

Prosody with babies at risk for autism: treatment and research

Marine, when she relapsed at 15 months

Marine had no eye contact with her mother. Even the psychologist from Mother and Child Protective Services has trouble catching her eye. At our first meeting, when she was 3 months old, Marine was in a baby carrier on her mother's belly, her body arched backwards, in opisthotonos; her gaze seemed to be trying to latch onto the ceiling. Her mother began by complaining that she was never able to catch the baby's eye, and described Marine's intense abdominal pains, how Marine would cry for a long time, with her mother distressed by her daughter's shrieking and unable to calm her down. We began a baby-mother treatment which proved successful: six months later Marine looked towards her mother every time she wanted to undertake some action, even when she wanted to enter into contact with me. It seems to me that the bond between the two had been established.¹

After the summer vacation, I found an adorable little girl of 13 months who was walking and who addressed her mother, the receptionist and myself in an invigorating-sounding dialogue. She seemed utterly happy. Since the daughter seemed to be doing so well, the mother asked if she could continue coming to talk about herself, and I agreed. She used her individual sessions to work on her relationships with her own body and with her husband. But at the end of the first session she remarked that Marine was somewhat withdrawn. At the next session she made this comment more insistently. One month later, she suddenly revealed that she and her husband were worried about Marine, who had become completely withdrawn and was wandering around incessantly. She asked me to see Marine again.

When I received her, I was confronted with a little girl drifting everywhere, who didn't make eye contact for the first thirty minutes, even if she followed what I was doing. The next session was hardly any easier. Though Marine didn't look like a 15 month-old baby who was on her way to becoming autistic and who had never been treated, as her refusal to communicate did not prevent her from following intellectually what was happening, I had to acknowledge that she had had a serious relapse.

After the All's Saints Holiday, the father accompanies the mother to her individual session.² He has never come before this, despite my invitations. He says he's very worried about his daughter who spent the weekend alone in a corner, stacking video cassette boxes. He asks me if I've ever thought that his daughter might be autistic. I reply that this illness is only diagnosed as such at three years of age and that we are doing what is necessary to prevent such a diagnosis from ever being made. This is an answer which, while not negating his intuition, leaves the door wide open for hope, especially insofar as our work with Marine between 3 and 12 months had initially allowed us to suppose that Marine had completely recovered. With children over the age of two, when the autistic tableau is fully set, I don't hesitate to confirm the diagnosis. Let us note in passing how parents are not taken in by their children's problems, once they dare to talk about them.

During the two years that followed Marine's relapse, we filmed practically all her sessions.³ Here are some excerpts from the third session, which took place a few hours after that first interview with the two parents.

¹ Laznik, M. C. "Marine, trois ans et demi, présentant un risque d'autisme", in *Aspects cliniques et pratiques de la prévention de l'autisme*. Col. Cahiers de PréAut, sous la direction de Graciela C. Crespin, Paris, L'Harmattan, 2004.

² At her request, we continued the mother's individual session, finding her a different appointment time.

³ This idea originated with Charles Melman and proved to be very useful for the work of deciphering the situation through micro-analysis. The first filmmaker was Mme. Anouk de Bordas, a colleague who began her studies in psychology after a long analysis. I believe it is indispensable for the "filmmaker" or "scribe" of a session with an autistic child to have a background in psychoanalysis. In terms of the transference, it would be

