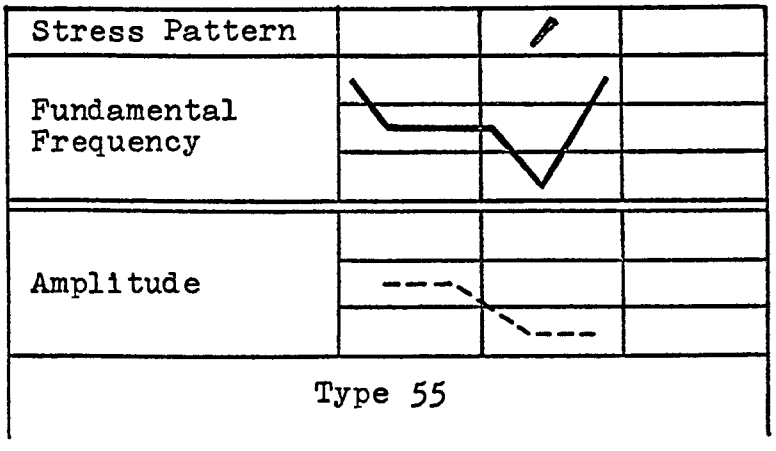
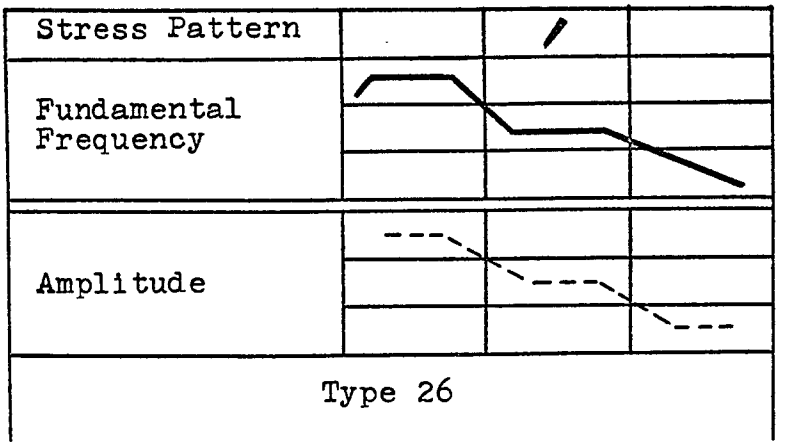
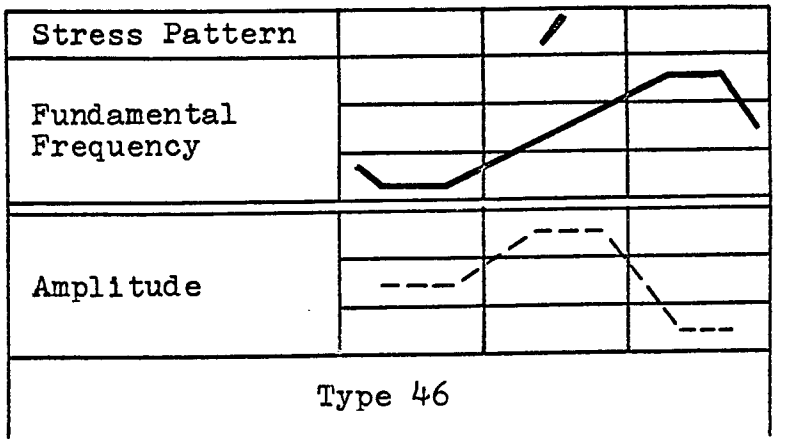


Figure 9 . Types with frequency and amplitude patterns lowest at stressed syllables.





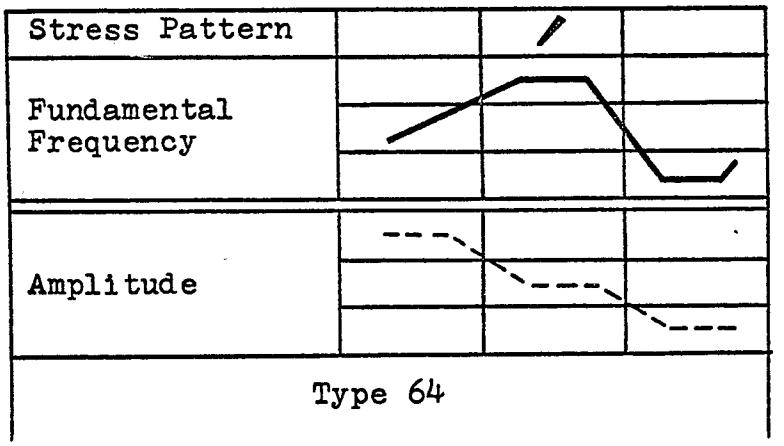
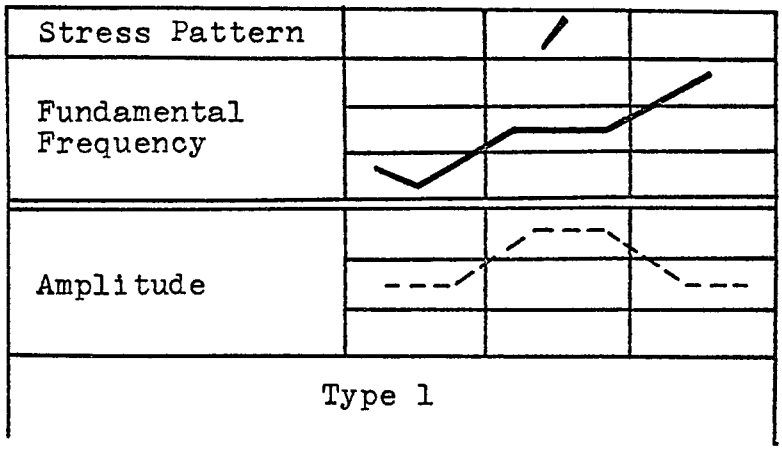
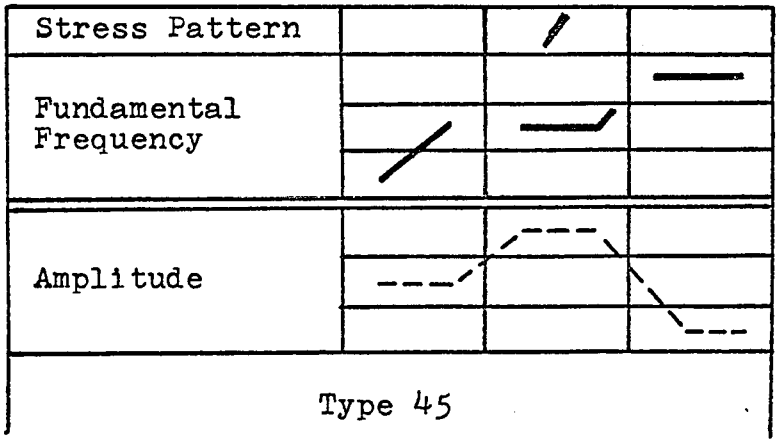


Figure 10. Types with either fall or rise throughout the entire segment normally stressed.

number of cases the frequency or amplitude contour at the point of normal stress lies midway between the highest and the lowest points, quite often with a certain horizontal levelling at that point, but often with a straight fall or rise, so that the rate is constant (see the frequency contour of Type 46 in Figure 10).

In analyzing the data used in this study, the difficulty arises that there is no possibility of manipulating the different parameters so that some can be varied while others remain constant, as is possible in the case of synthesized speech. The different types obtained from analysis of the final segment of the utterances under consideration present some possibilities for classification into a smaller number of types, but only if one of the parameters is to be considered without regard to the others. A small reduction in the number of types isolated is possible, for instance, in the case of the frequency patterns, some of which are similar enough so that they could be classified under the same type if the differences in the amplitude and the stress patterns were disregarded (see Figure 11). The number of types could also be reduced if only the amplitude pattern were to be considered. Likewise, the utterances with two consecutive stresses could be grouped with others with only one stress, or three-syllable patterns grouped with two-syllable ones on the basis of similar contours. This is the case of the utterances illustrated in Figure 12. However, the complexity of patterns extracted from the different utterances is so great that no justification can be found for disregarding any particu-





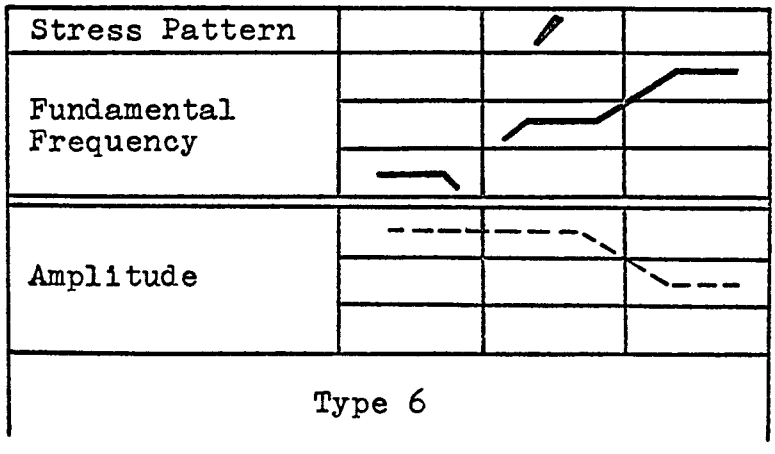
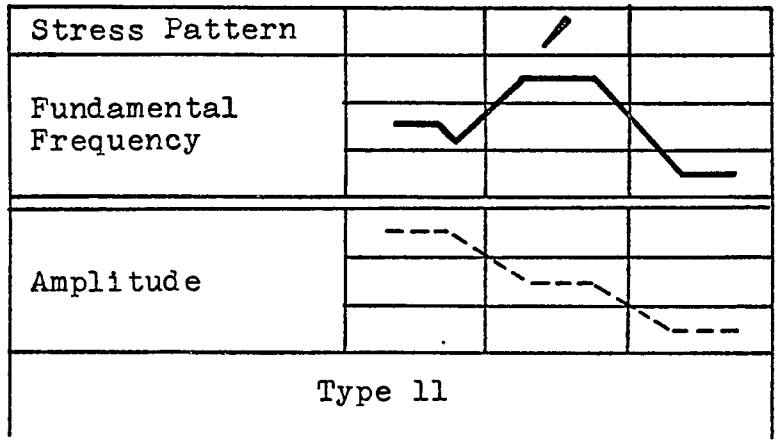
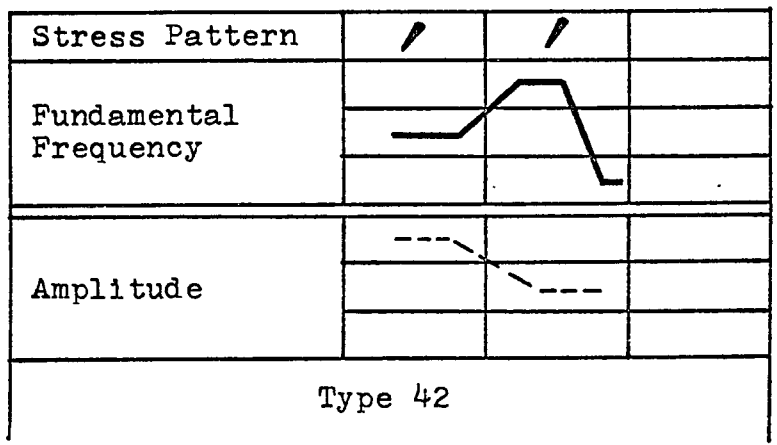


Figure 11. Contour types with similar frequency patterns.





