An experiment involving comprehension of intonation in children from 7 to 10

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An experiment involving comprehension of intonation in children from 7 to 10

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Abstract

A frequent claim has been made that the acquisition of intonation precedes other language learning. Little is known about developing comprehension of language in general and of intonation in particular. This article reports the result of an experiment testing the comprehension of certain intonation patterns between the ages of seven and ten. It is found that development is still going on during these years and is not wholly complete by the end of this period. Some suggestions are made about the order of acquisition.

A large number of piecemeal or impressionistic comments have been made about children’s early development of intonation, e.g. in Lewis (1936). Such comments usually suggest that intonation in some way precedes the development of syntax or even the development of the first words: for example, ‘It is widely accepted that the child effectively masters the intonation pattern of his language before he has learnt any words at all’ (Bever, Fodor & Weksel 1965). A difficulty with such comments is that different authors understand different things by intonation. For some, a response to an angry voice (which may involve a certain voice quality, a certain loudness, and an unusual pitch range) indicates a knowledge of intonation; for others, the child’s own use of a heightened pitch when excited may so indicate; others note the child’s mimicking of adult pitch patterns or his use of or response to one particular pitch pattern in one particular very limited context (e.g. a certain pattern induces the child to look towards the door, anticipating a visitor); and yet others note the child’s frequent use of a rising-falling pitch pattern and see in this the beginning of the ‘unmarked’ adult pitch pattern (Lieberman 1967). All these things may well occur before the first words: yet a glance at any of the textbooks of intonation (e.g. Pike 1945, O’Connor & Arnold 1961, Halliday 1967) reveals that such textbooks deal with none of these things (with the possible exception of the last – the ‘unmarked’ contour). Rather they are concerned with the division of utterances into intonation groups (also called sense groups, breath groups, or tone groups), the identification of the nucleus (also called tonic or main stress), and the differential use of various pitch contours. And the acquisition of such systems as are expounded in these textbooks remains largely unstudied. Children’s first sentences are short and largely
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Correspond with one intonation group (see Bloom (1970) for examples of two-word utterances being interpreted as one or two sentences on the basis of the use or non-use of an intonation boundary). When are their sentences long enough, or when is their intonation developed enough, to involve more than one intonation group per sentence (e.g. a separate group for a sentence-initial adverb)? Several authors on children’s two-word sentences have noted that stress (= falling pitch) on the first item may indicate a different sentence meaning from stress on the second item (e.g. Miller & Ervin 1964). Thus ‘daddy car’ indicates possession while ‘daddy scar’ indicates location. But how does this grow into the complex system of indicating new information by the placement of the nucleus (see Halliday 1967)? Again, a number of writers have suggested that yes/no questions are first indicated solely by pitch contour, but as anyone who has studied intonation in any detail knows, the marking of questions is a relatively minor function of pitch contour in the adult intonation system (at least of British English). More central are notions like: similarity or difference; expectedness or unexpectedness; finality or non-finality; doubt or certainty; subordination or superordination. When are such notions first comprehended and first expressed?

The study of the development of intonation remains then only in the embryo stage. Much the same might be said about the development of speech comprehension as opposed to speech production. For example, there have been many studies of children’s syntactic production, both written and oral, in the early school years (see the summary in Griffin 1968) – albeit these studies have often been linguistically naive – but little study of their comprehension. The notable exception has been C. Chomsky (1969), who showed, among other things, that between 5 and 10 years children were still in the process of learning to comprehend the syntactic/semantic patterns associated with certain verbs (promise, ask, tell). A pilot experiment has therefore been attempted concerning the comprehension of certain intonation patterns by children from 7 to 10. The meaning of pitch patterns being a somewhat more nebulous thing than many other types of linguistic meaning, it is not easy to find such fairly easily testable items as a doll’s being ‘easy to see’ when blindfolded (see Chomsky 1969: 26). It was decided to test children’s comprehension of the intonations used in the reading of football results. (The patterns involved are of wider significance, however, as will be discussed below.)