Upon arriving the mother says in a tone of forced cheerfulness, *"On the way here we looked a lot at the ceiling of the metro, of the elevator."* I answer in the same tone, *"A way of proving to Mom that she's right to take the trouble to bring her to see Mme. Laznik."* This cheerfulness is a way of facing up to the total absence of contact with Marine. The latter, is seated at a little play-table, tirelessly putting big felt-tipped pens into pot in front of her, then removing them again. Marine, who has a slight fever, refused her snack at the daycare center. The mother sets out to give her a yogurt; this will be the only time that she feeds her daughter during the session. Marine allows her pacifier to be removed without once taking her eyes off the pens, not even for an instant; stills gazing at them, she opens her mouth for the spoonful of yogurt, as her mother complains that she can't catch Marine's eye. *"I try sometimes, but I can't manage it. She turns away."* When I speak to Marine, she doesn't respond to me either. It is as if my voice were just a noise like any other. The successive spoonfuls go into Marine's mouth; she lets herself be fed without taking her attention or her gaze away from the felt-tipped pens. A pencil falls off the table. Marine whimpers as she tries to reach it. I hand it back to her saying, *"Here, Marine."* She takes without even glancing at me. I comment for her, *"No, I don't look at Mme. Laznik."* The mother, with whom we did much work during the first year of Marine's life, answers for Marine, *"I've found my little chair, I'm all settled in. And that's that."* This kind of speech turn, which had amused her so much as a baby,⁴ now falls flat. The mother, continuing to feed Marine, misses, and the yogurt winds up on Marine's face. Marine does not react in any way.

It has been ten minutes since the session began and it seems to be turning out like the two preceding ones, without any bond between Marine and us. I tell myself that it can't go on like this, the child is in danger. This withdrawal, which has been going on for almost two months, can only be harmful to her psychological apparatus.

Prof. René Diatkine and Dr. Jean Bergès⁵ both used to say that there must be a "psychosomatic" of autism, that the non-use of the organ must injure the organ.

Dialogue with Monica Zilbovicius

Two months after this session, at the Congress on Autism in Bonneval, Belgium, I was to hear Monica Zilbovicius presenting research that, in my opinion, offers concrete support for this hypothesis. She and her colleagues compared twenty-one primary autistic children with a control group of twelve children.⁶ They note a significant reduction, in the autistic children, of the concentration of gray matter in the Superior Temporal Sulcus (STS), which is responsible for listening to voices. These results seem compatible with the hypothesis of a hypo-perfusion of these different zones in autistic children.⁷

This led to a discussion of the innate or acquired character of such a difference, and Monica Zilbovicius admitted that no one could be sure that this difference was not acquired.

difficult for me to feel that someone was judging what I was trying to establish in order to make contact with the child. The year afterwards, the filmmaker was Mme. Catherine Thomas, who has the same sort of background. Both of them were essential to the work, and I thank them very much.

⁴ For a description of Marine's during the first year of her life, see Les cahiers de Préaut n°1, op. cit.

⁵ Both had been students of Prof. J. Ajouraguerra.

⁶ N. Boddaert, N. Chabane, H. Hervais, C. D. Good, M. Bourgeois, M.-H. Plumet, C. Barthelemy, M.-C. Mouren, E. Artiges, Y. Samson, F. Brunellee, R. S. J. Frackviak and M. Zilbovicius: "Superior Temporal Sulcus anatomical abnormalities in childhood autism: a voxel-based morphometry MRI study" in *Neuroimage*, n°23, pp 364-369, 2004.

⁷ A more detailed report of Zilbovicius' research, made by Prof. Golse, may be found in the appendix at the end of this article.

Last year, the mainstream press got hold of another one of her studies, this time on adult autistic subjects.⁸ This study, carried out with the functional MRI, showed that in normal adults, the Superior Temporal Sulcus (STS) is the zone specifically devoted to the treatment of vocal signals, while the Fusiform Face Area (FFA) is devoted to the recognition of faces: the recognition of the human voice and the recognition of faces constitute, as Golse reminds us, two main axes of social interaction.

This study compared five autistic male adults with a control group of eight adult males. The results showed that in autistic subjects there was practically no activation of STS; that cortical activation in these subjects was the same for voices and for noises, the latter being treated as in normal subjects.

I cannot help but agree that this research is interesting, though I nevertheless find it remarkable that it is seldom pointed out that this a study involving adults. This way of presenting things enables the mainstream media to report that the cause of autism has been found when – as the research now stands – there is no way to tell if we are dealing with a consequence or a cause.