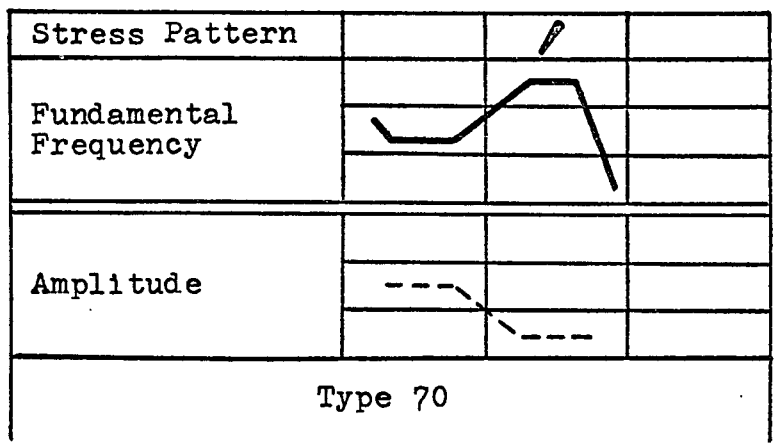
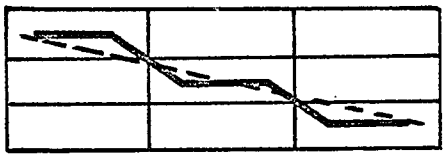


Figure 12. Types with similar frequency contours, but with a different accentual, syllabic, or amplitude pattern.

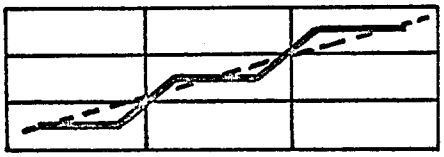
lar feature in favor of any other. Four basic shapes can be extracted from the contours observed, two centered on linear axes, and two which can be enclosed within curved boundaries (see Figure 13). The two linear shapes can be characterized as "descending" and "ascending," the curved figures as "convex" and "concave." The majority of the contours under observation can be represented by one of these four basic shapes, a small number by a combination of them. Seven amplitude contours do not fit any of these patterns. They are formed by a level horizontal line.

An analysis of the relationsips of descending contours in the amplitude of the final segment of the utterances in the corpus yields the following results: sixteen of the utterances judged to be questions had this type of amplitude contour. The same is true of thirteen of the utterances which were judged to be non-questions. This seems to indicate that this type of contour, at least by itself, is not capable of separating the two categories in question. Eleven of the amplitude contours are of the ascending type. Nine of them occur with utterances judged to be questions, the other two with utterances judged to be non-questions. The smaller number of utterances containing this type seems to indicate that it is not frequently used by the speakers participating in this study, yet its greater support of judgments in favor of questions makes it a more reliable signal for this category than for that of non-question.

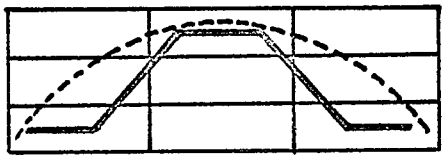
An analysis of the relationships of the convex type to judgments of question and non-question fails to indicate



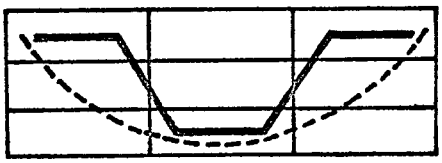
Descending



Ascending



Convex



Concave

Figure 13. Basic shapes found in frequency and amplitude contours observed.

any distinctive function in this amplitude type. This convex contour occurs with eighteen utterances judged to be questions and with twelve utterances judged to be non-questions. No utterance was found to have an amplitude contour that fell within the concave type. As for the level amplitude contour, it occurred with only seven utterances, four of which were judged to be non-questions and three questions.[1]

The frequency contours isolated for this study can also be described in terms of the preceding types. Although ten utterances had two consecutive syllables with peaks at the same frequency range, only one of them had a completely level contour throughout these two syllables; the others had either downward or upward deflections at the beginning or end of one or both syllables. Of these ten utterances, only one showed a pattern of less than three syllables. It was an utterance of which the third syllable was whispered.

The relationship of the descending frequency contour with judgments of question and non-question is as follows. A total of seven utterances exhibited this type of contour. Two of them were rated as questions and the rest as non-questions. The small number of utterances involved would not justify a generalized statement, but it appears that a falling

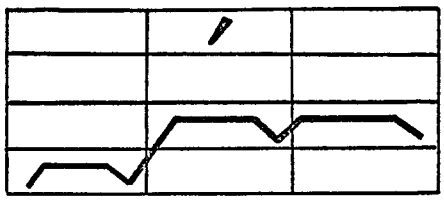
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[1]Here it must be remembered that when we speak of "level" amplitude contours we refer to a normalization of the actual trace obtained from the Mingograf. For these normalizations only the level of the amplitude peaks were considered, as already explained in the exposition of the experimental procedure. A "level" contour, therefore, is formed by a number of peaks reaching the same height.

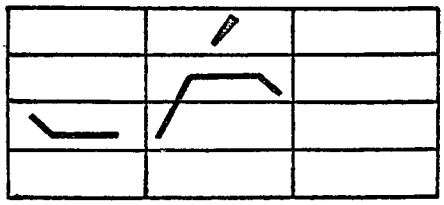
contour would not be a very reliable clue for questions. The ascending contour, on the other hand, appears to be a more reliable clue, as it shows 80% of the responses in favor of questions. Out of twenty-five utterances with this final contour, twenty were judged to be questions and five non-questions. It is interesting to note that all utterances of this last group judged to be non-questions had a number of downward turns along the contour, so that they appear to be formed by a series of convex shapes (see Figure 14), with at least one convex shape at the stressed syllable.

An analysis of the relationship of the convex final frequency contour with judgments of question and non-question shows that of thirty-one utterances exhibiting this type of contour, nineteen were judged to be non-questions, while the other twelve were judged to be questions. Although there is a decided advantage on the side of non-question judgments for this contour, the large number of judgments in favor of questions would seem to make the contour rather unreliable for a non-question signal. The number of concave utterances is rather small, reaching a total of seven. Of these, only one utterance was judged to be a non-question, all the others were judged questions. Here again, the small number of utterances exhibiting this particular contour scarcely justifies any generalization.

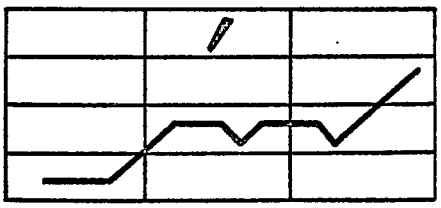
The judgments obtained from the listening test reflect the composite view of twenty subjects from five different Spanish speaking countries. At the same time, the utterances used in the test were spoken by eleven subjects from six dif-



Type 22



Type 37



Type 48

Figure 14. Three "ascending" frequency contours judged to be non-questions, showing convex shapes at the stressed syllable.

ferent countries. Chart IV lists the speakers, Chart V lists the participants in the listening test, all of them with their country and city of origin. An analysis of the fundamental frequency and amplitude types used by the speakers reveals the following results. Out of thirty-three utterances obtained from Colombian speakers, twenty-five were questions, the other eight being non-questions. All thirty-three utterances fall into thirty-one types, with three questions falling within the same type and the remaining ones falling separately into the other types. The basic shapes described on page 60 and illustrated in Figure 13 function in the following manner in the utterances under consideration. Of the questions, nine made use of an ascending frequency contour, two of a descending frequency contour, and twelve of a convex frequency contour, the other two showing a concave and a mixed contour, respectively. The contours occurring in the amplitude displays are distributed as follows: ascending, four utterances; descending, thirteen utterances; and convex, six utterances. Two utterances do not fall within any of these four basic shapes, their amplitude being a level horizontal line. Nine of the questions showed the same contour shape in both the frequency and the amplitude patterns. Of these nine, three show the ascending shape, two the descending shape, and four the convex shape. See Chart VI for the tabulated results.

Non-questions made use of the four basic contours in the following manner. In the frequency line: descending, one utterance; convex, seven utterances. In the amplitude line:

CHART IV

SPEAKERS AND THEIR ORIGIN

Speaker	Country	City
1	Argentina	Gualeguay
2	Cuba	Havana
3	Mexico	Merida
4	Colombia	Bucaramanga
5	Colombia	Bogota
6	Mexico	Monterrey
7	Colombia	Bogota
8	Colombia	Cali
9	Colombia	Medellin
10	Venezuela	Caracas
11	Chile	Santiago

CHART V

LISTENERS AND THEIR ORIGIN

Listener	Country	City
1	Spain	Valencia
2	Ecuador	Quito
3	Ecuador	Quito
4	Guatemala	Guatemala City
5	Mexico	Veracruz
6	Mexico	Mexico City
7	Mexico	Monterrey
8	Costa Rica	San Jose
9	Peru	Lima
10	Mexico	Mexico City
11	Mexico	Mexico City
12	Argentina	Gualeguay
13	Argentina	Cordoba
14	Cuba	Havana
15	Cuba	Havana
16	Mexico	Mexico City
17	Chile	Concepción
18	Spain	Salamanca
19	Ecuador	Quito
20	Colombia	Cienaga

CHART VI

BASIC SHAPES USED BY COLOMBIANS IN QUESTIONS

Utterance Number	Speaker	Contextual Status	Type	Frequency Shape	Amplitude Shape
2	8	Q	3	Ascending	Ascending
11	9	Q	20	Convex	Descending
27	9	Q	33	Convex	Descending
28	4	Q	62	Concave	Descending
32	8	Q	61	Ascending	Level
33	4	Q	4	Ascending	Descending
35	4	Q	71	Convex	Convex
38	9	Q	40	Convex	Convex
45	7	Q	17	Ascending	Convex
46	4	Q	3	Ascending	Ascending
52	8	Q	32	Ascending	Descending
55	8	Q	56	Ascending	Level
56	9	Q	41	Convex	Descending
58	4	Q	67	Convex	Convex
62	7	Q	3	Ascending	Ascending
66	8	Q	12	Convex	Descending
71	7	Q	14	Convex	Descending
90	4	Q	11	Convex	Descending
94	9	Q	47	Convex	Convex
95	9	Q	24	Descending	Descending
99	8	Q	43	Convex	Descending
103	9	Q	42	Convex	Descending
111	4	Q	68	Descending	Descending
115	4	Q	8	Mixed	Ascending
130	7	Q	45	Ascending	Convex

descending, two utterances; convex, five utterances; the amplitude line of one non-question consisted of a level horizontal line. Four of these non-questions showed the same contour shape in both the frequency and amplitude lines. This contour shape was of the convex variety in all four cases. Chart VII tabulates the relationship of the basic shapes to the amplitude and frequency lines of non-questions spoken by Colombians.

The two speakers from Mexico produced eleven of the utterances used in this study. Of these utterances, five were questions, and the remaining six were non-questions. The questions made use of the basic shapes in the following manner. In the frequency line: ascending, one utterance; descending, one utterance; convex, three utterances. In the amplitude line: descending, two utterances; convex, three utterances. Three of these questions showed agreement in the shape occurring in both the frequency and the amplitude line, one having the descending shape and the other two the convex shape.

The Mexican non-questions made the following use of the basic shapes in the frequency line. Two utterances used the ascending shape, and three used the convex shape. One utterance showed a level horizontal line. The amplitude line made use of the ascending shape in one utterance, of the descending shape in two utterances, and of the convex shape in two other utterances. One final utterance occurred with a level horizontal line in the amplitude segment. Three

CHART VII

BASIC SHAPES USED BY COLOMBIANS IN NON-QUESTIONS

Utterance Number	Speaker	Contextual Status	Type	Frequency Shape	Amplitude Shape
36	8	Non-Q	30	Descending	Convex
42	5	"	70	Convex	Descending
73	8	"	35	Convex	Convex
79	9	"	36	Convex	Convex
102	8	"	63	Convex	Descending
109	5	"	66	Convex	Convex
119	5	"	57	Convex	Level
122	5	"	65	Convex	Convex

utterances had the same shape in both the frequency and amplitude line, one being of the ascending shape, two of the convex shape. Chart VIII presents the results of the analysis of the Mexican utterances in tabulated form.

