

# **Eyebrow raisings and vocal pitch accent : the case of children blind from birth.**

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**Summary:** Data from the videotaped interviews of 5 children blind from birth indicate that the blind children produce many occurrences of eyebrow raisings that may be considered as ‘beats’ (‘batons’) or as ‘underliners’ (the emphasis stretches out over more than one word) following Ekman (1979). Eyebrow raisings function as highlighters, emphasis-producing gestures, similar in function to McNeill’s manual beat gestures (1992).

Confirming Iverson & Goldin-Meadow’s 1997 findings on other gestures used by blind children (mainly iconics in a conservation task), the presence of eyebrow raisings in the speech of blind children (who never saw eyebrow raisings nor experienced their effect on listeners) seems to confirm the importance of such movements *for the speaker*, and to support McNeill’s and Cosnier’s conception of a strong coordination between motor activity and speech, in an integrated system of verbal language and gesture.

Our study investigates the degree of synchronization of eyebrow raisings with pitch accents, in reference to Cavé & al. (1996) and Kraemer et Swerts (2004) findings in sighted adults.

## **1. Introduction.**

The issue of the existence of gestures in children blind from birth has a direct relationship to the theoretical issues of the general function of gestures (Iverson & Goldin-Meadow 1997). In the absence of a visual model, gestures performed by congenitally blind children cannot be seen as resulting from imitation. Besides, children who never saw gestures can have no direct experience of the communicative effect gestures have on receivers (Iverson & Goldin-Meadow, 1997, Maury-Rouan, 1998, 2003). So, as Iverson & Goldin-Meadow pointed out, the presence of co-verbal gestures in children blind from birth has little to do with communication: and the fact that blind children do gesture while speaking supports theoretic views such as Cosnier’s “Énonciatif-Dénonciatif” model (1984, 2000, 2003) and McNeill’s Growth Point theory (1992) that gestures generally speaking play a role for the speaker, independently from the semiotic function they serve for the recipient in the communicative process.

The manual gestures identified in blind children by Iverson & Goldin-Meadow (1997) had been produced throughout a series of tasks comparing the performances of blind, sighted and blindfolded sighted children. Iverson & Goldin-Meadow found that the blind children did

not use gestures in all of the contexts in which the sighted children did: most of their gestures occurred while they provided verbal explanations during a conservation task. In the narrative task, children as a whole, whether blind or sighted, produced few gestures; in the direction task, while the sighted children gestured a lot, the blind children hardly produced any gestures. In the conservation task, the gestures used by the blind children were mainly iconics, which appeared quite similar in form and function to the ones the sighted children used.

In a 1998 study based on a group of 6 congenitally blind children and investigating co-verbal facial expressions in blind subjects, Maury-Rouan found a high frequency of co-verbal eyebrow movements (1998). The presence of these eyebrow movements that seemed to parallel speech in the same way they parallel sighted speakers utterances was quite unexpected, as eyebrow raisings cannot be heard (while smiles other facial expressions influence the quality of the voice); therefore they cannot have been learned from imitation of a model in the case of blind children. As for the way eyebrow movements, such as brow raisings or frowning participate in communication, their general functions were thoroughly described and analyzed by Ekman 's 1979 study "About Brows".

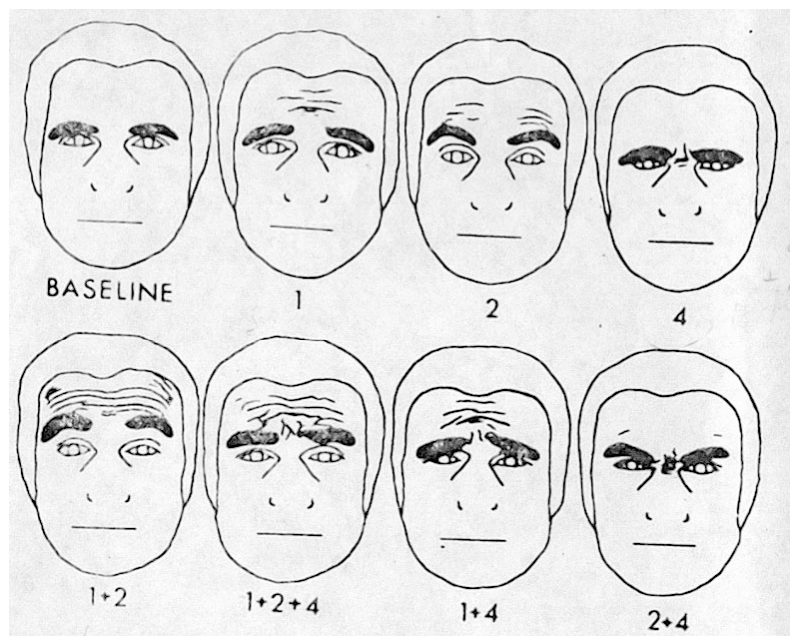


Fig.1: Eyebrow movements From Ekman (1979) "About Brows"