This is fascinating research, if we leave aside its aspect of unproven etiological explanation. What is certain is that at four years of age, and perhaps earlier, the non-use of this organ will leave the Superior Temporal Sulcus out of play, perhaps permanently.

Let us hear what Monica Zilbovicius herself has to say on this subject⁹: *"We have shown that, in autistic subjects, the perception of the human voice does not lead to the activation of a very specific area of the brain that deals with the human voice ... They treat the human voice like any other sound, that of a car or a bell, for example. All of this happens in the course of development. The human being is born with a particular attraction to human stimuli, and so we specialize, we become experts in the human voice and face. There is probably something innate in autists: they are not born with this attraction. So they do not become experts and their brain does not develop in the same way."*

These hypotheses corroborate other studies on imagery by MRI dealing with the perception of the face; these suggest that this kind of perception is not associated with an activation of regions involved in attributing emotional value to a stimulus. The hypothesis would be that the absence of emotional activation in the course of development would lead to a lack of expertise in dealing with faces and, as a consequence, a lack of development of the Gyrus fusiform, which is responsible to the recognition of faces. This model, known as Schultz's model,¹⁰ when coupled with Zilbovicius' proposals, provides a scientific basis for the hypothesis of Bergès and Diatkine concerning the irrefutable effects of the psyche on the soma in the case of autism.

This leads Zilbovicius to recommend early intervention with children – starting at four years of age¹¹ – to make them want to listen to voices and – other studies lead us to add – to look at faces. Up to this point I can only concur with her, and tell her that psychoanalytical practice is able to instill this desire. This is what I will try to show in this article.

On the other hand, I am worried when she talks about "multimedia methods." We have known for some time that certain autists are fascinated by audio and video cassettes. This still

⁸ H. Gervais, P. Belin, N. Boddaert, M. Leboyer, A. Coez, I. Sfaello, C. Barthelemy, F. Brunelle, Y. Samson, M. Zilbovicius: "Abnormal cortical voice processing in autism" in *Nature Neuroscience*, n°7, 8, pp 801-802, 2004.

⁹ Excerpted from *l'Express en ligne* of Dec. 20, 2004: Les chercheurs de l'année 2004, "Les autistes ne reconnaissent pas la voix humaine," an interview conducted by F. Maxime and E. Lecluyse.

¹⁰ Shultz, R. T.; Grelotti, D. J.; Klin, A.; Kleinman, J.; Van de Gaag, C.; Marois, R. & Skudlarski, P. (2003) The role of the fusiform face area in social cognition: implications for the pathobiology of autism." *Philosophical Transactions of the Royal Society of London, Series B: Biological Sciences*, 356 (1430), 415-427. Cited by Mottron, L.: *L'autisme: une autre intelligence*, Mardaga, Belgium, 2004, p.97.

¹¹ The same age is given in another research paper Zilbovicius presented in Belgium. Personally, I think that one must intervene at a much earlier age.

doesn't lead them to become interested in flesh and blood human beings, and thus does not seem to correspond to her aims. Having suggested the use of re-educative methods combined with anti-depressants, she adds: "*This is not the fault of the parents, it's the fault of... unluckiness. The parents are very important actors in the re-education of these children and in their integration into society.*" Indeed, I too think that the parents should be partners in the child's psychotherapeutic treatment.