The Argentine utterances consisted of six non- questions spoken by a single individual. The frequency line made use of the ascending shape in two of the utterances, while the remaining four showed the convex shape. The amplitude line showed one utterance with the ascending shape, one with the descending shape, and four with the convex shape. Two utterances had the same basic shape in both the frequency and amplitude line, both utterances showing the convex shape. Chart IX tabulates these results.

The Cuban utterances were seven questions spoken by the same subject. The basic shapes appear in these utterances in the following manner. In the frequency line: ascending, four utterances; convex, three utterances. In the amplitude line: ascending, two utterances; descending, two utterances; and one utterance each of the convex and the concave shapes. The seventh utterance showed a level horizontal line in the amplitude section. Three utterances showed matching shapes in both the frequency and the amplitude lines, two being of the ascending shape, and the other one of the convex shape. The tabulation of these results appears in Chart X.

The nine Venezuelan utterances, obtained from one speaker, consisted of four questions and five non-questions. The questions showed the following shapes in the frequency line: ascending, three utterances;

CHART VIII

BASIC SHAPES USED BY MEXICANS

Utterance Number	Speaker	Contextual Status	Type	Frequency Shape	Amplitude Shape
15	6	Non-Q	31	Convex	Descending
47	6	Q	7	Convex	Convex
69	6	Q	22	Ascending	Convex
82	3	Non-Q	7	Convex	Convex
86	6	Non-Q	37	Ascending	Level
112	6	Q	59	Convex	Convex
113	6	Non-Q	27	Level	Descending
123	6	Q	29	Descending	Descending
125	3	Q	11	Convex	Descending
133	6	Non-Q	39	Ascending	Ascending
134	3	Non-Q	9	Convex	Convex

CHART IX

BASIC SHAPES USED BY ARGENTINE

Utterance Number	Speaker	Contextual Status	Type	Frequency Shape	Amplitude Shape
40	1	Non-Q	19	Convex	Ascending
77	1	"	58	Convex	Descending
116	1	"	23	Ascending	Convex
120	1	"	2	Convex	Convex
121	1	"	38	Convex	Convex
124	1	"	48	Ascending	Convex

CHART X

BASIC SHAPES USED BY CUBAN

Utterance Number	Speaker	Contextual Status	Type	Frequency Shape	Amplitude Shape
37	2	Q	11	Convex	Descending
39	2	Q	69	Ascending	Ascending
60	2	Q	34	Ascending	Descending
64	2	Q	21	Convex	Level
78	2	Q	52	Ascending	Concave
83	2	Q	13	Ascending	Ascending
88	2	Q	10	Convex	Convex

concave, one utterance. The amplitude line of these questions showed the descending shape in two utterances, and the convex shape in one utterance. The fourth question showed a level horizontal line in the amplitude contour.

The five Venezuelan non-questions showed the ascending shape in the frequency contour of one utterance, and the descending shape in the frequency contour of three utterances. The fifth non-question made use of the concave shape in the frequency line. Four of these five utterances showed a descending shape in the amplitude line, while the fifth used the convex shape. An agreement in the shapes used in both the frequency and the amplitude line was found in three of these non-questions. The shape used in all three cases was the descending one. Chart XI tabulates these results.

The thirteen utterances obtained from a single Chilean speaker consisted of twelve questions and one non-question. Eleven of the questions had the ascending shape in the frequency line, and only one showed the convex shape. The amplitude contour of these questions showed the ascending shape in three utterances, the descending shape in three others, and the convex shape in six. Three of these questions showed the ascending shape in both the frequency and the amplitude lines.

The one non-question obtained from the Chilean speaker showed the concave shape in the frequency

CHART XI

BASIC SHAPES USED BY VENEZUELAN

Utterance Number	Speaker	Contextual Status	Type	Frequency Shape	Amplitude Shape
41	10	Q	60	Ascending	Level
44	10	Non-Q	55	Concave	Descending
49	10	Q	5	Ascending	Descending
63	10	Non-Q	28	Descending	Descending
65	10	Non-Q	54	Descending	Descending
75	10	Q	18	Concave	Descending
98	10	Q	46	Ascending	Convex
107	10	Non-Q	26	Descending	Descending
126	10	Non-Q	51	Ascending	Convex

line, and a level horizontal line in the amplitude trace. These results are found in tabulated form in Chart XII.

In the preceding analysis of the shapes used by speakers from different countries, certain combinations of shapes in the frequency and the amplitude lines are repeated within the utterances from a given country, other combinations occur only once. Thus, certain preferences for particular combinations can be determined. In the utterances spoken by Colombians, the combination of an ascending shape in the frequency contour with the same shape in the amplitude contour was used three times, in all cases with questions. A combination of the convex shape in the frequency line with a descending shape in the amplitude occurred ten times, eight with questions, and two with non-questions. Two utterances showed an ascending shape in the frequency combined with a level line in the amplitude. Both of these were questions. The ascending shape in the frequency line combined with the descending shape in the amplitude occurred in the case of two questions. A combination of the convex shape in both the frequency and the amplitude lines occurred eight times, four with questions, and four with non-questions. An ascending shape in the frequency combined with a convex shape in the amplitude occurred twice, both times with questions. One last combination was found in the utterances obtained from Colombians which occurred with two questions. It consisted of a descending shape in both the frequency and the amplitude lines. Chart XIII tabulates the results of the inquiry into the preference of Colombians for specific combinations

CHART XII

BASIC SHAPES USED BY CHILEAN

Utterance Number	Speaker	Contextual Status	Type	Frequency Shape	Amplitude Shape
4	11	Q	3	Ascending	Ascending
12	11	Q	64	Convex	Descending
17	11	Q	6	Ascending	Descending
48	11	Q	3	Ascending	Ascending
54	11	Q	1	Ascending	Convex
72	11	Q	49	Ascending	Convex
80	11	Non-Q	25	Concave	Level
84	11	Q	15	Ascending	Ascending
91	11	Q	44	Ascending	Convex
105	11	Q	52	Ascending	Convex
108	11	Q	16	Ascending	Descending
110	11	Q	1	Ascending	Convex
135	11	Q	50	Ascending	Convex

CHART XIII

COMBINATIONS OF SHAPES RECURRING IN THE UTTERANCES OF COLOMBIANS

Frequency Shape	Amplitude Shape	Number of Questions	Number of Non-questions
Ascending	Ascending	3	-
Convex	Descending	8	2
Ascending	Level	2	-
Ascending	Descending	2	-
Convex	Convex	4	4
Ascending	Convex	2	-
Descending	Descending	2	-

of shapes.

Two combinations of shapes in the frequency and amplitude lines occurred more than once in the utterances obtained from the Mexican speakers. One combination consisting of the convex shape in the frequency line and the descending shape in the amplitude occurred with one question and one non-question. A second combination consisting of the convex shape in both the frequency and the amplitude lines occurred four times, twice with questions, and twice with non-questions.

The Argentine utterances, all non-questions, show two combinations of shapes, both of which occurred twice. One combination consists of the ascending shape in the frequency line and the convex shape in the amplitude line. The other combination has the convex shape in both the frequency and the amplitude lines.

The Cuban utterances were all questions. One combination of the basic shapes was found to occur more than once in these utterances; it is the ascending shape, appearing in both the frequency and the amplitude lines.

Three different combinations of the basic shapes are found in the Venezuelan utterances. One combination consists of the concave shape in the frequency line and the descending shape in the amplitude line. This combination occurs twice, once with a question, and once with a non-question. Another combination consists of the ascending shape in the

frequency line and the convex shape in the amplitude line. This second combination occurs twice, once with a question and once with a non-question. The third combination, consisting of the descending shape in both the frequency and the amplitude lines occurs three times, in all cases with non-questions.

Finally, the Chilean utterances show three different combinations of the basic shapes occurring more than once. The first combination has the ascending shape in the frequency line and the descending shape in the amplitude. This combination appears twice, both times with questions. The second combination, that of the ascending shape in the frequency and the convex shape in the amplitude, occurs with six utterances, all of them questions. The last combination occurs three times, in all three cases with questions. It shows the ascending shape in both the frequency and the amplitude line.

Of the ten countries represented in the listening test, five were represented by more than one participant. In analyzing the judgments of the listeners, by country, the following results were obtained. Six subjects from Mexico participated in the test. Their judgments over the one hundred and thirty-eight utterances presented to them vary in the following manner. All six participants were in total agreement in thirty-four of the utterances. Five participants agreed in the case of thirty-seven utterances, other than the ones receiving total agreement. An agreement among four of the six listeners was found in 27 utterances not counted in

the other two groups just mentioned. The remaining utterances were agreed upon by fewer than four of the six participants.

The three Ecuadorian listeners were in complete agreement in the case of seventy-one of the one hundred and thirty-eight utterances. Sixty-four other utterances received an agreement of two of the listeners.

The two listeners from Spain agreed in the case of ninety-five of the total utterances presented to them for judgment. The two listeners from Cuba agreed in one hundred and two of the utterances, and the two Argentine listeners in one hundred and seven of the utterances.

A comparison of the judgments obtained from the listeners of a specific country with the actual contextual status of the utterances spoken by the subject or subjects from the same country yields the following results. In the case of those countries represented by more than one participant in the listening test, it was thought that only those utterances which had obtained more than a 50% agreement on the part of the listeners from the same country could be usefully compared. All the utterances spoken by subjects from the same country as those represented by a single participant in the listening test were taken into consideration for agreement or disagreement.

Seventeen of the Mexican utterances received more than a 50% agreement from the Mexican participants in the listening test. Of these seventeen, three received total agreement among the six listeners, eight received the agreement of five of the listeners, and six received the agreement of four of

the listeners. Of those utterances receiving total agreement, two were judged to be questions, and the remaining one a non-question. Two of these three judgments agreed with the actual contextual status of those utterances. The eight utterances receiving the agreement of five of the listeners were judged to be questions in the case of five utterances, the remaining three having received a judgment of non-question. The judgments received by these eight utterances from the five listeners agree with the contextual status of these utterances in five of the cases. Of the utterances agreed upon by four of the listeners, three were judged to be questions, the remaining three receiving non-question judgments. The agreement of the judgments received by the preceding six utterances with their actual contextual status was accurate in the case of four of the judgments. These results appear in tabulated form in Chart XIV.

The Argentine utterances were all non-questions. The two Argentine listeners agreed with each other in their judgments in the case of six of the total eight utterances. Their judgment matched the actual contextual status of those six utterances in four cases.

The two Cubans participating in the listening test agreed with each other in eleven of the sixteen utterances, all questions, spoken by a Cuban. Of the eleven utterances agreed upon by the listeners, six matched their contextual status.

The Colombian listener's judgments reached an agreement with the contextual status of the sixty-one utterances spoken

CHART XIV

MEXICAN UTTERANCES WHICH RECEIVED MORE THAN A 50% AGREEMENT FROM MEXICAN LISTENERS, WITH THE AGREEMENT BETWEEN THE JUDGMENTS ON AND THE CONTEXTUAL STATUS OF SAID UTTERANCES

Utterance Number	Listeners Agreeing	Type of Judgment	Contextual Status
3	5	Q	Q
13	4	Non-Q	Q
14	4	Q	Q
15	5	Non-Q	Non-Q
47	5	Q	Q
50	5	Q	Non-Q
69	4	Non-Q	Q
81	4	Q	Q
82	6	Q	Non-Q
86	4	Non-Q	Non-Q
97	5	Q	Q
112	5	Non-Q	Q
113	6	Non-Q	Non-Q
123	4	Q	Q
125	6	Q	Q
133	5	Non-Q	Non-Q
134	5	Q	Non-Q

by the five Colombians in twenty-seven of these utterances.