Movement 1+2, the eyebrow raising, universally present in the expression of surprise and in beckoning signals according to Ekman, is also one of the most frequent conversational signals; when paralleling speech, it operates as an emphasize, highlighting important pieces of information in the utterance. So, from a functional point of view, eyebrow raisings may be considered as facial equivalents of manual gestures such as "batons" (in Efron or Ekman's terminology) -"beats" (in McNeill's typology 1992: 15, 169). Ekman (1979: 183 ) introduced a further distinction between "batons" as fast eyebrow raisings coinciding with one word or syllable, and "underliners", used when the eyebrows remain raisingd for a longer period of time, so that the emphasis stretches out over more than one word.

The use of such gestures, operating as highlighters as they focus on one point or part of the utterance, indicates that the speaker takes a meta-pragmatic perspective over discourse

as a whole. The fact that blind children might resort to frequent eyebrow raisings while speaking (a movement they could not have learned from a visual model, and although they could not have experienced the effect it may have on recipients) raises the same issues as the iconic gestures, produced by the children studied by Iverson & Goldin-Meadow, did: if blind children use them, it means that, generally speaking, such gestures should be considered as serving an important function for the speaker, independently from their effect on listeners.

Maury-Rouan's 1998 data indicated that the blind children produced, under the form of eyebrow raisings, many occurrences of what might be considered as 'beats' (or 'batons') as 'underliners' (when the emphasis stretched out over more than one word). A similar use of eyebrow raisings had been found in the sighted children reference group (Maury-Rouan, 1998).

Still, the origin and function of such eyebrow raisings in blind children, and their actual value as independent gestures remained uncertain, since their presence might have been simply accounted for in relation to prosody.

It is a well-established fact that pitch accents have an important role in emphasis, similar to that of manual or facial beats in highlighting the word they accompany. Bolinger (1985) used the metaphor *Up and Down* to describe the strong coordination of eyebrow movements and voice: when the pitch rises or falls, the eyebrows tend to follow the same pattern. Ekman (1979) also insisted on the difficulty of de-synchronizing both patterns intentionally. In this perspective, whether in sighted speakers or in blind children, eyebrow raisings, instead of amounting to independent gestures, might be seen as the mere result of muscular synergy (eyebrow movements being automatically triggered by the motor command of vocal pitch accents).

On the other hand, alternate studies on eyebrow movement in sighted speakers did not find an absolute coordination with vocal variations: Cavé, Guaitella & al. (1996) found that although Fo and eyebrow raisings were often associated, (in 71% of the cases), each might occur separately. Accordingly, they concluded that in the cases when voice and eyebrows were actually synchronized, it might mean that they coincided for communicative reasons rather than reasons of muscular synergy. Kraemer & Swerts (2004) found that the distribution of both patterns was also subject to cross-linguistic variety.

In order to establish whether or not brow raisings might be considered as independent co-verbal gestures in blind children, or whether they were automatically linked to prosody –in which case they could simply have been acquired together with the acoustic model, and their presence would no longer be relevant in the gesture-speech relationship issue - it seemed necessary to investigate the extent to which brow raisings were synchronized with pitch accents throughout the blind children corpus.

## **2. Methods.**

Our study was based on videotaped interviews (including parts of informal talk) of 5 children blind from birth (aged from 6 to 12 years). The children had been chosen (among a group of more than one hundred blind children attending the School) as being blind from birth and as bearing no other handicap. They were filmed in a familiar setting (whether in a classroom or at their homes), first as they listened to an audio-taped tale, then during an interview when they were asked questions about the story they had listened to, and eventually by an informal verbal interaction with the interviewer.