INTONATION ANALYSIS

It is well known that, when listening to a reading of the result of a (Rugby or Association) football match, the result can often be predicted before the second score is read out (at least in British English). The intonation anticipates the second score. The features of intonation which produce this effect are best described by starting from the most neutral or ‘unmarked’ pattern. In this pattern there is a
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rising or a falling–rising nucleus on the first score\(^1\) (the type of intonational ‘head’ used on the first team is largely irrelevant although it is usually mid-high level); followed by a falling nucleus on the second score (again the type of ‘head’ is largely irrelevant). This is regarded as the most neutral intonation because it is a common intonation for home wins or away wins (but not for draws). The choice between rising and falling–rising on the first score would seem to depend largely on the likeliness of the score, the higher and thus more unlikely having the falling–rising pattern (sometimes it is the unlikeliness of the second score which produces the fall–rise).

There are further obligatory or optional features which characterize home wins, away wins, or draws.

A. HOME WINS It is obligatory to have a narrow or low fall on the second score (this will usually mean that the starting point of the fall will be lower than the height of the preceding head) thus:

Everton 2 Liverpool 1
\[
\text{---} \downarrow \text{---}
\]
or

Everton 2 Liverpool 1
\[
\text{---} \downarrow \text{---}
\]

B. AWAY WINS It is obligatory to have a high fall on the second score (this will usually mean that the starting point of the fall will be higher than that of the preceding head),\(^2\) thus:

Everton 1 Liverpool 2
\[
\text{---} \downarrow \text{---}
\]
or

Everton 1 Liverpool 2
\[
\text{---} \downarrow \text{---}
\]

It is optional to have a separate rising or falling–rising nucleus on the second team, thus having three intonation groups in all, thus:

Everton 1 Liverpool 2
\[
\text{---} \uparrow \text{---}
\]

(Only the fall–rise will be diagrammed for all examples in future: low rise and mid level should always be assumed to be possible as variants.)

C. DRAWS It is obligatory to have a falling intonation (usually high falling) on the second team with a following ‘tail’ on the score, thus:

Everton 1 Liverpool 1
\[
\text{---} \downarrow \text{---}
\]

\[1\] Occasionally mid-level (which is in general a variant of low rise in British English intonation).

\[2\] Occasionally the relative height of two level ‘heads’ on the two teams is used to differentiate homes and aways (i.e. the second head lower for homes but higher for aways).
Occasionally the ‘draw’ pattern is used for a different though similar purpose, that is to indicate parallelism between two results following one another, e.g.

Halifax 1 Oldham 2
Shrewsbury 1 Rochdale 2,

where Rochdale would have a falling intonation with a following tail.

It is optional to move the rising or falling-rising intonation in the first half onto the team, thus:

Everton 1 Liverpool 1 or Everton 1 Liverpool 1

This latter draw pattern we will in future call the emphatic draw pattern. This move is also optionally usable where there is a parallelism between two ‘Uniteds’, ‘Rovers’, etc., e.g.

Sheffield United 1 Manchester United 2,

where a falling-rising tune may begin on Sheffield (but Manchester United will have the away pattern of fall-rise on team and fall on score). It is also optional for the second score to have a fall in addition to the fall on the second team, provided it is a lower fall, thus:

Everton 1 Liverpool 1

The patterns just described can regularly be heard from BBC Radio readers of football results – though there are certain rogue announcers who mislead listeners by misreading (for example, the anticipation of an away win is let down by a draw), and TV readers deviate from these patterns more commonly because of interference from the visual results, which have often been read by the viewer before the reader reads them, and the reader knows it.

Four intonation variables are involved.

(a) Placement of nucleus: nucleus on second team for a draw or an away win (obligatory for draw; optional for away); optional nucleus on first team for a draw. Otherwise nuclei on scores.