The Chilean listener's judgments matched the contextual status of the Chilean utterances in seventeen out of the total number of twenty-one.

V. EVALUATION OF THE RESULTS

The results of the attempt to classify the utterances constituting the corpus for this study, taking into consideration the different composite patterns resulting from the combination of a variety of amplitude, fundamental frequency, and stress patterns, were far too complex to be useful as a tool for our proposed analysis. These composite patterns, referred to in this study as "types," appear in Appendix B. Seventy-one such types were isolated. Interestingly enough, each individual type is associated with only one kind of judgment derived from the listening test. In other words, a specific type corresponds to either a judgment of question, or to a judgment of non-question. In no case do utterances receiving opposite judgments fall under the same type. This, of course, is mainly due to the fact that only in the case of four types (numbers 1, 3, 7, and 11 in Appendix B) did more than one utterance fall within the same type. Besides the fact that these types correspond to a judgment of question or non-question, they also reveal that stress in Spanish, defined in terms of frequency peaks, does not occur in connected speech on that syllable of a word where it is expected from its position in citation forms, if indeed it is such peaks of frequency that constitute stress in citation forms. The frequency variations illustrated in the types under discussion behave somewhat more like the variations described by D. L. Bolinger (1958) and illustrated in Figure 1.

The variations in frequency and amplitude observed in the seventy-one types were such that they could be reduced to a small number of recurring shapes (see Figure 16) which account for all the variations in frequency and amplitude encountered.

Taking into consideration all the utterances which received judgments above +9 or below -9, it appears that for Spanish in general, viewed as a diasystem, an ascending contour in the final segment of an utterance, whether in the frequency or in the amplitude line, shows a very strong correlation with judgments of question. Although this particular shape occurs with both questions and non-questions, the proportion of questions having this shape in the final segment greatly outnumbers that of non-questions. Taking the frequency line, we find that it shows this shape in the case of twenty questions, as opposed to five non-questions. The number of utterances showing this shape in the amplitude line is considerably smaller than that showing it in the frequency line. Nine questions had an ascending amplitude contour in the final segment, as opposed to two non-questions.

The descending shape does not seem to be significantly distinctive. It appears mainly in the amplitude line, where it was found in sixteen questions and thirteen non-questions, whereas only seven utterances were found to show this shape in the frequency line, twice in the case of questions, and five times in the case of non-questions.

The convex shape seems to function in opposite ways,

depending on whether it occurs in the frequency or in the amplitude line. In the frequency line it correlates with non-questions (19 non-questions *vs.* 12 questions), whereas in the amplitude line it correlates with questions (18 questions *vs.* 12 non-questions).

The concave shape was found only in the frequency line. Perhaps the reason for the absence of the concave shape from the amplitude trace is that in order for a contour such as this to occur, an increase of the subglottal pressure would have to come into play at a time when the speech power may have reached a relatively low point. Although the occurrence of the concave shape in the frequency line is proportionally greater in favor of judgments of question, the small number of utterances showing this shape (6 questions and 1 non-question) weakens any correlation that might be made in terms of percentages.

The level contour, which, with one exception, occurred only with the amplitude sections, cannot be significantly evaluated due to the small number of utterances showing it. It was found in the amplitude line of three questions and four non-questions.

In general, it appears that increases in frequency, such as are found in the rising frequency contour of the ascending shape and in the contour of the concave shape in a modified way (a fall followed by a rise in frequency) are highly significant in the perception of questions for Spanish as a whole.

The role of the amplitude variations in judgments of question or non-question is not as easily determined. Although

a straight rising shape seems significant in the perception of questions, the convex shape (basically an increase followed by a decrease in amplitude) seems to correlate with judgments of question also. Perhaps the significant feature is not the actual shape of the contour in this case, but rather the increase in effort inherent in the production of a rising contour, and also in the creation of a final peak in amplitude such as that of the convex shape, albeit followed by a more gradual fall in speech power than that occurring after the ascending shape.

The Colombian speakers, as a whole, seem to prefer a convex final contour in the frequency line of questions, with the ascending shape as a close second choice. However, although a greater number of questions showed the convex shape than the ascending shape (12 convex vs. 9 ascending) the convex shape also occurred with seven non-questions, while no non-question was uttered with a final ascending contour. The exclusive use of the ascending contour in the formulation of questions seems to make this contour a more reliable clue, especially in the light of the general results of the listening test, which showed a rising final contour to have the highest correlation with judgments of question.

The amplitude contour of the Colombian questions shows a marked preference for the descending shape, which occurred in thirteen of the questions, with the convex shape being the second-most frequently used shape. But since these two shapes occur with seven of the eight non-questions, they apparently are not used, when occurring in the ampli-

tude line of an utterance, to distinguish questions from non-questions in Colombian Spanish. This observation is in agreement with the results obtained from the general study made of the listening test judgments.

The use of the basic shapes by the Mexican speakers does not agree with the general results or with the results obtained from the study of the Colombian utterances. The ascending shape, which correlated highly with questions in these two analyses, seems to behave in a rather neutral fashion in the Mexican utterances. The ascending shape occurred only once in the frequency of questions, but it occurred in the frequency of two non-questions. Similarly, the convex shape occurred in the frequency line of three questions and three non-questions. In the amplitude line, the more frequently used shapes, descending and convex, are almost equally divided between questions and non-questions. It is in the use of the basic shapes in the amplitude contour that an agreement is found between the Mexican utterances, on one side, and the Colombian utterances and the general results on the other side.

The Argentine utterances, all non-questions, showed only the convex and the ascending shapes in the frequency line, and these are, with one exception, the shapes used in the amplitude line as well. In the absence of questions in the Argentine corpus, it is not possible to determine how these shapes behave in contrasting the two categories under study, if indeed they are functional in signalling such a contrast in the speech of Argentines.

The seven Cuban utterances, all questions, follow the pattern established in general for all utterances and in particular for the Colombian utterances. These Cuban utterances make use of the ascending shape (4 utterances) and the convex shape (the remaining 3 utterances) exclusively in the frequency line. The amplitude line shows a variety of shapes, with no shape occurring more than twice.

The four Venezuelan questions use the ascending shape in three of the utterances, with the fourth one showing the concave shape, as regards the frequency line. In using these shapes, Venezuelan speakers follow the pattern established so far in the general analysis and for speakers of different countries, with the exception of the Mexican speakers. Non-questions in this group use the descending shape predominantly in the frequency line, with only one utterance showing a shape used in questions, that is the ascending shape. The predominant shape found in the amplitude line was the descending one, occurring with both questions and non-questions. Here again an indication is found that the amplitude pattern is, if at all, significant to a much lesser extent than is the frequency line in distinguishing questions from non-questions.

Perhaps the most significant results in favor of the ascending frequency contour as a correlate of the formulation of questions are those found in the Chilean utterances. Eleven of the twelve questions showed this shape in the frequency line, the twelfth one showing the convex shape. In contrast, the one non-question included in this group showed

the concave shape in the frequency line. The ascending shape occurred in the amplitude contour of three of the utterances, but in all three cases with questions.

The agreement of listeners from a specific country with the contextual status of utterances spoken by subjects from the same country, with the exception of the Mexican utterances, is greater in those cases in which the particular group of utterances shows the ascending shape in the frequency line of more of its members. The agreement reached by the Chilean speaker and listener reaches 80.9% of all cases, with eleven out of twelve questions showing this frequency shape. The Cuban utterances, four of which showed the ascending shape as opposed to three with a convex contour, reached a 54.5% agreement. In the Colombian utterances, in which the convex shape outnumbered the ascending shape thirteen to nine, the agreement was 44.2%. Interestingly, the Argentinean utterances, all of which were non-questions, and two of which showed the ascending shape, the agreement reached 50%, with the two utterances showing the ascending shape in the frequency line being judged to be non-questions. The Mexican utterances reached the second highest agreement, 64.7%, even though the convex shape outnumbered the ascending shape three to two.

Although none of the contours, or shapes, isolated in this study is found to occur exclusively with questions or non-questions, in a highly significant number of utterances judgments of question were obtained when the ascending shape occurred in the final contour of the frequency line. One can,

therefore, predict the judgment an utterance will receive by determining the frequency contour of its final segment. This fact holds true in a general sense for all the eleven countries represented in this study, as well as for individual countries, with the possible exception of Mexico and Argentina, the former because of the apparently neutral status of the final contour when judged by Mexicans, the latter due to a lack of a proper frame of reference because of the absence of questions from the Argentine corpus.

The role of the amplitude pattern is more difficult to establish. Only by taking the corpus as a whole can one observe a consistent function. The ascending shape, which occurred in the amplitude contour of eleven utterances, did so in the case of nine questions as opposed to two non-questions. Such an increase in amplitude at the end of an utterance is represented by the ascending shape only (the concave shape did not occur in the amplitude line of any utterance), and it might constitute a reinforcement in favor of judgments of question. However, this possible role is not apparent when taking the different countries individually. As for the role of the other shapes in the amplitude line, no significant pattern emerges.

APPENDIX A

THE CORPUS

The order in which the utterances are presented in this Appendix is that used in the listening test.

1. ¿Tú no sabes nada al respecto?
2. ¿Sabes lo que le podemos hacer?
3. ¿La UNAM, la Universidad Nacional Autónoma de Méjico?
4. ¿Y se fue Pedro manejando el camión?
5. ¿Un poquito más caro?
6. ¿Y en la universidad de ustedes?
7. ¿Pol favol?
8. ¿Quizás nos vamos ya?
9. ¿Me "dropea" antes allá en Cali?
10. ¿Y en Bogotá?
11. ¿Sacan las de ahí no más?
12. ¿De la mañana?
13. ¿Te acuerdas, en el programa?
14. ¿Ah, sí?
15. O todo el mundo lo quiere, o todo el mundo lo aprueba.
16. ¿Es exactamente el mismo carro, o usted ve un carro americano?
17. ¿Y las copias serán muy caras?
18. ¿En Panamerican a Nueva York, o eso?
19. ¿Recordarás la vez pasada cuando... lo... lo... lo amena que estuvo la conversada?
20. ¿Abajo de tu cama?
21. ¿Nunca... has ido a la casa por ahí, a la Cucateta?
22. ¿Y ustedes han perdido algunos grandes profesores con ese motivo?
23. ¿Compañía americana?

24. ¿Doce horas?

25. ¿Lo dan?

26. ¿Tiene un garaje?

27. ¿Pero estás peleándote?

28. ¿También tienen la Ford allá?

29. ¿Compañía americana? (A different utterance from 23)

30. ¿El chicle?

31. ¿Es oficial del gobierno?

32. ¿Ahn?

33. ¿Ya no hay?

34. ¿Sabes que cuando le... le... le... le sacan el... el... el índice a uno, el "index," to... le quitan todas esas materias a uno y le sacan el "index" no más sólo de las requeridas?

35. ¿Lo que le dieron fue plátano frito?

36. Un poquito más caro.

37. ¿Se sabe algo?

38. ¿Será que nos están grabando?

39. ¿Pero, le dieron la cátedra en propiedad?

40. Y hace ya como tres años que es rector?

41. ¿Hmn?

42. Montones de sal.

43. ¿Lo conoces?

44. Pol favol.

45. ¿Él es colombiano?

46. ¿Verdad?

47. ¿Me entiendes?

48. ¿Quiere ir?

49. ¿No son todos amigos de la Vanni?

50. Comparado con este... comparado con cinco mil Volvos que producirá aquí una fábrica en tres días.

51. ¿Y se ha influido mucho la política ahora con... después del golpe de estado de Onganía?

