A Brief Note on Mother's Judgment of Cry and Non-cry Utterances of Pre-linguistic Infants

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Human beings are born with birth cries. They are very simple and automatic actions which arise from breathing. From a naive observation they look like expressions of some high emotion, though, researchers who investigated birth cries closely (Ruja, 1948) could not demonstrate that that is true in a scientific sense.

One or two months after birth a baby comes to produce several kinds of sounds. For example, Bullowa et al. (1964) classified utterances of babies up to 3 months old into four classes: i. e. whimper, tremble, cry and scream. Wolff (1969) also classified utterrances into several classes including "faking cry", which, he thought, reflected the baby's emotion or even intention. However, it is open to question if an utterance could be actually and exactly classified according to those classes.

On the other hand, there is literature which has reported that the judgment of cry and non-cry utterances depended on the facial expression of a baby (Irwin, 1941; Irwin and Chen, 1941).

Recent studies in developmental psychology (e. g. Masataka, 1992) often implicitly presuppose that utterances can be divided into cries and non-cries. It is possible to identify the typical cry utterance and the typical non-cry utterance, though, the authors of the studies do not explain what is the essential difference between the two kinds of utterances.

Our recent study (Hayashibe et al., 1996) hypothesizes that cry and non-cry utterances are the origins of the various functions of language like *mand* and *tact* (Skinner, 1957). We are planning to demonstrate that cry utterance is the primitive form of *mand* (*demand*ing verbal behavior). For that purpose it is necessary to have criteria to divide utterances into cries and non-cries. In this short article we will clarify if utterances can be divided into certain classes using objective criteria.

At first, we required that the subject (actually the mother of a child) divided the stimuli (utterances) into two categories, i. e. cry and non-cry utterances in order to find out criteria. However, the subject was often at a loss as to which category to classify. So we added a third category, i. e. faking cry.

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METHOD

Subject

A boy was born normally on the 9th of November, 1994, to his Japanese-speaking mother. He is developing normal both physically and mentally so far.

He and his mother were videotaped one day, six hours, every month. The field of view included the crib in which the boy spent almost all day, and the area around the crib (approximately 1.5 meters). So the video camera was set up about three meters from the bed.

The mother started the recording at a certain time, and continued to record for six hours.

The recording was started when the child was 20 days old. We named it the first month recording (1M). After that the recording was carried out once a month for a year.

Stimuli

For the purpose of this experiment we chose 3M (when the child was 79 days old) because the baby came to produce various kinds of voices from that time on. We also chose 5M (when the child was 133 days old) to reveal the changes that occured as he grew.

Some samples were chosen randomly from the video tapes of 3M and 5M for this research. From each recording we picked 6 samples which include many types of vocalizations. Each sample is from 5 minutes to 12.5 minutes. The 3M samples are about 45 minutes in all and the 5M samples are about 32 minutes in all. So 12 samples are about 77 minutes in all.

The samples were divided into 10-second intervals. We picked one salient utterance data from every 10 seconds to be used for the experiment. Those salient utterances were selected using the following criteria: utterances that occurred in many variations, or utterances with the greatest volume within the 10-second interval.

As for all salient utterances selected every 10 minutes in the samples, the acoustic features of each data were analysed by using a Kay DSP Sonagraph (Model 4300 and Model 4300B) with a 29-Hz band filter and a frequency scale up to 4000 Hz. An utterance was defined as a continuous vocalization of the infant bounded by pauses of longer than 0.3 seconds. Two prosodic parameters were prepared for the analysis: average fundamental frequency and duration. An average fundamental frequency was an arithmetic mean of start frequency, end frequency, peak frequency and minimum frequency of one utterance.

Procedure

The mother watched and listened to one sample three times. One time she watched only pictures (P) ; another time, listened to only sounds (S) ; and another time, watched both pictures and listened to sounds (P&S). These three ways of presentation were arranged in a random sequence. Each time, the mother was asked to judge the kind of vocalization by category: non-cry utterance (V), faking cry (F), or cry utterance (C). All the kinds of utterances were judged solely by the mother and each judgment was noted by the experimenter.