(b) Number of intonation groups: three in the case of the away pattern with fall-rise on the second team. Optionally three groups for the emphatic draw pattern. Otherwise two groups.

(c) Pitch contour: falling nucleus on second team for a draw; (falling-)rising nucleus on second team for an away win.

(d) Pitch range: high fall on second score indicates an away win; low fall on second team indicates a home win.

The second and fourth variables, (b) and (d), are not testable because they do not
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anticipate but co-occur with the second score. The other two variables are testable because they anticipate results in the following ways:

(i) falling nucleus on second team indicates a draw;
(ii) (falling-)rising nucleus on second team indicates an away win;
(iii) 'head' (usually level) on second team indicates a home or away win;
(iv) (falling-)rising nucleus on first team indicates a draw. Thus a home win cannot be unambiguously anticipated.

THE EXPERIMENT

Taking account of the various testable anticipatory patterns the following nine results were recorded (the second score of course being omitted). The result to be predicted is given in brackets following the intonation transcription. The teams were from the Scottish League Division II (so that prejudicial support for one team might not interfere in any way – the experiment being carried out in the Manchester area).

(1) Albion Rovers 1 Clyde

(2) Clydebank 2 Stirling Albion

(3) Cowdenbeath 2 Raith Rovers

(4) Forfar 3 Stranraer

(5) Montr6se 1 Stenhousemuir

(6) Queen of the South 2 Brechin

(7) Hamilton Académicals 1 Queen's Park

(8) St Mirren 2 East Stirlingshire

(9) Dunfermline Athletic 3 Berwick Rängers

[' indicates stressed syllable, which in turn indicates nucleus when nucleus is on team.]

Over and above the inclusion of the various anticipatory markers, two other points need to be mentioned. Firstly, the first score was sometimes said with a low rise and sometimes with a fall-rise, as one pattern might be learnt before the other. Secondly (4) and (7) (draws) have the same intonation pattern; so also do (6) and (9) (aways). However, (4) and (9) had a score of 3, which generally in football, intonation apart, would predispose towards expecting a home win. Correct comprehension of the intonation patterns to predict a draw and an away would therefore in these two cases be highly significant. Similarly, it may be noted that there was no score of 0, which, of course, would rule out the possibility of a home win.
The tape-recorded results were first presented to fifteen adults, chosen mainly for their non-interest in football, who were asked to guess the second score. All of the adult informants answered the nine results correctly in terms of home, away and draw, despite their lack of interest in football. All had the necessary intonation system readily available.¹

All the boys (numbering 28) in the junior classes of a primary school (ages 7–10) were presented with the tape-recorded results and asked to guess the second score. Of course in dealing with children of these ages (particularly the younger ages) a certain amount of orientation was necessary. This was achieved by discussing football with them in a general way—whom they supported, whether they watched games very often, and so on. A rating for football interest was given at this time. The children were then given a few sample results on which to practise their guesses before listening to the tape-recorded results, each of which they were allowed to hear as many times as they liked.

RESULTS

(i) General

Table 1 tabulates various raw scores.

Before attempting to treat these results statistically, it must be stressed that this was only a pilot experiment. It was uncertain which intonational factors might be important in a child's developing competence and therefore a large number of variations in intonational form had to be included, if only to see which were irrelevant. Also, some factors may affect the results of the experiment in a way difficult to quantify. For example, a moment's thought will tell one that if the child is just guessing a number when he answers (with no knowledge of the system) he is less likely to answer with the score which indicates a draw than he is to answer with one of the many numbers which might indicate a home or an away. Therefore a relatively higher number correct might be demanded on results (3) and (5) (HOME or AWAY), while a relatively lower number correctly giving the draw results might be considered highly significant. The statistical results are not therefore to be taken as conclusive but merely as highly suggestive or pointing the way to a more tightly controlled experiment.

