

SOUND ENVIRONMENT DURING THE CHILD'S DEVELOPMENT

Annie Moch, *Campus Paris X-Nanterre, Department of Psychology, University of Paris.*

ABSTRACT

This paper explores the effect of sound in early childhood, receptive and productive beginning at in-utero; sound as communication and its transformation into human language; and consequently the acquisition of the same as a determinant in learning and development. The effects of noise as dangerous to health and distractors in learning environments are also explored. Whereas younger children are not attracted to noisy environments, teenagers seem to thrive on them. In conclusion, noise is considered a risk factor for mental and physical health and should no longer be ignored as such but not as an expression of life.

Although they are not very exposed to sound of an industrial type, children may nevertheless be disturbed by the aggression of various noises:

- at home: household appliances, phones, sounds from television or hi-fi systems that may impair their development (Wachs, 1982), disturb their sleep or alter their health (Cohen and et. al., 1986),

- at "work": in nursery schools, kindergardens, and school: acoustics sometimes are very poor and the premises may be subject to various sounds such as planes, trains, and traffic noises, all of which perturb communication and hinder the learning process.

There is knowledge date on the specific impact of noise on children, but we think that during some critical periods of not complete development, children should be much more vulnerable than adults to the impact of noise.

In addition, among all sensory input and stimulations which the young child is exposed to, sounds are believed to be the most varied and rich and richest in information.

Already in utero, the fetus receives outside sounds, dampened as if in a cotton surrounding, through the amniotic liquid in which he bathes; as shown by certain advanced techniques in acoustic message acquisition. It has thus been confirmed that the fetus is continuously stimulated by auditory information. In addition to background sounds coming mainly from the activity of the organs such as: the beat of the heart, the bellows of the lungs, the rumbling of the intestines (as Tomatis had foreseen previously in 1977 without being able at that time to prove it scientifically), sounds from the outside do reach him. It must be understood that these noises undergo a substantial attenuation which originates from the abdominal inner walls and from the interface

between the air and liquid environments.

Numerous studies have shown that outside voices, in particular, emerge rather clearly although they are, like music, much distorted by background sounds. The maternal voice comes out clearer than any of the other voices, owing to the voice vibration transmission through thorax and abdominal paths.

If the sound environment of the fetus has thus been clearly characterized, a lot remains unknown in regard to his real capacities concerning perception ability or sensory integration.

As a matter of fact, the human ear is estimated to start being functional after a 5 or 6 month gestation period; and from an anatomical point of view, it is very similar to that of the adult's. We don't know yet what the fetus really hears or analyzes (the auditive fibres' myelinisation continues much longer after birth) and what the real impact these stimulations have on the child's further growth is, as well as on the existence of a memory trace. However, we know that, in reaction to a sound of a certain intensity, the fetus systematically answers by increasing his motricity (various feet, hands, and head movements) and by an acceleration in heart speed. It seems moreover that these answers can be conditioned (Cohen, 1983).

In addition, recent experiments lead to arguing in favor of a mechanism similar to that of the impregnation phenomenon observed within some animal species. For example, some newly hatched birds leaving their nest shortly after birth, recognize the species' call, provided they had already heard it when inside the egg. In the same fashion, newborn guinea-pigs do not show any reaction when hearing other species' calls, provided they had heard this call in utero. There seems to be a memorization of sounds heard before birth, as suggested by the fact that newborn babies of less than 3 days of age are in a

privileged way, looking for the stimulations they had been exposed to during their fetal life (De Casper and Fifer, 1980). Experiments have even shown that the less than 2 hours' old newborn baby recognizes his mother's voice among five other feminine voices (Querleu, Renard, 1987). Such babies recognize and prefer nursery rhymes they have been exposed to in utero. Children probably perceive and memorize melodic sound configurations in which pitch variations, rhythmic patterns constitute the essential elements. In addition, certain familiar sounds heard before birth seem to quiet and appease them (heart beats, for example) and it has been also observed that noise exposed newborns exposed to noise during their fetal life later show a certain habituation to it, as shown in Japanese studies (Ando and Attori, 1978).