RESULTS

Analysis of the reliability

The correspondence among the three categories (P, S, and P&S) is shown in Table 1. The correspondence is rather high. The fact that the correspondence of S and P&S is the highest (90%) indicated that the subject depended on the sounds information especially.

Table 1. The percentages of the correspondence
among the three categories

The way of presentation \ Month	3M	5M	Overall
S, P and P&S	73%	73%	73%
S and P	76%	77%	76%
P and P&S	78%	79%	79%
S and P&S	91%	88%	90%

Analysis of the factors to discriminate utterances

Figures 1 and 2 show the scatter diagram of the two parameters, duration and frequency, of every data. We could classify them into three types of the utterances (V, F, C).
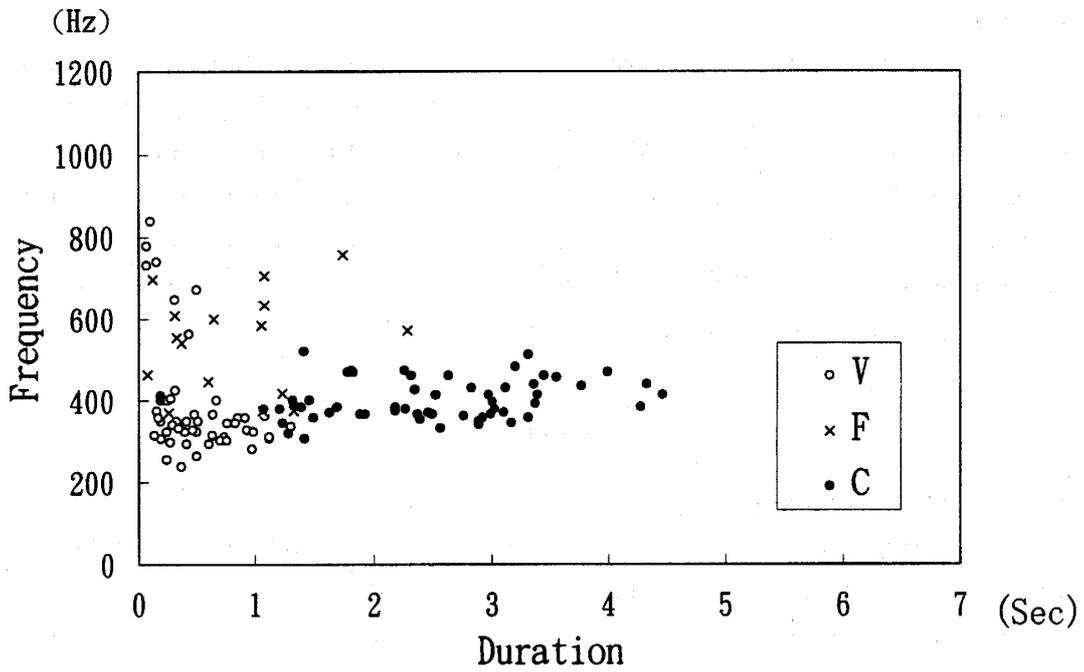
Fig. 1. The scatter diagram of the two parameters,
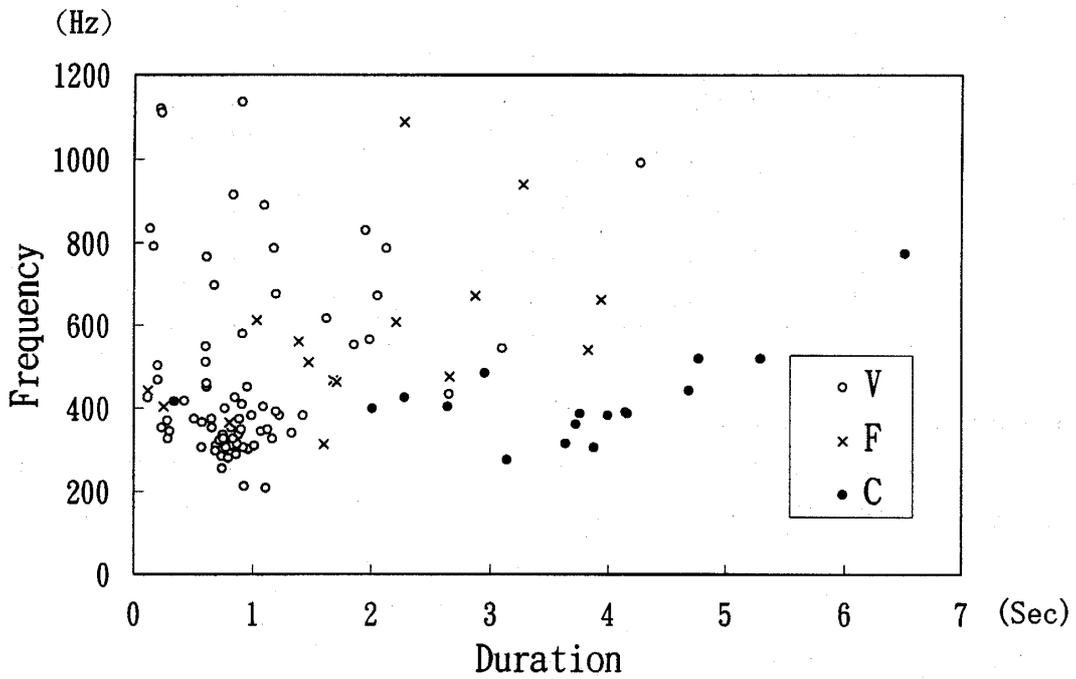duration and frequency in 3M utterances