52. ¿Es más barato?

53. ¿Es un plato típico de... de... de Méjico?

54. ¿De palta?

55. ¿Ah, sí?

56. ¿La viste?

57. ¿Y la dejaste ahí?

58. ¿Usted ha comido yuca?

59. ¿Es exactamente el mismo carro?

60. ¿Ha mejorado?

61. ¿Setenta?

62. ¿Español?

63. De la mañana.

64. ¿Y la situación general del estudiante actual?

65. Pol favol.

66. ¿A vos te han mandado ese papelito, la tarjetita del "Selective Service"?

67. ¿Y de ellos algunos no... no estarían también trabajando secretamente en algunas cosas?

68. Inexplotados.

69. ¿Colombiano?

70. ¿Compañías americanas?

71. ¿Te vas para allá todavía?

72. ¿Y toda la otra gente?

73. En tipo "elective."

74. ¿Nueva?

75. ¿Y Ernesto?

76. ¿Se casó?

77. Hace un año, más o menos.

78. ¿Y allí se hace por elecciones entre el profesorado?

79. En la clase, pues, que se graduó ahora.

80. Palta.

81. ¿Lo conoces?

82. Una gringa.

83. ¿Un... un hindú?

84. ¿Tú compras?

85. ¿Cinco cuartos?

86. Para soltar una bomba nuclear.

87. ¿"Brother" Teta?

88. ¿Pero buenos?

89. ¿Quedaban muchos profesores allí?

90. ¿No les dieron yuca en la comida de anoche?

91. ¿Y tú las castigaste?

92. ¿Gilberto Gómez?

93. ¿Ése que tiene árboles lindos?

94. ¿No más?

95. ¿Eso lo dan en "Summer School," hombre?

96. ¿Lleva muchos años en la Argentina?

97. ¿Yuca?

98. ¿Hablamos ahora?

99. ¿Que vamos a sacar "straight A" en todos los cursos?

100. ¿Y la unión de los peronistas y los comunistas?

101. Entonces ha estado ahí.

102. Pero Panagra volaba Miami-Panamá-Cali.

103. ¿Se da cuenta cómo está la vaina más mejor?

104. No alca... alcanzó votos.

105. ¿Van a venir los Jarca?

106. Tú sabes esas dos hojitas que le dan, que tres de aquí y seis de allá.

107. Doce horas.

108. ¿Ustedes se escribían con ellos siempre?

109. De cobre.

110. ¿Usted quería jugar con la Verónica y la esta... y la gorda?

111. ¿Ustedes eh... comen mucha yuca en... en...?

112. ¿Gilberto Gómez?

113. Cinco cuartos.

114. Tengo que cocinar yo para esta noche.

115. Y entonces les tocó venirse acá a hacer la carrera.

116. Es una persona muy hábil.

117. ¿Estarán poniendo algo ahí en la otra punta?

118. Cuando volaba Panagra, Braniff también volaba.

119. Colombia no más.

120. No... no tiene posibilidad de trabajo en industria privada.

121. Ellos han venido acá precisamente por eso.

122. Chile tiene montones de hierro.

123. ¿Y sabes dónde va a ser el siguiente, después de Vietnam?

124. En arquitectura y urbanismo.

125. ¿Re... resisten?

126. Y entonces yo voy a hacer el postre.

127. ¿Tú no conoces este muchacho que estudió en la casa de mi hermano aquí?

128. Después vino a la Argentina.

129. Brasil también.

130. ¿Como César?

131. Todo el mundo está a contento de eso.

132. Va a volar.

133. Y así pasa.

134. Pero ésa es este... es compañía mejicana.

135. ¿Él es americano?

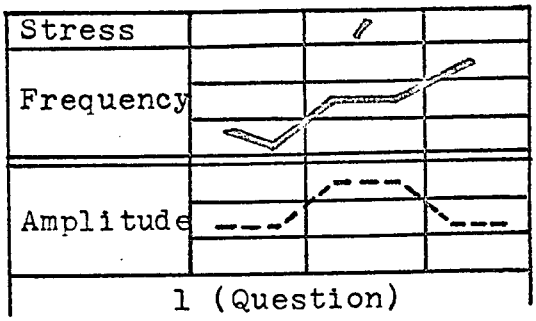
136. Un país de más como Colombia.

137. ¿No puedes contar más?

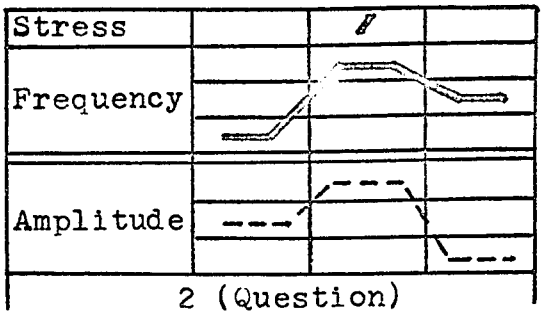
138. Jamón con palta.

APPENDIX B

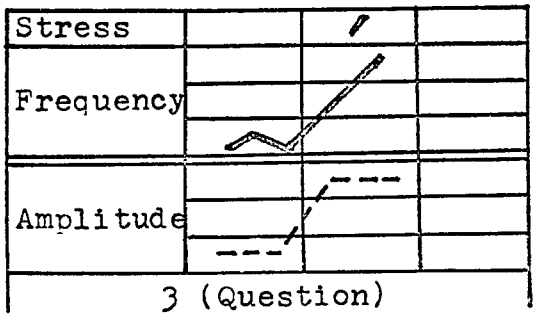
STRESS, FREQUENCY, AND AMPLITUDE TYPES, WITH THE CORRESPONDING JUDGMENT FROM THE LISTENING TEST



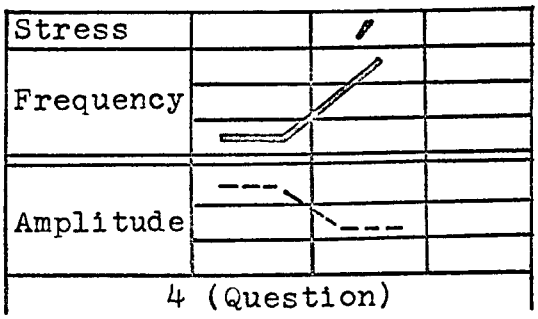
1 (Question)



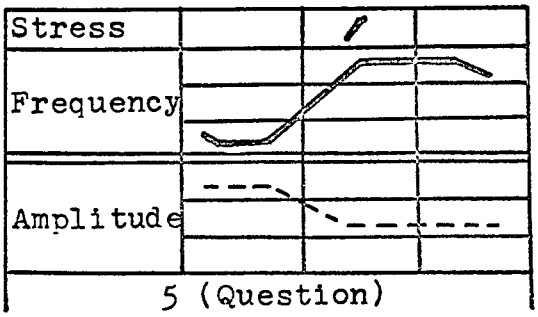
2 (Question)



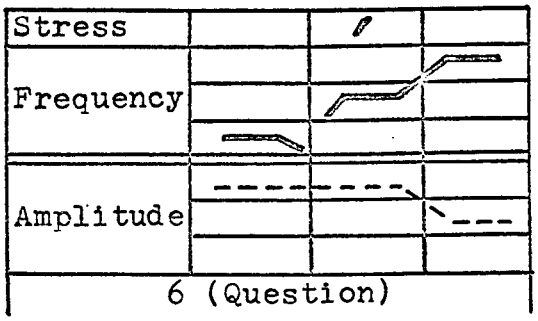
3 (Question)



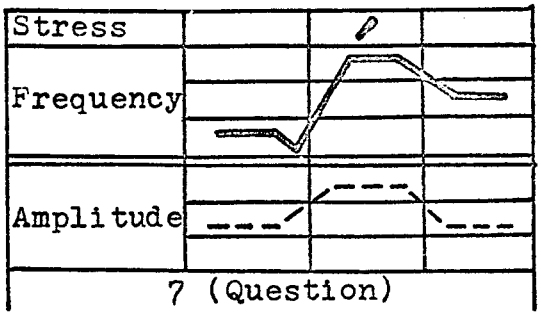
4 (Question)



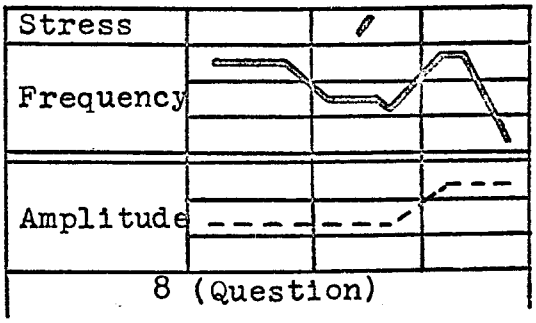
5 (Question)



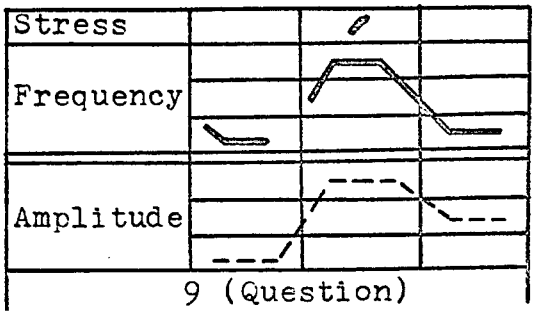
6 (Question)



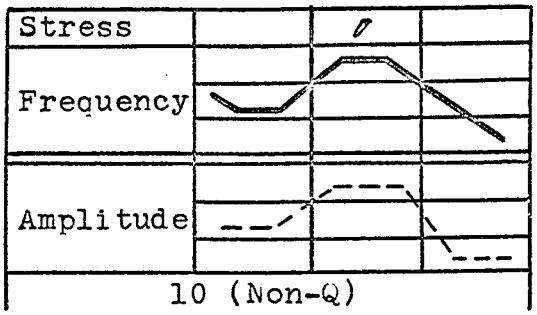
7 (Question)



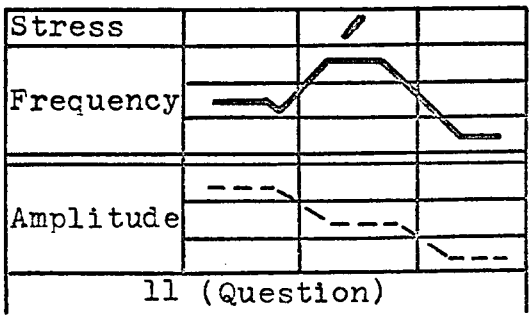
8 (Question)



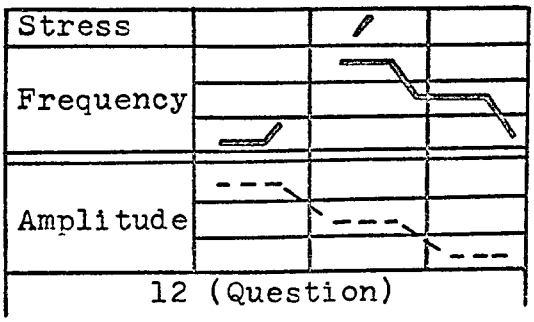
9 (Question)



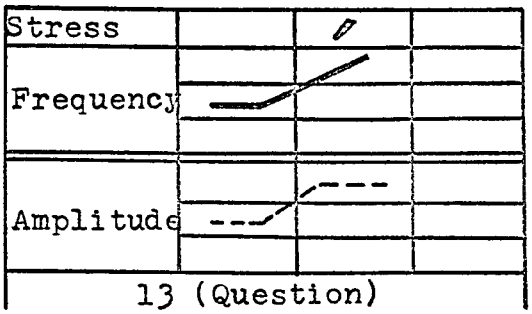
10 (Non-Q)