If we have so far insisted on the rather favorable effects of sounds, it must also be stressed that chronic exposure to an adverse industrial type atmosphere for pregnant women may cause damaging effects on the child's development. Severe auditory and non auditory impairing attacks have been evidenced. Experiences performed on young animals have shown that a premature exposure to intense noises brought about more important auditory impairing damages among young rather than adult animals. In the same way, it is estimated that a chronic exposure to airplane noises may lead to a disastrous effect on fetus development. Studies carried out in Japan, in the United Kingdom, in the United States on populations living in airport areas, have evidenced an abnormally high rate of malformations, and of newborns with a lower than average weight. Moreover, a higher number of stillborns is also recorded. Could noise have a teratogeneous effect under certain conditions? (Jones et al. 1978).

From the very moment of birth, the child will discover the outside world owing to progressive control of its own sound productions.

He will first establish contact with his surroundings through his cries and tears. He will then learn to play with his own voice, then refine the control of his phonatory system, then vocalize. His progressively better and more delicately controlled sound emissions will result in the mastery of first words. All the familiar sounds will be useful to

the child in his exploration-conquest of the outside world and of his own language acquisition.

It is therefore very important that his hearing be good. Since a child born with an important hearing loss handicap can become mute and if he has, at the beginning, the same auditory capacities as the other children, these may regress and never lead to a normal speech development into words much less into sentences and verbal communication may never be established.

For the child, an important auditory handicap acts as a real brake for his communication and may, in addition, bring about a series of difficulties in his family or educational environments even if his initial handicap was minimal at the onset.

To be able to learn to express himself, to have the desire to formulate a connected speech, to evolve from babbling into word structuration, the child needs a rich environment full of a variety of noises and of language sounds. Deficiencies or excesses in this field may lead to various problems and close relatives around him should keep a close watch on the quality of the sound and musical environment in which the child is growing.

Indeed, it has been observed that the very early, cultural and linguistical environment plays a great part in the range of sounds we are able to utter.

At birth, for example, the child is capable of producing extremely rich and numerous sound some authors have counted up to eighty- four different ones, (Radowska-Jalilard, 1982)- which are progressively restrained by the cultural and the linguistic contexts in which the child grows.

One has thus been able to determine the frequencies most often used in the different languages and to show that each corresponds to limited areas of auditory fields, making up what is called "the band width" or "selectivity band" of the language considered. This phenomenon could be the origin of difficulties met with later in learning a new language that is very different from the one learnt during one's childhood, because as time passes, we are unable to pronounce certain phonemes. This impact of the sound context during the child's growth on his vocal and sound

production has been scientifically observed in research on vocal production of eight to ten-month old babies (Boisson-Bardes, 1983).

It has thus been shown that adults can identify sound production of children coming from their own linguistic context in comparison to those emitted by children from other cultural environments. The proposed aim in this study was to differentiate French from Arab and Cantonese babbling. Refined acoustic analyses have demonstrated the objective presence of different contrasts in these sound productions concerning phonetic and intonation modes, rhythm intensity and frequency modes.

In addition to all of the above observations, the sound environment can damage at a very early stage both the mental and physical health of the young child.

This is why a certain number of pediatricians have expressed alarm because of the excessive noise levels present in premature baby centers and intensive care pre-natal nurseries (Bachy, 1989).

Excessive noise originates, at the same time, from the operation of the incubator itself, (motor noise, humming of the air conditioning, doors), as well as from the noise of the activities of the hospital service and also from the premature baby's cries amplified by the sides of the premature baby's incubator.