As can be seen from Table 2, scores of 5 and 6 correct (out of 7, leaving aside results (3) and (5))² clearly indicate something very near to full competence; a

¹ It is to be noted that foreign speakers of English acquire the system only when attaining a very high level of competence. Some are completely unaware of the possibility of predicting the second score (presumably because this is not possible in their mother tongue).

² (3) and (5) are left out of consideration here because they have the possibility of two correct guesses out of three, whereas the remaining seven have the possibility of only one correct guess out of three. It would be difficult to make allowance for this in such a table of a priori probability. They are considered further below.
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**Table 1. Raw scores obtained**

<table>
<thead>
<tr>
<th>Age</th>
<th>Football interest (1 high; 5 low)</th>
<th>Correct (out of 9)</th>
<th>Correct (out of 7)</th>
<th>Draws correct</th>
<th>Aways correct</th>
<th>Draw/Away*</th>
<th>Right/Wrong</th>
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<tr>
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<td>3</td>
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<td>3</td>
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<td>4</td>
<td>2</td>
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<td>6</td>
<td>4</td>
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<td>6</td>
<td>4</td>
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<td>4</td>
<td>4</td>
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<td>4</td>
<td>1</td>
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<td>7;10</td>
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<td>5</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>

* Computed by adding draws and away correctly identified and deducting results incorrectly identified as draws and away respectively.

**Table 2. A priori probability of a given number of correct guesses**

[Graph showing probability distribution]
score of 4 indicates some competence. It can be seen from column 5 of Table 1 that only 8 of the children had anything approaching full competence. The correlation between age (column 1) and score out of 9 (column 3) was computed as $r = 0.33$ using the Spearman rank correlation coefficient, and using a t-test (one-tailed) this was computed as significant at the $P < 0.05$ level. For the correlation between age and score out of 7 (column 4) $r = 0.42$ ($P < 0.025$); an exactly similar correlation and probability obtained for the relationship between age and the draw/away right/wrong score (column 7) (which in several ways might be considered a truer measure of their competence). Of the 28 children, five guessed the 9 results as all the same or 8 as the same (that is, they guessed, for example, that in all cases the away team had won or that in 8 cases the away team had won): it was perhaps legitimate to conclude that these children had not understood the point of the experiment and to exclude them from the statistical treatment. When the relationship between age and draw/away right/wrong score was computed for the remaining 23 children $r = 0.68$ which was significant at the $P < 0.001$ level.

As noted above each child was impressionistically rated for football interest on a scale of 1–5. The correlation between football interest (Table 1, column 2) and score out of 7 (column 4) was computed as $r = 0.31$ ($P < 0.10$).

There is obviously a strong relationship between age and score and a lesser relationship between football interest and score. It does not therefore seem as if the increase in competence with age is completely attributable to a parallel increase in football interest.

(ii) The draw pattern

It is immediately obvious that the number of correctly heard draws increases strongly with age (see column 5). For this relationship $r = 0.58$ ($P < 0.001$). There was no tendency for children to master the emphatic draw pattern before the unemphatic nor vice versa; nor was there any indication that the use of low rise or fall-rise on the score in the unemphatic type had any influence. Nor did a high draw score (result 4) produce any noticeable difference to a low draw score (result 7).

There appeared to be no particular bias towards misinterpreting the draw pattern or any of the sub-types as either home or away.

(iii) The away pattern

There is no increase in the number of correctly heard aways (column 6) towards the top of the age range. For this relationship $r = -0.19$.

Of the three away results a greater number got (6) correct than either of the other two. This is perhaps due to two reasons. Firstly a falling–rising pattern on the second team is perceptually more obvious than the simple rising tune which is used on (2). Secondly the high score away (result (9) – home score 3) may influence against the away result.
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There is a marked tendency throughout the age range for aways to be interpreted as homes rather than draws. Of the misinterpreted draws 32 were misinterpreted as homes, 11 as draws. In those results (6 and 9) where a falling-rising tune was used on the second team (rather than a simple rising tune) this tendency was even more marked: of these, 23 were misheard as homes and only 4 as draws.