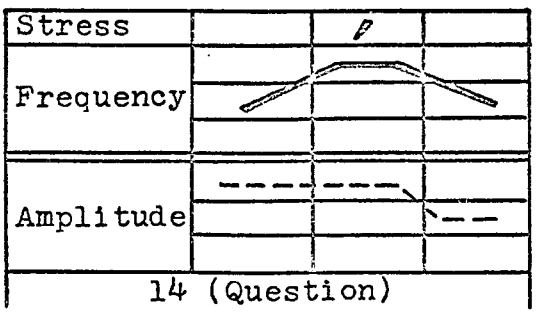
11 (Question)



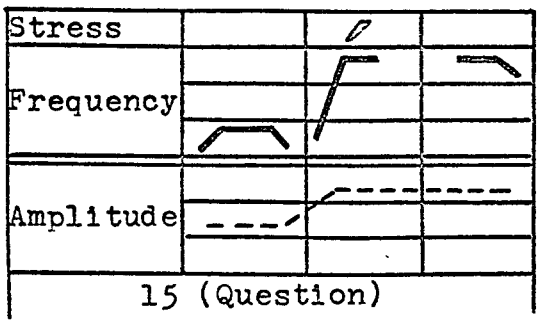
12 (Question)



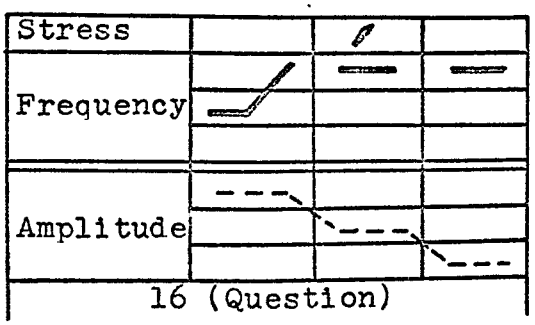
13 (Question)



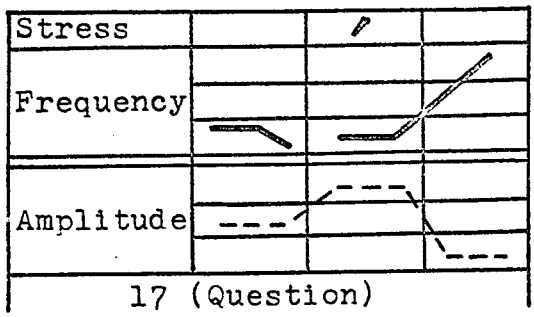
14 (Question)



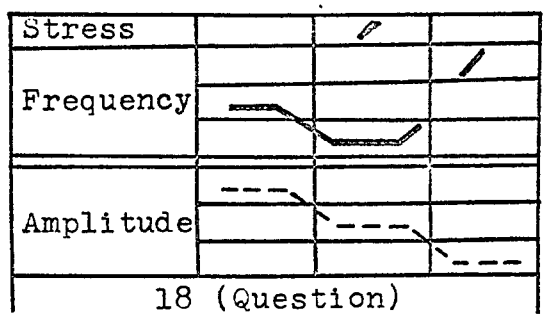
15 (Question)



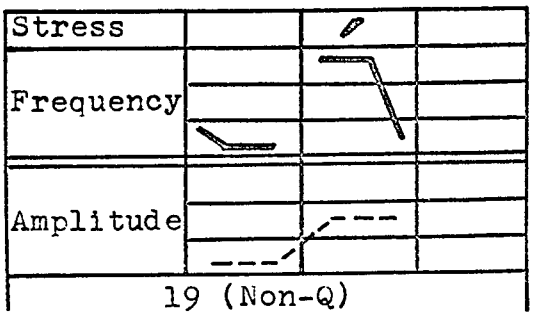
16 (Question)



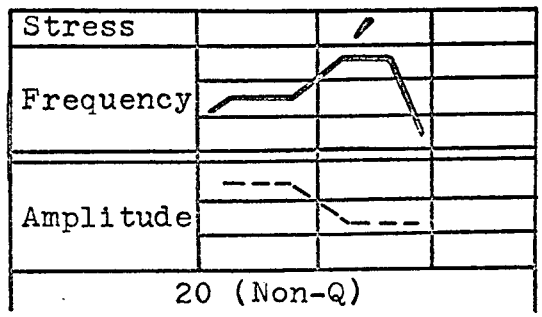
17 (Question)



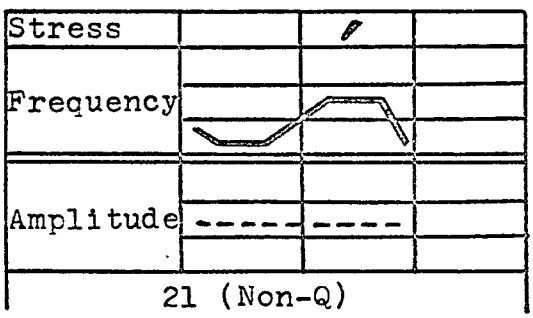
18 (Question)



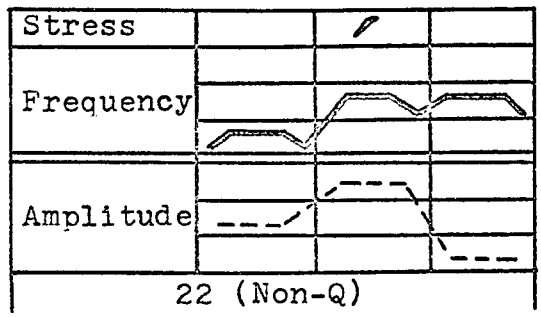
19 (Non-Q)



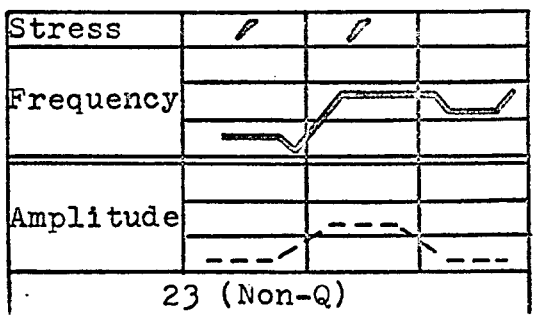
20 (Non-Q)



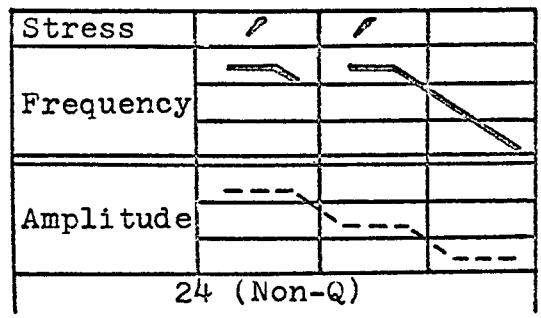
21 (Non-Q)



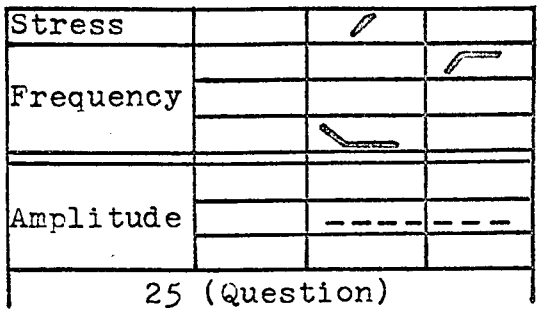
22 (Non-Q)



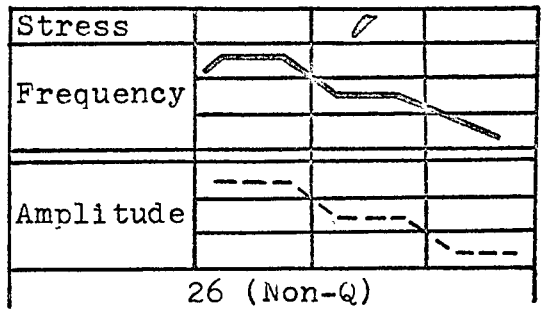
23 (Non-Q)



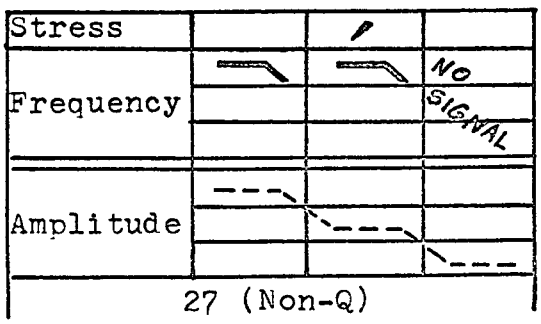
24 (Non-Q)