Besides these extreme cases of already weakened children on whom noisy surroundings may have very noxious effects, it is actually estimated that excessive sound levels may damage health and also lead to damaging effects on the whole organism bringing about, among others, cardiovascular, digestive and sleeping troubles. A recent study on this subject (Evans, 1988) found a significant link between exposure to relatively high level noises (airport, road or train traffic) and high blood pressure in children living around in these areas. This is, in particular, the theme of a Cohen et. al. (1980) study. We will now examine another case of health alteration in the form of sleeping problems we have previously referred to.

We know that the child's sleep needs are progressively decreasing from birth to teen-age. So during the first months, when he has not yet

acquired the nyctemeral rhythm, the child sleeps during the day as well as during the night, and this increases the risks of being subject to the damaging effects of noises accompanying human activities which are often louder during the day than during the night. His sleep is, in addition, open to being altered at any moment. Since children seem to be awakened by noise levels higher than those which wake up adults, this may bring about problems such as falling asleep and the normal process of the different stages of sleep. Noise, therefore, could reduce paradoxical sleep periods linked with the dreaming activities and also disturb the deep sleep stages.

It was also observed that an excessive exposure to noise would lead to important range variations of cardiac and vasomotor responses in a clearer and more intense way than that of the adult's (Muzet, 1989). The child, therefore, seems to be more reaction-prone to noises during the night than adults are, especially in relation to his vegetative nervous system and cardiovascular domain responses. It is therefore recommended not to expose the young child to noisy surroundings which may impair his health, such as radio or TV continuously in operation, or to bad exposure in his bedroom. The young child may become nervous, restless and subject to nightmares. While essentially repairing for adults, the sleep can be qualified as constructive for children and needs to be preserved.

As soon as school begins, and starting from nursery school, the child with a normal hearing will have a good tool for the learning process. Sounds that are recognized, identified and integrated will result in conversational language at about three years of age.

On the contrary, a pupil losing sound messages will be refrained in his learning processes and social behavior. His acquisition and mastery of oral and written language will be handicapped. It would seem therefore that these children do not discriminate acoustic cues of similar types. In the same way, experiments carried out within schools indicate that there is a higher rate of errors in understanding the teacher's speech whenever the inside acoustics are bad or when outside noise is high. When noise renders the teacher's speech inaudible, it causes secondary damaging

effects on school performances, particularly on those linked with oral communications as well as those requiring a strong effort of concentration and thinking.

In a very noisy environment, it is usually hard to understand conversations in general; speech intelligibility is more difficult for the child when he is not yet familiarized with certain words as the language is for him less redundant in certain ways than for an adult. The child has difficulty in completing those voids within the conversation which he has not been able to understand. Thus, noise levels interfering a little or not at all for adults may on the contrary have a significant impact not only on the level of speech perception but also on the acquisition process of the spoken and written language (Moch, 1985).

This is confirmed by the conclusions of numerous studies converged on exposing delays in reading ability which were displayed by children whose schools were located in the vicinity of major truck roads or railroad tracks or exposed to aircraft traffic noises (Bronzaft, 1981; Lukas, 1981).

The most currently mentioned hypothesis is that children reared in a noisy environment tend to become inattentive to acoustic cues in general. More precisely, they would no longer be able to discriminate relevant from irrelevant language cues. It would then be followed up by troubles in listening capacity. This is a severe handicap for school achievement. In addition, studies have shown that children already suffering from certain handicaps (low socioeconomic levels, various sensory handicaps) are more vulnerable than others to disruption produced by noise (Johansson, 1983).

Yet in France today, it is estimated that acoustics are of a very poor quality in eighty per cent of all of the classrooms, day nurseries, schools, covered playgrounds, gymnasiums, with large room volumes or very strong noise reverberation from the surfaces enhanced by the use of inadequate building materials such as glass or cement. In addition to a poor intelligibility of the teacher's speech, there is also an induced tiredness and the child will have acquisition difficulties producing a lack in interest, or even outright school failure (Noise in Educational Environment, 1985).