Fig. 2. The scatter diagram of the two parameters,
duration and frequency in 5M utterances

(1) DURATION

Figure 3 shows the duration which indicates that duration is different between V and C utterances.

Figures 4 and 5 show the percentage of the number of the durations which are judged as non-cry (V) and cry (C) utterances when we classified the durations every 0.5 seconds. Here, the total percentage of V is 100%, and the total percentage of C is 100%, too.
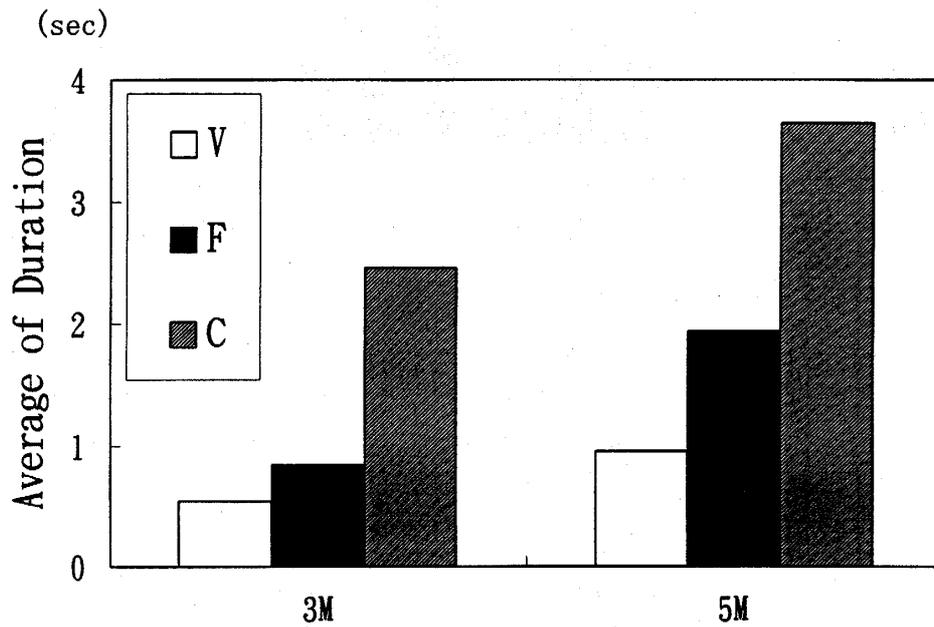