It seems to me that we can also agree about this etiology of ...*unluckiness* – where no explanation, whether genetic or biological, is offered. Long ago, my viewing of home movies showing children who later became autistic taught me that, from the very beginning, starting at birth, they do not go towards the Other. This does not rule out the possibility that complex factors, still unknown to us, could have played some part during pregnancy. Geneviève Haag speaks of a pre-natal root for sound problems, a very important one in her view.¹²

My experience with Marine and her relapse have taught me that there must be an additional factor in play, beyond the one demonstrated by Zilbovicius. Even after having discovered her attraction for the human voice and face when she was a baby, Marine was capable of withdrawing again. I have often asked myself about the causes of this relapse. There was of course the fact that I had accepted to stop seeing her, agreeing to the mother's request all the more willingly in that the fifty-day interruption occasioned by summer vacation did not seem to have affected Marine. Later I will learn that Marine went back to the daycare center only after my return, and that it was particularly difficult for her, since the two childcare workers she'd become accustomed to were no longer there. I will also learn that the mother's return to work had been marked by the replacement of her immediate supervisor and by her feeling of having been left out. In November, the mother was depressed and it is difficult to determine who dragged whom into the downward spiral. In any case, I should emphasize that in this child there is a factor of greater sensitivity towards changes in her environment than in other children. When faced with such fragility in a child, we could even ask whether it is really opportune to accept to see the mother in psychoanalytic psychotherapy. We know that at the beginning of this kind of personal process, the subject is often lost in his or her thoughts. Could this have been interpreted by the child as a loss of the bond with her mother?

What I can affirm, in any case, is that faced with this set of difficulties, Marine, like a little submarine, had battened down her hatches and dived under. In this session, all her attention, visual and auditory, was concentrated on the big felt pens that she kept putting in and taking out of the pot; she was visibly attentive to the little noise they made and to their colors. Might we think of the will of a proto-subject not to hear the human voice? Could there be a factor of hypersensitivity¹³ in these babies leading them to avoid the human voice as soon as it shows the least sign of depression? As though it could not help but provoke an intolerable depressive-type response in the baby? Monica Zilbovicius' idea of using anti-depressants on these children implies that she hypothesizes metabolic processes of this kind. Although I have great reservations about using this type of substance with children, I must admit that when Marine's mother was on anti-depressants, their interpersonal relationship improved. But this could only happen fifteen months later, when Marine had for the most part recovered. At first there was no question of speaking to the mother, whom I was seeing every

¹² Haag G. "Réflexions de psychothérapeutes de formation psychanalytique s'occupant de sujet avec autisme", not yet published.

¹³ Frances Tustin had evoked something analogous concerning these children – future autists – very vulnerable children who ought to have been kept in greenhouse. But I do not agree with her when she imagines that there is a preliminary period during which mother and child are supposed to have experienced an abnormally close bond whose rupture would have been traumatic for both. This is absolutely not what we can gather from home movies or from my analytical experience with babies and their mothers. See: Tustin F.: *Conversation psychanalytique*, Association Audit Anduze, 1994.

week, about treatment for her depression, for to do so would have seemed equivalent to making her take undue responsibility in this situation, especially when Marine's state of withdrawal would have made any parent depressed. Later, when her daughter started to have a real relationship with her, she was able to talk to me about her depressive core, which was present long before the birth of her daughter. But is above all her desire that her daughter's entry into school will go as smoothly as possible that will make her decide to start taking "a little something" before the summer vacation. I am not saying that the mother's somewhat depressive structure could be the cause of her daughter's pathology – if that were the case a large part of humankind would be autistic. It seems rather that this element brought out something analogous in the child and that was intolerable for her. Isn't this where Zilbovicius dreams of intervening?

Return to the clinical material

While opening her mouth for the spoonfuls of yogurt, Marine attentively watches the camera in front of her.

The mother, speaking for the child, says: "*On the other hand, I find this camera stuff intriguing.*"¹⁴

Despite the harmonious, empathetic side of our session, Marine remains stonily unresponsive, as if our voices were just background noise. She doesn't pay any more attention to them than to the noise of cars coming from the street. It is obvious that clinical work with such children confirms Zilbovicius' discoveries: our voices are in fact treated like external noises.

Marine was not going to become an "expert in human voices and faces" this way, to use Zilbovicius' expression, and her brain was "at risk of not developing in the usual way." The first results in cerebral imaging have highlighted the difficulty of coupling a voice and a visual image in autism. Laurent Mottron¹⁵ has done a survey of studies on troubles of intermodal perception.