Five excerpts, from 15.555 to 36.530 ms, amounting to a total of 129.161 ms, were extracted from the each child's digitalized video data. An analysis of the vocal track synchronized with a Quicktime video display was operated under SparkME software.

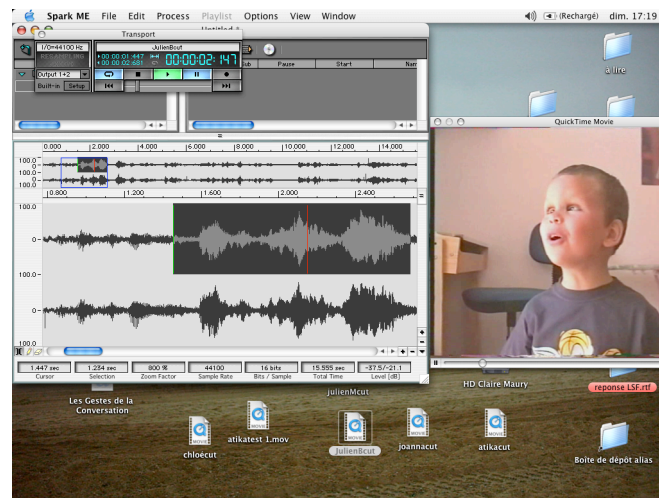


Fig. 2 : Vocal track and video under SparkME

The eyebrow raisings were first noted after the video track. In a distinct following step, these eyebrow raisings were related to the variations in intensity and duration of the utterance that appeared the oscillogram.

### 3. Results and comments.

This analysis confirmed that the eyebrow raisings, either in each child considered separately, or in the whole group, even though often synchronized, did function independently from vocal pitch accents. Roughly, independent eyebrow raisings (68%) amounted to more than twice the occurrences of eyebrow raisings that were synchronized with accents (32% of the total number of eyebrow raisings).

Considering that muscular synergy between voice and facial action might imply a longer delay in the execution of the facial act, the cases when the eyebrow raising occurred immediately after the vocal accent (10% of the cases) were put aside from the total number of independent eyebrow raisings as being possible cases of delayed synchronization. Even so, we found that the remaining cases of independent eyebrow raisings (58% of the total number of eyebrow raisings) amounted to nearly twice the cases of eyebrow raisings that were clearly synchronized with vocal accents (32% of the total number of eyebrow raisings).