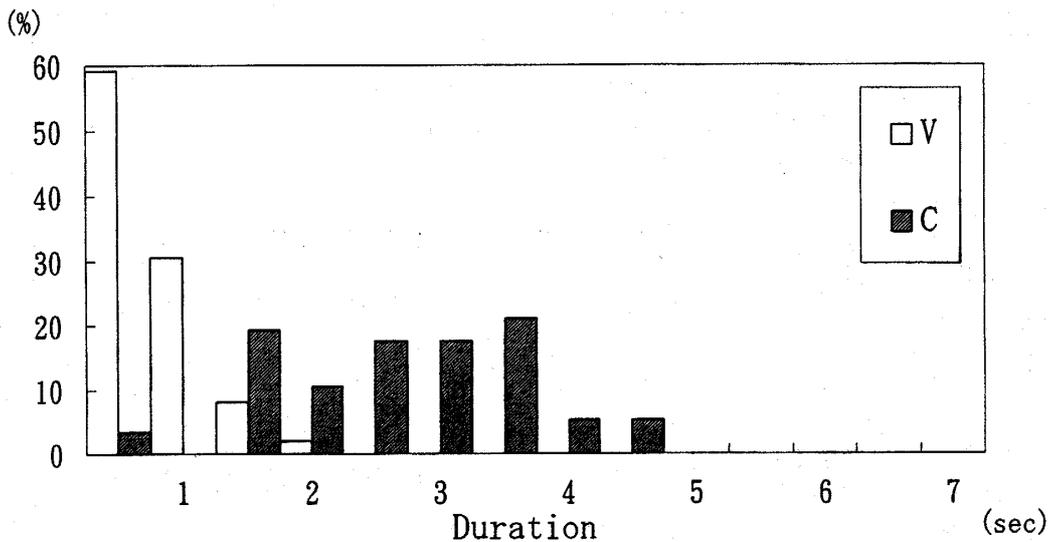Fig. 3. The differences in duration

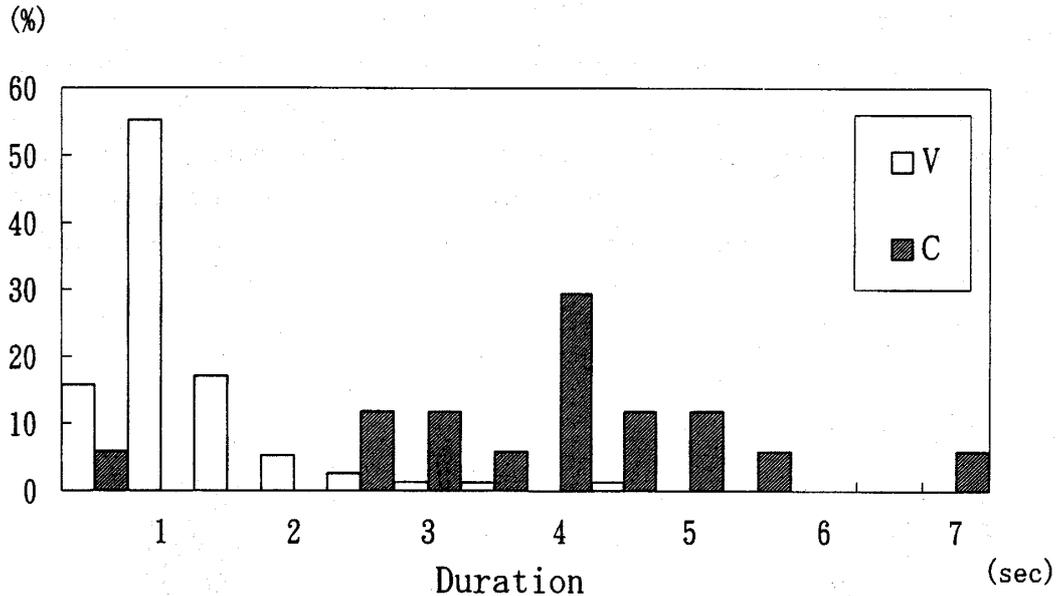Fig. 4. The percentage of the number of durations in 3M utterances

(%)

Fig. 5. The percentage of the number of durations in 5M utterances

When we compare Figures 4 and 5, we notice that there is a boundary between V and C durations and the boundary shifts to longer durations as the child grows up.