It is therefore more urgent than ever to try to give back to little Marines under the age of two the desire to hear the human voice and to look at the faces of those who are close to them. And this is just what happened in the second part of this session, which was a genuine psychical resuscitation.

I pretend to eat the next spoonful of yogurt.

MCL: "*Now Mme Laznik is going to eat some. Mmm! Mmm! Mmm! Vanilla is good!*" This fragment, showing my surprise and pleasure at the odor of vanilla, provokes – starting with the first "*Mmm!*" – a smiling gaze from Marine, as though she were sharing my pleasure. But this vanishes at the end of the sentence.

The mother tries to catch her daughter's gaze too. To do this, she also pretends to eat yogurt, saying:

Mother: "*May I have a little? I'm allowed to have a little of this yogurt? I wonder if there's a little strawberry in it ...*" she adds, pretending to taste.

Marine shows no sign of having perceived her mother's play. Trying not to lose her composure, the mother gives her another spoonful of yogurt. Marine is perfectly able to

¹⁴ In all film showing babies who later became autistic, we notice this interest in the camera. In the past, when the camera had to be placed in front of a human face, it was possible to have some doubt as to which object was being invested by the baby's gaze. But now that cameras are used from farther away, it is clearly the machine, not the face of the cameraman, that is being watched.

¹⁵ Mottron L. *L'autisme: une autre intelligence*, Op.cit, p. 97. He cites the work of Boucher J., Lewis, V., and Collins, G. (1998). "Familiar face and voice matching and recognition in children with autism." *Journal of Child Psychology and Psychiatry*, 39(2), 171-181.

anticipate the arrival of the spoon by opening her mouth, but nothing in her is suggestive of shared pleasure.

I decide to pretend to eat again.

MCL: "*Mme Laznik's turn! I want some too! Mmm! That's good.*" At my first "*Mmm!*" of surprise and pleasure, Marine looks me in the eye again, with a big smile, as though sharing my pleasure. But this doesn't last more than two seconds.

My transference tells me that this latest success has caused the mother distress: I can do what she can't. I decide to turn the game around. Taking the yogurt and the spoon, I say:

MCL: "*Now Mme. Laznik is going to give some to Mommy.*"

Mother: "*Ah! We've changed distributors!*" exclaims the mother. Thanks to our old bond, this unusual situation – involving a forty year-old woman, who probably hasn't been spoon-fed for decades – elicits an exclamation of surprise and amusement from the mother. Marine looks at both of us, laughing and rhythmically bringing her arms together, as though she would clap her hands. I comment:

MCL: "*I only get that when we're clowning around.*"

This child can clearly distinguish between the register of alimentary need and that of oral drive, necessarily interwoven with the scopic and invocatory drives, casting doubt on Freud's theory that the bond with the Other comes to rely on the satisfaction of alimentary need.¹⁶ It is not yogurt that will feed her desire to be seen and listened to; it is a particular prosody in our voices, marked by alternating peaks of surprise and pleasure. These peaks are characteristic of what has long been called *motherese* and which, more recently, has been called *parent-ese*, since fathers are as gifted for producing it as mothers. We have known for a long time (A. Fernald 1979) that the prosody emerging from it can be found in speech between adults only in exceptional situations where surprise and pleasure merge. Recently (N. Reissland 2002) it has been proven that surprise produces in the voice of the baby's parent a heightened peak of energy, while pleasure produces a very low peak. I have observed that when these two peaks are produced in succession, it gives the aspect of choppy hills proper to the prosody of *parent-ese*. But before treating the analysis of our voices, let us return to the end of the session.