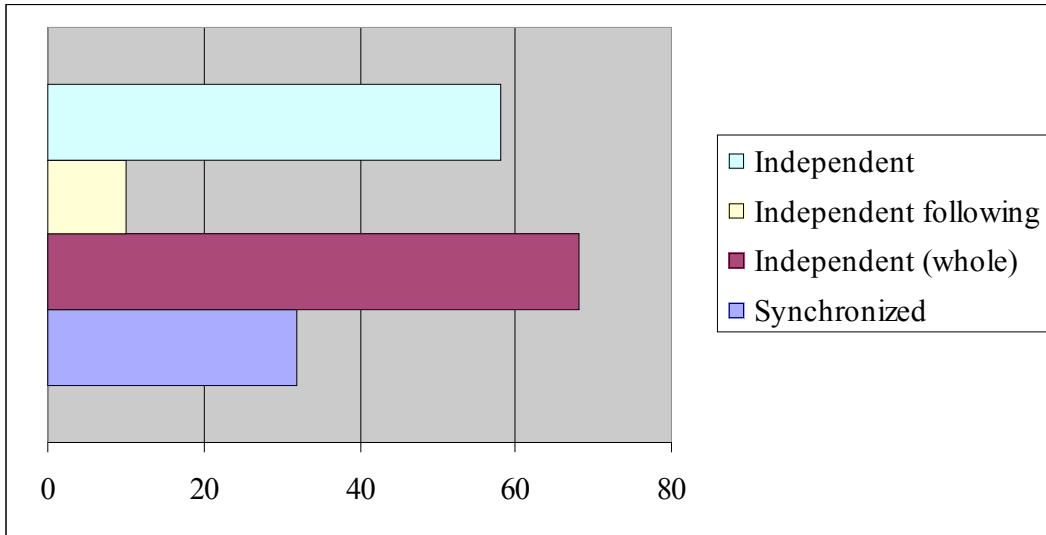


Fig. 3. Eyebrow raisings and pitch accents: whole group

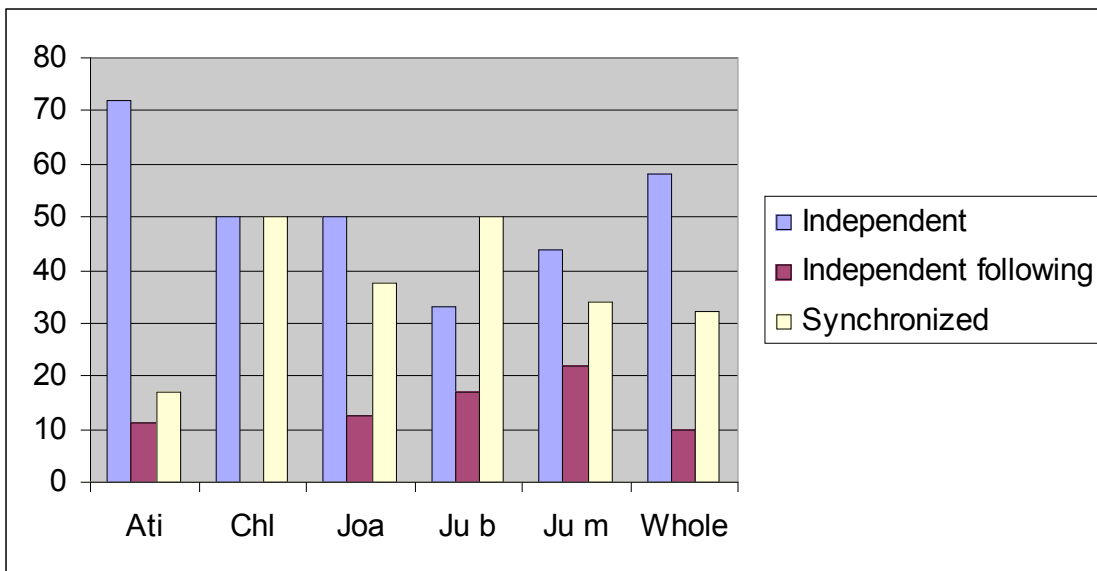


Fig. 4 . Eyebrow raising and pitch accents: Individual results.

Although the results tables display an important individual variation regarding the distribution and the degree of synchronization of eyebrow raisings and vocal pitch accents, they indicate that each of the blind children resorts to some extent to independent eyebrow raisings.

The existence of such eyebrow raisings, functioning as “beats” or “highlighters”, in a potentially independent mode (alternately linked to, or distinct from prosodic emphasis) in blind children seems likely in the light of our first results, However, this study should not be considered as more than the first step of work in progress. Our next study should include more accuracy by introducing Anvil Software to the investigation of our corpus, encompassing both Quicktime video track and Praat vocal analysis, adding more precision

and allowing us to examine the variations of the Fo in addition to the parameters of duration and intensity of the voice.

#### **4. Conclusion.**

Following up Ekman (1979), Cavé, Guaitella & al (1996) and Krahmer & Swerts (2004), eyebrow raisings may be seen as highlighting gestures producing emphasis, in a similar way to other beat gestures. This raises an issue in the classification of gestures, as it should be noted that eyebrow movements, as opposed to McNeill's manual beat gestures, may either be displayed in a rapid mode or stretch over more than one word (Ekman's *underliners*). If taken into account, this specificity might introduce a new aspect into McNeill's 1992 typology of gestures. Such a qualitative difference seems to be based on substance: unlike manual gestures, facial actions have the property of remaining present as long as necessary, paralleling other verbal and gestural modalities. Yet functionally, they should be considered as having the same role as beat gestures.

Our study indicates that such eyebrow movements are used while speaking by congenitally blind children, and the presence of such gestures has consequences in the theoretic field of the general function of gestures.

As these children were never able themselves to see eyebrow raisings, nor experience the effect of eyebrow raisings on listeners, the communicative function of such gestures in them is dubious: but their maintained presence as emphasizeurs of points of the discourse confirms that such movements are important to speakers (generally speaking). In a similar way to Iverson & Goldin-Meadow's 1997 study, this presence supports the conceptions of a strong coordination between motor activity and language, and the existence of an integrated system of language and gesture (Cosnier 1984, 200, 2003, McNeill 1992), introducing the idea that such a coordination should include, beyond hand and arm gestures, other co-verbal movements in the face area.

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