Only C-duration is longer than the others in 3M, and in 5M, the durations of the three categories (V, F, C) were all different (c.f. Table 2). There is also a change of growth.

Table 2. The results of t-test of the durations and
the frequency (t-score (df) ; **p<0.01 *p<0.05)

Duration

Month \ Category	V-F	F-C	C-V
3M	1.87 (19)	8.00 (38)**	13.85 (74)**
5M	3.31 (17)**	3.82 (30)**	7.73 (18)**

Frequency

Month \ Category	V-F	F-C	C-V
3M	4.16 (29)**	4.55 (16)**	0.48 (57)
5M	1.72 (23)	2.57 (23)*	1.35 (48)

The difference of the growth

Factor \ Category	V (3M-5M)	F (3M-5M)	C (3M-5M)
Duration	4.52 (121)**	3.35 (23)**	3.27 (21)**
Frequency	2.60 (123)*	0.46 (25)	0.87 (18)

(2) FREQUENCY

Figure 6 shows the differences of the frequency. F utterances are a little higher than other utterances especially in the case of 3M data. V-frequency is slightly increasing together with the child's growth.

Only F-frequency is higher than the others in 3M (c.f. Table 2).
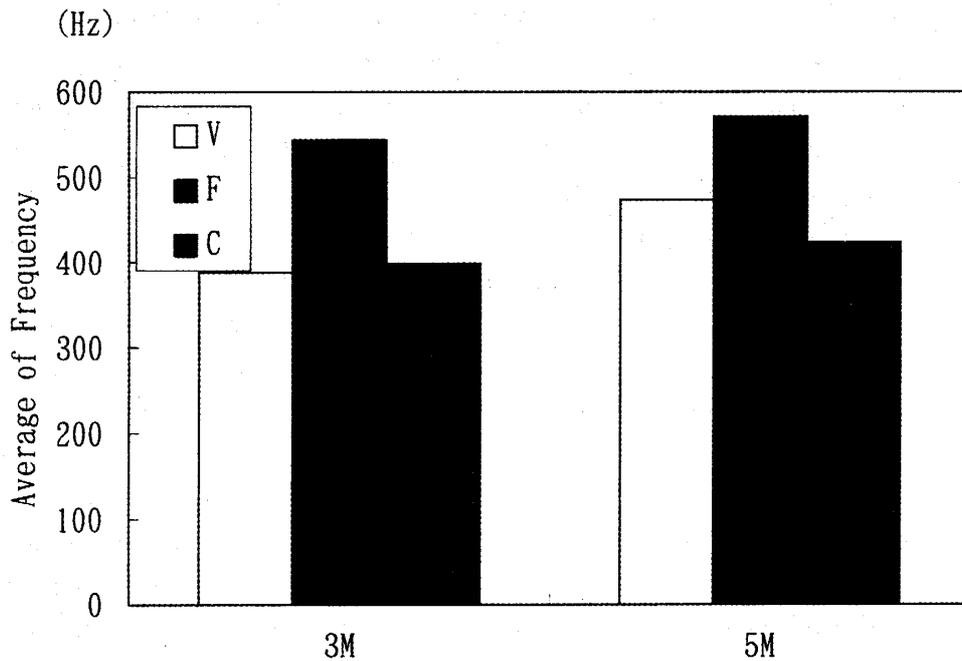

Fig. 6. The differences in frequency

DISCUSSION

Generally speaking, the results show that the subject (i. e. the mother) has rather clear criteria to distinguish at least three classes of utterances.