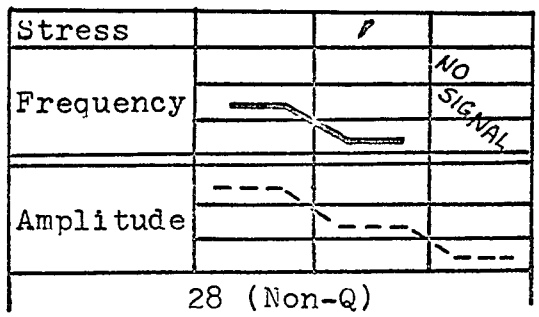
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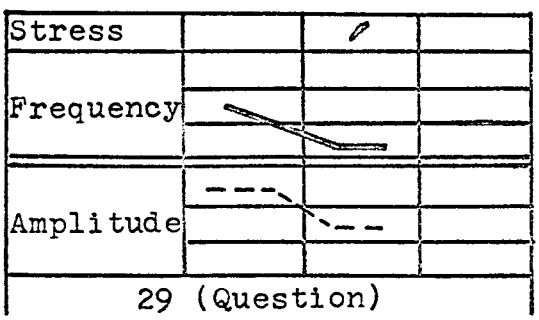
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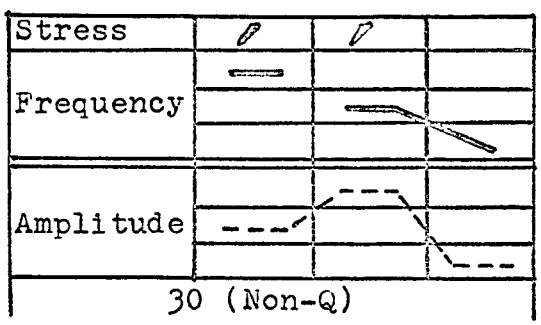
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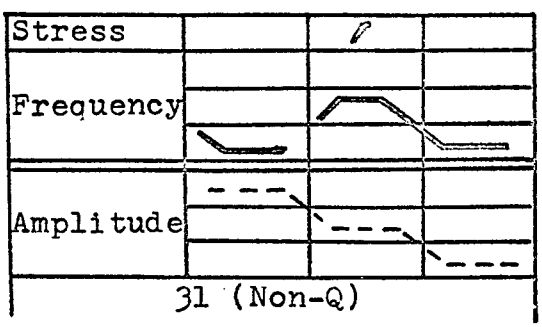
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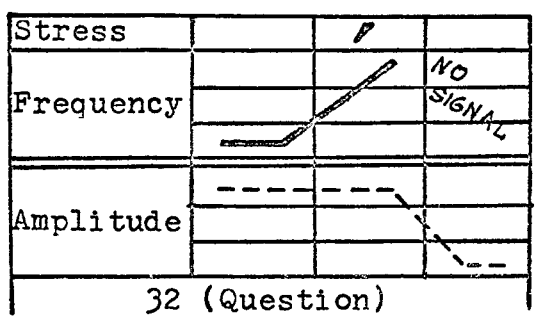
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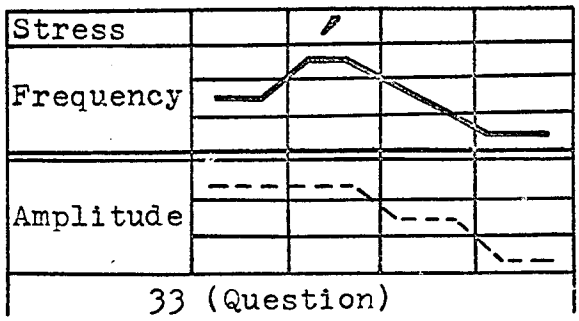
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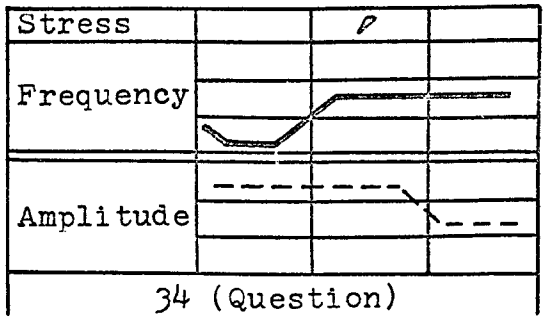
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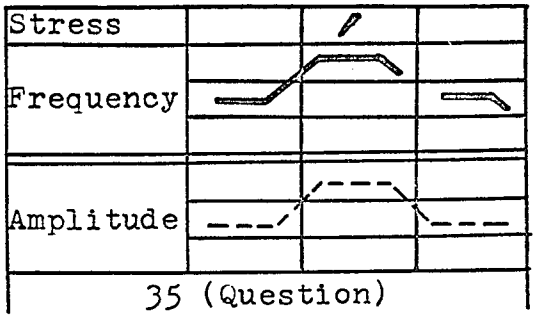
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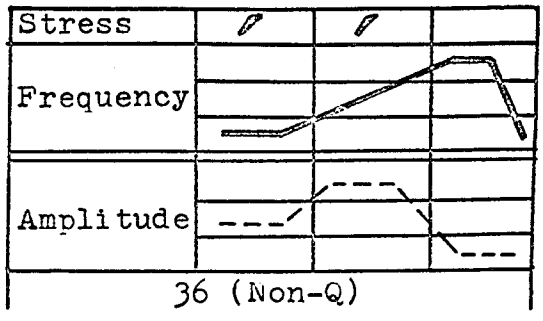
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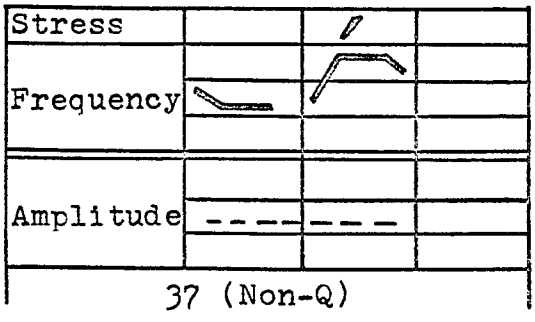
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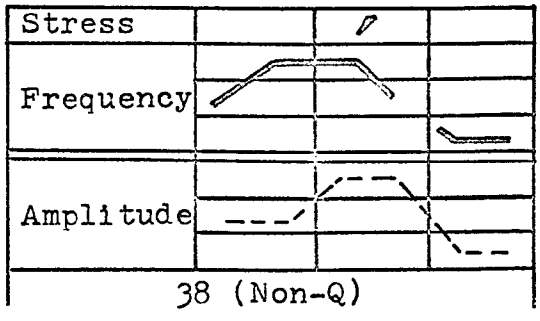
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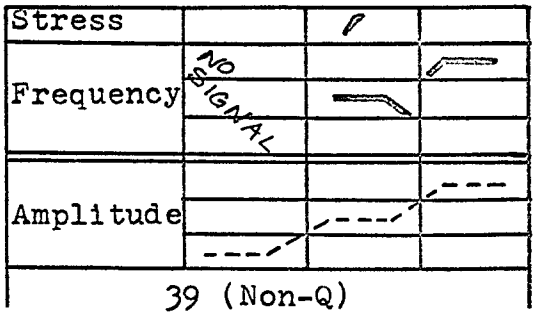
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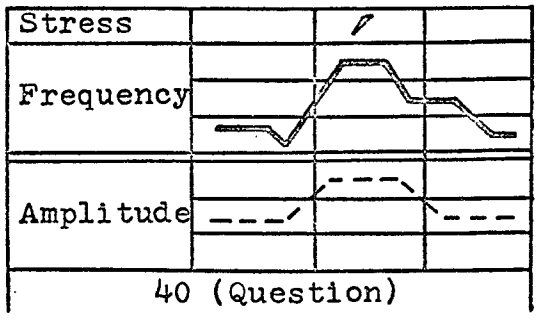
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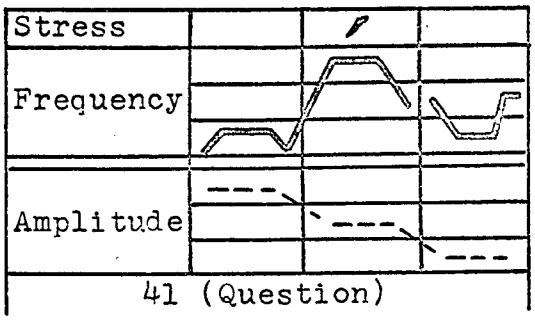
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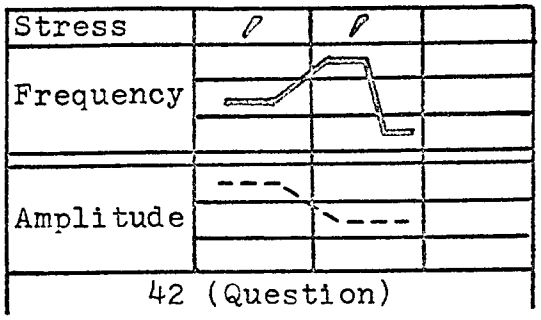
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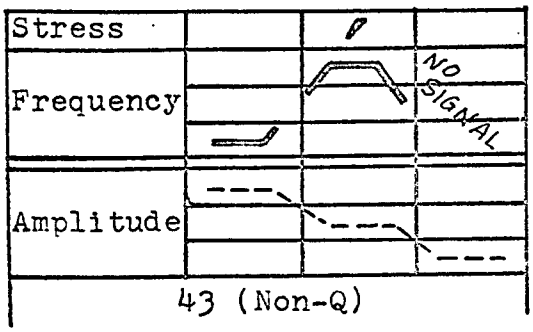
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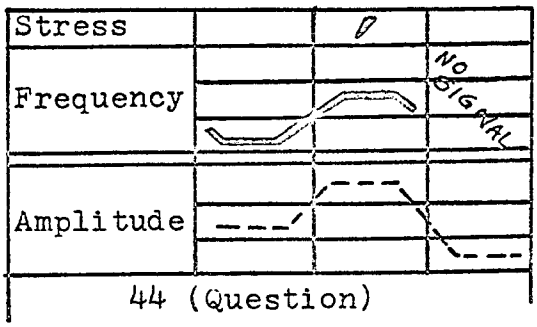
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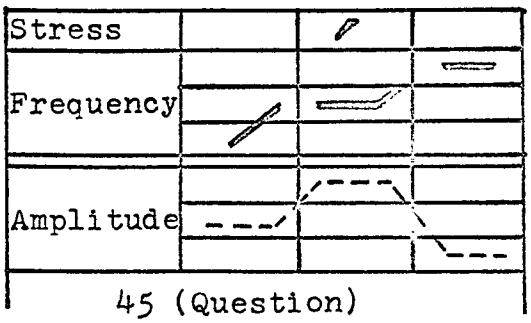
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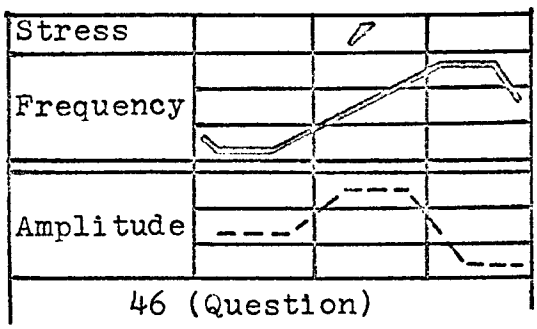
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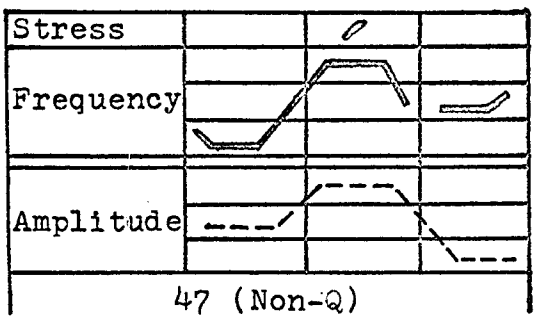
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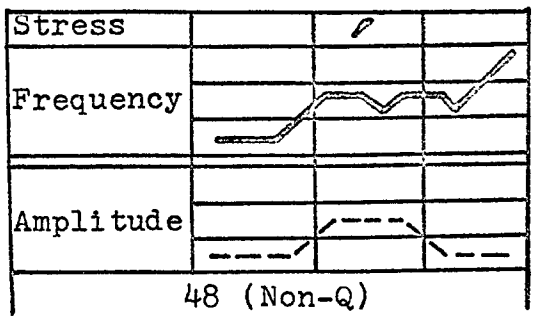
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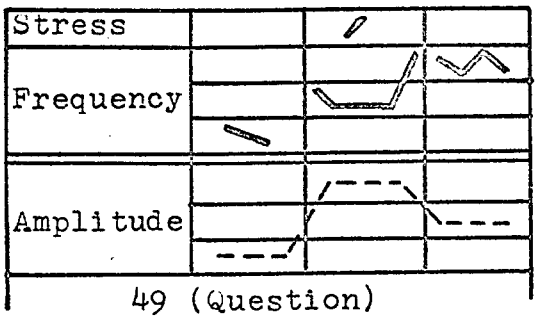
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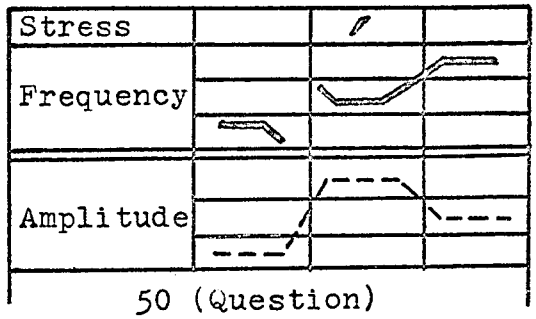