I give the yogurt back to the mother, who says:

Mother: "*A little more?*" Trying to catch her daughter's eye, she pulls the spoon away when the mouth opens, asking: "*Where's the mouth?*" Marine, unmovable, continues to manipulate the big felt pens, opening her mouth when the spoon approaches. When she has swallowed her spoonful, I ask:

MCL: "*Was it good? It was good?*" She is like a stone. The contact has been broken.

MCL: "*What about me? What about me? What about me?*" I get a brief glance from her. But the next time I try, the trick doesn't work any more.

I am worried, fearing that she will withdraw for a long time. Knowing what I do about the "siren voice" that a prosody expressing "bewilderment and enlightenment" can have, even on babies who later became autistic, I try to create within myself an internal image that could put me into this kind of state. I take the pot of yogurt and smell its odor; I am invaded by vanilla. Then I imagine a beautiful park with a big vanilla plant. The park has a tropical atmosphere, like a poster for Club Med. Even if I've never been on any of their trips, I could not help feeling the impact of their advertising, those big billboards that are designed to provoke dreams of unknown elsewhere. My imaginary vanilla plant looks like a big bush with shiny leaves, covered with beautiful white flowers. When I think of it now, I realize that it resembles a huge gardenia. The whiteness of the flowers was probably inspired by the color of the yogurt. I've never seen a vanilla plant and I don't know what one looks like. No

¹⁶ See Laznik M. C. : "La voix comme premier objet de la pulsion orale" in *La revue Psychanalyse et Enfance du Centre Alfred Binet*, Paris 2000.

matter, in infinitely less time than it takes to describe it, I am propelled into a magic world of surprise and pleasure. I hear myself say to Marine as I hold a spoonful of yogurt up to her nose for her to smell:

MCL “*Look at the smell!*” There is plenty of enthusiasm in what I say and the prosodic peaks of my voice must convey it, for the little girl looks at me with a smile. As for the apparent absurdity of my utterance, it is surely due to a condensation of my desire to make her smell both the joy of the scent and the beauty of the flowers. I would even offer the hypothesis that the drive, when it takes the Other into its mouth, produces co-modality.

Twenty minutes later, Marine herself, using her tea set, will offer me a dish and a spoon, pretending to feed me in turn. But before analyzing the value of this scene, it is worthwhile to point out that it took place just after another one: Marine wants to push a little chair around the room. At this time, she used to move the furniture all around, to the despair of her parents who rightly saw it as withdrawing action on her part. This also happened during the preceding sessions, but now, instead of throwing the doll that was on the chair to the floor, Marine places it on my lap. I decide to sing it a lullaby, “Cuddle, cuddly, cudd-a-ly, cudd-a-ly, cuddle, cuddly, cuddly for dolly.” The rhythm is slow, but marked by repetitions, and the vowels are especially accentuated and lengthened. Marine doesn’t take her eyes off me during the song, but stops paying attention the minute the singing is over. However, she herself will pick up the chant a few sessions later, while rocking the tiny, two centimeters-long baby in its tiny cradle. There is certainly much to reflect upon regarding the power of such rhythms in the treatment of this kind of child.

But let us return to the session where she feeds me. I am filled with great hope at that moment: she has just succeeded in spontaneously answering one of the key questions of the C.H.A.T.¹⁷, a question normally given to children older than she is. Her *capacity for pretending* is established! My inner joy at such success on a cognitive test rests on the fact that I have long believed that the question “Is the child, using a toy tea set, able to offer a cup coffee or tea to his or her mother?” goes well beyond the *capacity for pretending*. Its bedrock is none other than the completion of the third phase of the drive circuit. When a child plays at offering something good to the mother, he is outside the register of the satisfaction of need. In addition, this particular object is good for the mother but not for the child, who is at an age where one likes neither coffee nor tea. The bedrock of the child’s capacity to provide a positive response to this question from the C.H.A.T. thus depends of the child’s capacity for wishing to make him or herself the bearer of the object that answers the mother’s oral drive. While the infant offers its little foot or hand to its mother, so that she can enjoy pretending to eat them, the older child offers, to the drive enjoyment of the Other, not a piece of its own body, but rather a sublimated object. When Marine spoon-feeds me, I pretend to eat a delicious imaginary object. Marine follows attentively the signs of pleasures on my face and in my voice.