The most important criterion between vocalization (V) and crying (C) is the duration of an utterance. When the duration was longer she judged the utterance as a cry, while other features were mostly the same (Fig. 3). In addition, the boundary between them show a developmental change (Figs. 4, 5) which indicates at the beginning the child could not regulate the vocalization mechanisms like breathing well and became better afterward. Using these criteria we were able to divide utterances into cries and non-cries.

Another criterion which separates especially faking cry and others is the pitch of an utterance. Generally the utterances of high pitch sounds are classified as faking cry, while those of relatively low ones are as vocalizations or crying. Looking at the

detail of the data (Figs. 1, 2), the utterances which have the shortest duration (0.5 sec or so) are classified mostly as vocalizations, although their pitches are rather high. Thus it is more accurate to say that faking cry consists of high pitch and slightly longer sounds compared to vocalizations.

If we speculate the function of the faking cry as trying to catch adult's attention, it is natural for them to have high pitch sounds. It is possible that faking cry is the origin of *mand*. To assure this speculation we should see several things including mother's responses immediately after faking cries, vocalizations and cries.

In order to make an exact definition of cry and non-cry utterances, we should attend to more details of the data. One of the factors which can affect the judgment of cries and non-cries is the oscillation of the pitch pattern. From our direct observation of sound spectrograms, some of the cry utterances have peculiar oscillation of the pitch which we cannot find in the non-cries. Since this tendency is not consistent for all of the cry utterances, we neglected this factor this time. It is possible that a judgment is based on the complex combination of such kinds of factors. More detailed research is expected in the future.

In addition, the data in this paper were obtained from only one pair of mother and child. In order to generalize the results, we should observe at least two or three pairs. If we will see considerable number of pairs, we could hypothesize the factors which affect children's utterances, i. e. in what way they come to utter faking cries, or how the vocalizations come to be longer, etc. We hope further studies will appear soon.

SUMMARY

Recent studies in developmental psychology often implicitly presuppose that utterances can be divided into cry and non-cry utterances (e. g. Masataka, 1992). Our last study (Hayashibe, et al., 1996) hypothesizes that cry and non-cry utterances are the origins of the various functions of language like *mand* and *tact* (Skinner, 1957). Obviously we should have criteria to divide child's utterances into some classes including cries and non-cries. Thus we carried out an experiment in which a mother listened to her child's utterances and classified them into certain categories. The results indicate that the mother has a clear criterion to divide the utterances into three categories, i. e. vocalization, cry and faking cry, and that the duration and the pitch of utterances affect the mother's judgment.

REFERENCES

Bullowa, M., Jones, L. G., and Bever, T. G.   1964

    The development from vocal to verbal behavior in chidren. In U. Bellugi and R. W. Brown (eds.) *The Acquisition of Language. Monographs of the Society for Research in Child Development,* 29, 101-107.

Hayashibe, H., Fujikane, M., and Teramoto, T.   1996

    Salute: A brand-new class of verbal opetrants. *Annual Report of the Research and Clinical Center for Handicapped Children,* 9, 1-7.

Irwin, O. C.   1941

    The profile as a visual device for indicating central tendencies in speech data. *Child Development,* 12, 111-120.

Irwin, O. C. and Chen, H. P.   1941

    A reliability study of speech sounds. *Child Development,* 12, 351-368.

Masataka, N.   1992

    Early ontogeny of vocal behavior of Japanese infants in response to maternal speech. *Child Development,* 63, 1177-1185.

Ruja, H.   1948

    The relation between neonate crying and length of labor. *Journal of Genetic Psychology,* 73, 53-55.

Skinner, B. F.   1957

    Verbal Behavior. Prentice-Hall.

Wolff, P. H.   1969

    The natural history of crying and other vocalizations in early infancy. In B. Foss (ed.) *Determinants of Infant Behavior, Vol 4.* Methuen.