Noise at school seems therefore to have a nega-

tive influence on the attention abilities which develop during the first years of life. One witnesses as well a reduced pupil participation in different activities offered at school. Also concentration on a given task is difficult. They show a tendency to give up quickly on an assignment which they consider difficult. In a study dealing with the effects of airplane traffic noise on the listening capacities of more than one thousand pupils, more important chronic inattention moments were observed among those who were daily exposed to noise pollution. There are also reports on aggressiveness, irritability, tiredness, psychomotor manic agitation which may also impair the social climate, originate conflicts, clashes and fights. Yet little research has been carried out in these fields.

Once out of school, the child has to face street hubbub, traffic roaring and all of the disparate sounds which make up today's urban space. All of them represent various sources of aggression that may lead to stress reactions for the child as well as for adults (Moch, 1989). Yet the specific impact and seriousness of these aggressions on the young are, to date, little known or studied.

We observed as a matter of fact that young ones generally do not complain much about noise and although recent studies attempt to locate and explain the emergence of complaints towards the aggression of noise as an environment during the child's growth (Vernand, 1989), we do not yet know exactly the origin and the evolution of the notion of constraint experienced by the child to teenager to adult.

Young people, indeed, appear to look for and enjoy noisy situations. If we just observe schools and playgrounds, we are faced with an overdose of shrieks and of voice shouting matches which children utter and/or participate in with the greatest pleasure; when getting older, the young one seems to show an increasing tendency to express himself within noisy activities.

When a teenager, a young boy or girl asserts his/her personality through various manifestations which serve, according to our studies (Moch, 1985), to affirm his/her presence, to be noticed, to release an overdose of aggressiveness; he/she expresses those facts through group hullabaloo, motorbike hummings, excessive sonority sounds of music they like.

The choice of hobbies they appreciate most shows their infatuation for noise which represents a source of life, of others' presence, whereas silence returns them back to solicitude and death.

Thus, they are capable of expression when questioned about this subject.

They thus frequently gather within gangs where they laugh, make a rumpus, ride motorbikes, listen to music together. In France today, there are about twenty-five thousand amateur bands playing modern music.

Youngsters seem to seek and enjoy music environments of an excessive loudness in nightclubs or at home, because this brings them a specific enjoyment, as well as dense and strong sensations.

This musical surrounding also offers them an escape, allowing them to forget everyday problems and worries.

In different teen-age periods, each generation often has a corresponding music, a specific rhythm different from that of the previous ones. Moreover, today's audio-visual means offer inexhaustible and incomparable possibilities of playing with and causing sounds to vary indefinitely.

In addition to these loud tones, there are, in addition, low frequency vibrations which amplify sensations and which may lead to phenomena such as trances or temporary losses of outside world consciousness (some kind of drug ersatz).

These apocalyptic atmospheres and these vibrations may have harmful effects on several accounts:

- On the auditory system, if they are too loud or too long, they can damage hearing, as attested to by the temporary, yet sometimes very important, loss of audition observed on several occasions with youngsters who were just leaving nightclubs or pop music concerts, or more permanent ones such as hearing loss observed on disc-jockeys or on young amateur band musicians.

The long term risks of these repeated exposures of today's youngsters to noise is not known yet.

However, the observation of populations living in quiet surroundings leads us to believe that in our

industrialized societies witnessing a multiplied growth of noise sources (traffic and urbanization growth), there is an acceleration of the natural phenomenon of auditory loss due to old age (presbycusis). Aren't we producing generations of early-deaf people?

From a standpoint of general effect on the organism, noise is suspected as being the origin of various reactions which assimilate to stress reactions, and which may probably be more serious for youngsters than for adults, such as:

- alteration towards an acceleration of heart rhythm

- increase in blood pressure

- digestive problems

- hormonal problems

- sleep disruptions

So either at home or in nightclubs, in the street, on his motorbike with a doctored muffler, the youngster endangers his ears and those of the others, as well as his own health.