Her father comes with her to the next session. She plays restaurant again, feeding us by turns, delighted to be giving us so much pleasure.

Marine confirms my current hypothesis about the establishment of the psychical apparatus: her pleasure in functioning is a tributary of the pleasure she causes in the Other. This formulation is not without analogy to that which prevails for bigger people, and which we owe to Lacan: the desire of the subject is the desire of the Other.

But in Marine’s case these happy moments are still just little islands emerging from a sea of indifference. Even the session of which I’ve just recounted several excerpts, is spotted with this indifference, which prompted Pr Pierre Ferrari to say, as he watched a video of it:

¹⁷ This is a cognitive questionnaire designed by Baron Cohen; it allows us to pinpoint, as early as 18 months of age, children who will be autistic at three years. In our research at PréAut, on the early sign of autism, we use slightly modified French variant of the C.H.A.T.

"Do you think we can come through for her?" This question, asked with tenderness, gives a glimpse of his legitimate worry. At the time I don't know how to answer it either; I only know that at fifteen months she is much more difficult to mobilize than at three months. Only a year later will I be able to say that she seems to have recovered. It is not possible to remind pediatrician too much of how important it is to send these children to us in the first months of their lives!

The entire work of the psychological reanimation carried out in the session rests on interdisciplinary work that I have undertaken elsewhere.

Research: Prosody in the interactions between babies who became autistic and their parents

This research is derived from our studies on the early signs of autism.¹⁸ It is multidisciplinary, multi-focus research conducted along with Prof. Filippo Muratori and Dr. Sandra Maestro,¹⁹ who study the early signs of autism using home movies, and with Erika Parlato, a psycholinguist.²⁰ As Trevarthen and Fernald have proven, the baby shows from birth an interest for certain elements of his mother's voice. I have linked this research with the hypotheses about the "invocatory drive" advanced by Jacques Lacan. Let us not forget that Lacan added the gaze and the voice to the list of drive objects described by Freud: breast, penis, feces. My interest in this subject came to me when I noticed some strange phenomena in home movies showing babies who later became autistic. Babies who, during the daily activities of changing, bathing and feeding, do not look at the parent who is taking care of them, were suddenly able not only to look, but to answer, entering into a veritable "proto-conversation."

One striking example is found in the film of little Marco. This baby, then aged two and a half months, who can remain perfectly indifferent to the human world around him, suddenly shows himself capable of looking at his mother and answering her by gurgling when she hums him a song. Their sustained interaction goes on for nearly three minutes. When this fragment of the movie was shown by Maestro and Muratori without any explanation of the context, it provoked lively reactions from colleagues all over the world; how can one accept the very idea of such a baby becoming autistic? Does it mean that it is impossible to make a prediction at this age? But in practically all the rest of this home movie, the baby's state of withdrawal is easily detectable. How do we account for such disparity in this baby's relational modes? This is one aporia that got me working. Without ignoring the triggering factor of the mother's song, a study of the prosody of the two parents, both present in this scene, shows that the father's voice presents the prosodic characteristics of the *motherese* described by psycholinguists. Even if this paternal voice cannot be heard well on the movie's soundtrack, it was able to sustain the pursuit of the visual and vocal bond between mother and child. So we decided to compare the voice of Marco's mother, when she is speaking to her child, with the voice of a mother speaking to her normal baby in a comparable enough situation, when the baby's diaper was being changed.

Fig. 1a and 1b show the spectrogram of the two voices. In spectral analyses, the horizontal axis represents time and the vertical axis represents frequency. The degree of darkness of the streaks indicates the level of energy.