There appears to be a tendency to identify the away pattern at least as a non-draw and there is some slight evidence of identification of the falling-rising tune on the second team as an away. Both these tendencies are distributed over the complete age range.

However, the caveat mentioned above concerning the higher chance of guessing away or home compared with a draw, must at least raise a doubt about the significance of these findings.

(iv) The home/away pattern

There is a tendency to get this pattern right throughout the age range (that is, not to hear it as a draw). This tendency does not increase with age. Once again, the caveat mentioned in the last paragraph of the preceding section raises doubt about the significance of this tendency.

INTERPRETATION

Two facts indisputably emerge from the results. One is that children are in the process of acquiring this particular intonational competence between the ages of 7 and 10 and that at age 9 at least 50 per cent of children show nothing approaching complete competence. The second is that the draw pattern is the first pattern to be thoroughly grasped and this was comprehended by most children at age 9. Another possibility suggested by the experiment is that some other patterns may at least be identified as non-draws. The development of competence in this area would appear to be a case of binary splitting: firstly the development of the distinction draw vs. non-draw and only later the refinement of the non-draw with the new distinction home vs. away (which a majority of children had certainly not attained by age 9).

This pattern of development is slightly contradicted by the evidence mentioned above for the identification of the falling-rising tune on the second team as an away. However, since this tendency shows no increase with age, and since there is definitely a tendency for this pattern to be identified as a non-draw, we may ascribe this contradictory evidence to a chance effect (it seems impossible to devise a statistical test to prove this).
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GENERALIZATIONS

Any generalizations formed on the basis of this experiment must be treated circumspectly on two counts.

(a) Any experiment performed with children may produce restrictions on their competence which are not present in more natural situations.

(b) As noted above, their intonational performance on this task may be somewhat related to their interest in football.

It nevertheless seems likely that certain generalizations do follow from this experiment.

In order to interpret correctly the limited system of draw vs. non-draw, which children at age 9 appear usually to be able to do, attention has to be focused on a pitch pattern occurring at a certain point, generally the second team. The pitch pattern has to be recognized as of a rising or a falling type (or a level). As noted at the beginning of this article both these abilities - nucleus placement and fall vs. rise - are utilized fairly early in language development (probably before the age of 3). It is not likely therefore that the child between the ages of 7 and 10 is learning to focus on one point and recognize the difference between fall and rise. It is more likely that the child is learning during this period to associate certain meanings with these intonations. He is learning that a nucleus on the first team suggests the teams are to be compared rather than the results, which will be the same (i.e. the result will be a draw). He is learning that a falling tune on the second team suggests that it is the last piece of new information, and that therefore the second score will be the same as the first; whereas a rising or level tune indicates a nucleus on the following score, further new information, and that therefore the second score is different from the first. More particularly he is learning that a rising tune on the second team indicates comparison of both teams and scores, only necessary in the case of an away win, in general the least expected result.

The knowledge of intonation which is implicit in the interpretation of football results is knowledge which pervades all uses of English intonation. A rising or falling–rising nuclear tune frequently indicates a further intonation group to follow within the same clause - for instance, in those many cases where a noun-phrase subject has a separate group, e.g. The "best person to do it/(would be...). The nucleus regularly indicates the 'new' information, e.g. (Peter passed the exam) and "John did/(too). Two intonation groups involve two nuclei and therefore two pieces of new information: (John walked slowly)/but "Bill/ran. This applies particularly to correlative constructions, e.g. (John gave Bill seven)/but "Peter/gave "Jane/six. Thus the intonation of football results encapsulates more general systems of intonation in English. Given the weak correlation between football interest and success in the experiment, there is at least a strong presumption that children between the ages of 7 and 10 are in the process of acquiring fundamental functions of intonation in English.

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