There are places where the pupils' ears may suffer a lot with their hearing due to insufficient protection. Persons in charge have not studied that problem enough: in most vocational training schools in France, in order to obtain their vocational ability diploma, youngsters spend on average of three to four years studying. Certain trades taught there are extremely noisy, and are recognized as such in the industrial world. There, these trades are subject to very strict labor code regulations, which is not the case in vocational training. Among those trades, one can mention boilermaking, various jobs in the metal industry, printing jobs, wood and wood processing jobs.

Observation and data gathered mainly by school doctors lead us to believe that weekly exposure lasting for about twenty hours with an intensity reaching sometimes 90 to 110 db., without any particular ear protection, can lead to early deafness. A recent study carried out for the Ministry of Environment by a multi-disciplinary group made up of medical doctors, psychologists and acousticians has permitted us to characterize the acoustic surroundings corresponding to the different special fields taught and to study auditory

and non auditory effects of such exposure.

We were able to demonstrate that the real noise level found did not follow always what could have been foreseen from the names of the specialities and from what was considered as noisy or non noisy types of training. It was found that it is necessary to take precise measurements in the field so as to qualify the real sound level surroundings. Noise level strongly depended not only on the type of learning but also on the specific local characteristics (design, materials, motors).

Although we did not find in this study signs showing an auditory impairment, at variance with other research carried out in vocational training schools (as DUCLOS did in 1983), we were able, however, to show that the teen-age pupils were very much aware of communication difficulties met within workshops: they had to get closer to each other in order to speak to one another or to the teacher, or to hear what was said. The teacher would sometimes need to stop the motors (Ministry of Environment report, 1989). Indeed, we have compared the answers from pupils exposed and no exposed to noise using a closed standardized inquiry which was filled out by all of the pupils. In answer to the question "Do you have to get closer to others?", there are significantly different answers between those who have been noise exposed and those who have not. In the same way, in answer to the question "Do you hear the teacher?, or "Should the teacher speak louder?, the results always go towards representing greater comprehension difficulties for those children who have been noise exposed and those who have not. These conclusions apply in general to the youngsters ending their first year as well as to those completing their second year.

In conclusion, noise appears to be a risk factor for the mental and physical health of children and teenagers whose vulnerability to this type of pollution has remained generally ignored. It is therefore necessary to protect them against it. However, one must not forget that the young are often at the onset of noisy manifestations and by that they remind us that a certain amount of noise is necessary to express life.

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THE INFLUENCE OF THE ENVIRONMENT ON TEACHING: CLASSROOM DISTRIBUTION AND TEACHING PSYCHO-MOTOR SKILLS

Luisa Mir, María Fortuny, Antonieta Tiera, Rosa Rodríguez and María Rosello, University of Science Education, National School for Teachers, EGB

ABSTRACT

The teacher takes part in the psychomotor training transforming the children's environment (school equipment and spaces) and developing the children's behavior in this environment. This paper describes and justifies the distribution of space and teaching materials in the classroom of psychomotricity.

THE ENVIRONMENT AS A PSYCHO-PEDAGOGICAL SUPPORT IN CHILDREN'S EDUCATION

Antonieta Rieta, Rosa Rodríguez, María Rosello and Luisa Mir, University of Science Education, National School for Teachers, EGB

ABSTRACT

This paper wants to set out the criteria and necessary conditions of physical and environmental aspects that the centers for the education of children aged 0 to 6 years old should have. For that we: a) Review studies and research done in the infant field of ecological psychology and environment pedagogy. b) Get to know the educational context in our country and abroad. c) Understand the physical environment in this stage as determinant and a conditionant factor for the attitudes, perceptions, behaviours, objectives and educational project. We are defining the criteria for an environment in children's education according to the needs of the evolutionary moment: physical needs and sensory motives; affective needs; autonomy needs; cognitive needs; interaction and socializing needs.