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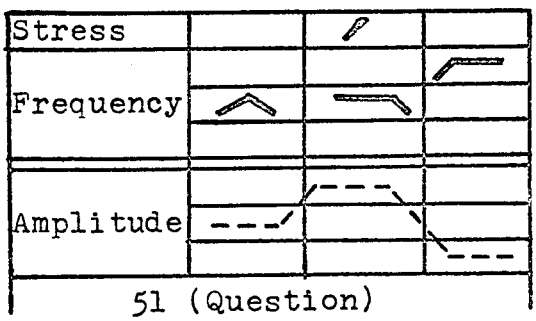
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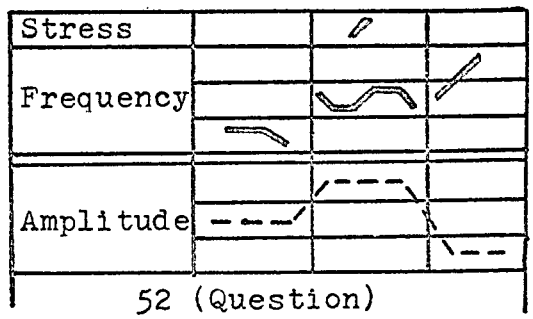
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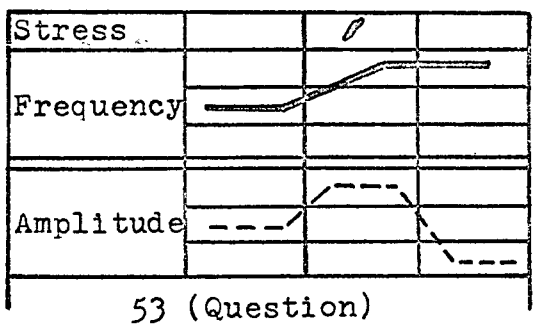
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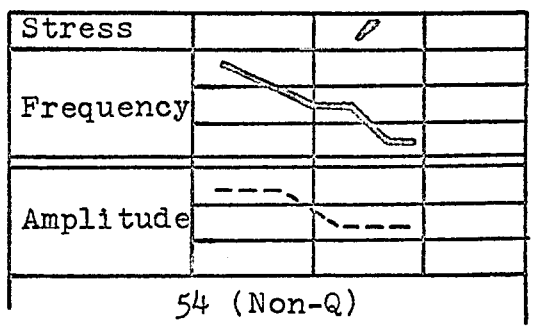
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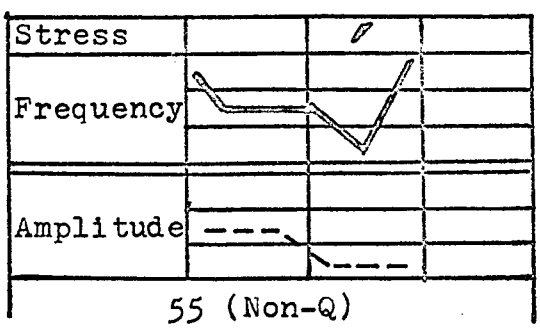
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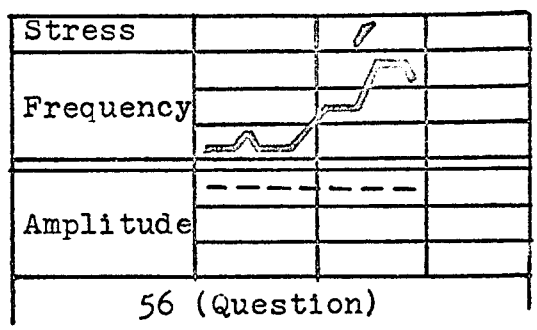
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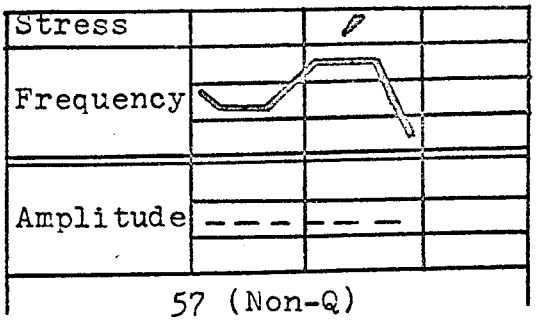
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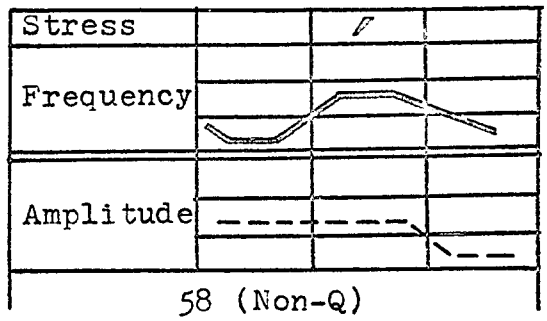
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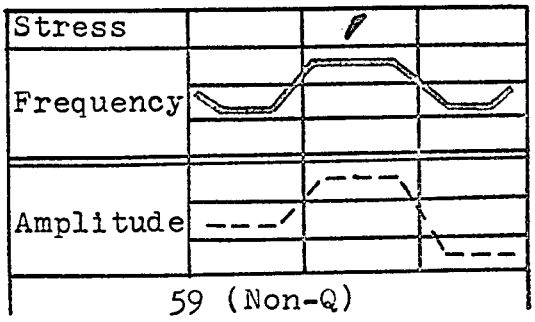
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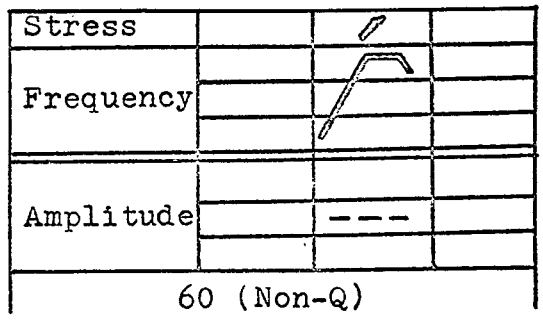
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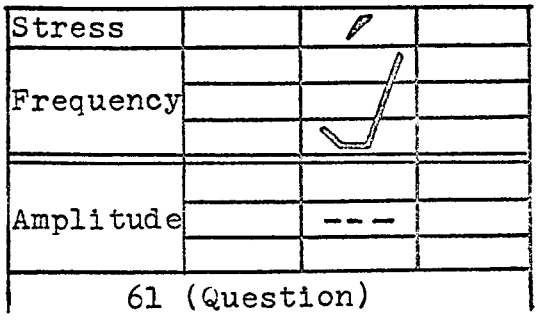
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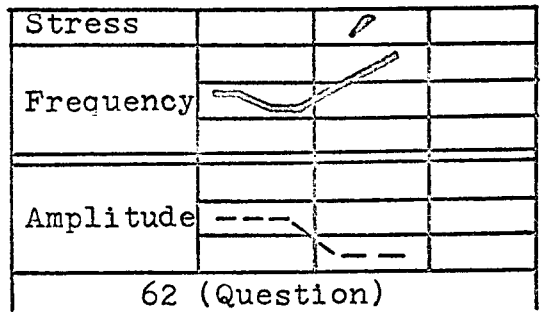
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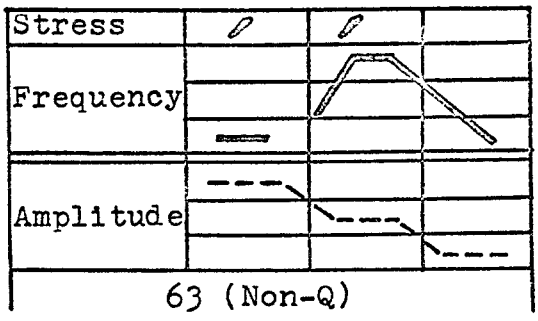
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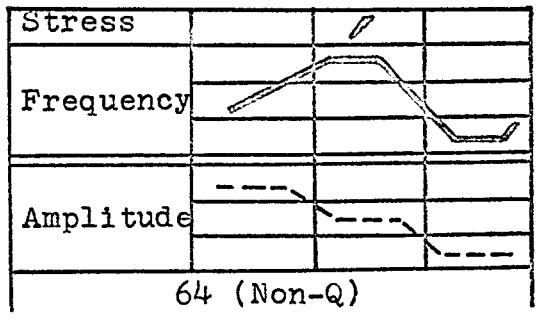
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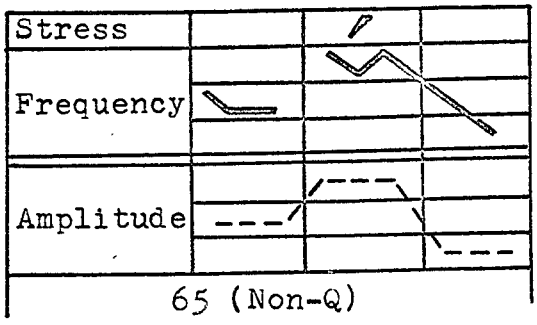
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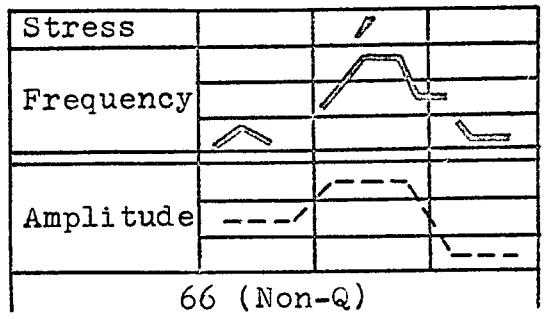
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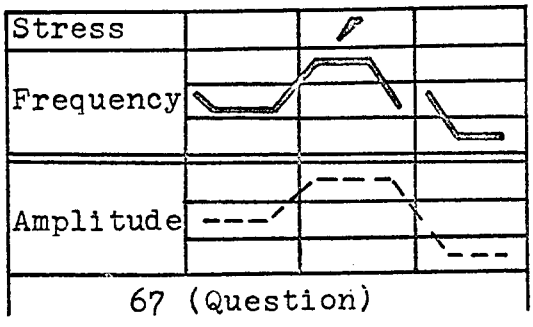
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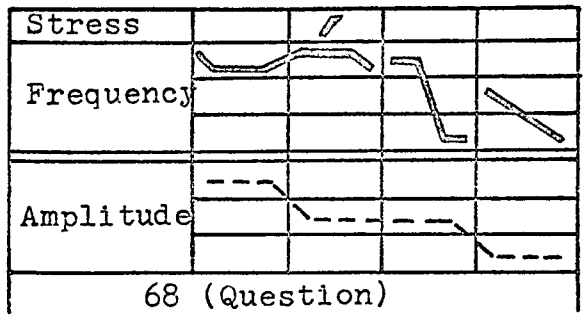
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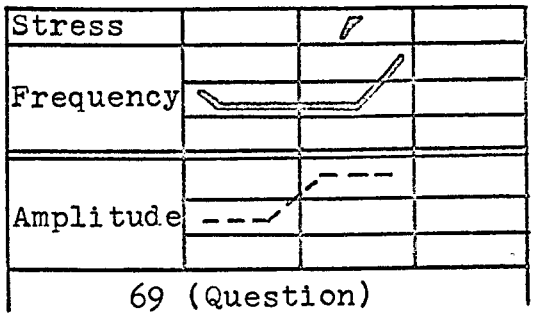
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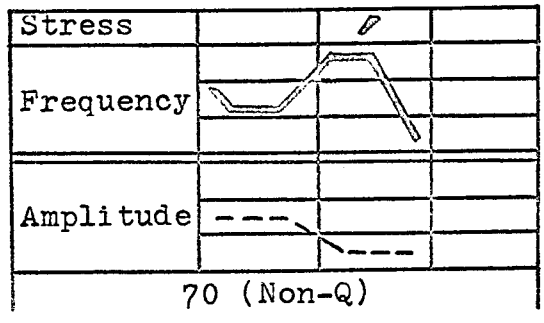
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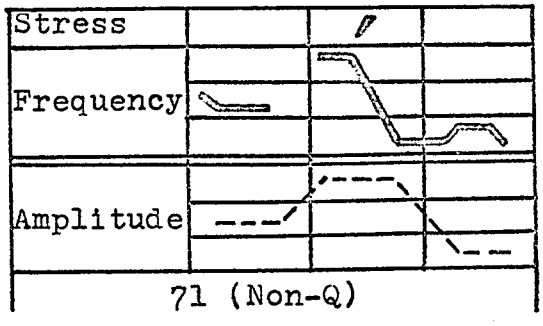
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69 (Question)



70 (Non-Q)



71 (Non-Q)

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