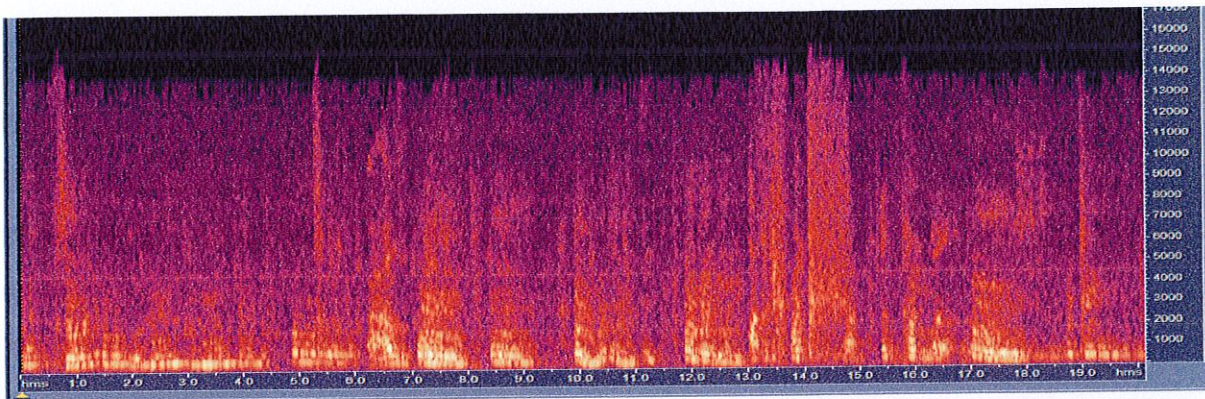
Fig. 1: spectral analysis of the voice of the mother of a normal child (1a)

¹⁸ Under the aegis of the Association Préaut.

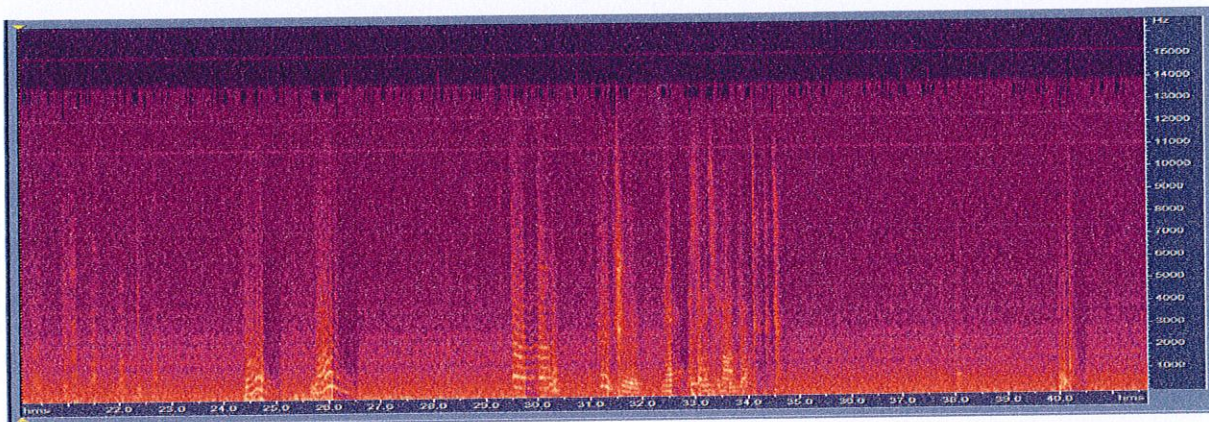
¹⁹ Fondation Stella Maris, Faculté de Médecine de Pise.

²⁰ Brazil. This work produced an earlier joint publication.

compared with the voice of the mother of an autistic child (1b)



Fabien's mother (Fig. 1a)



Marco's mother (Fig. 1b)

The voice of Marco's mother does not present the characteristics of motherese. The comparison of the two spectrograms is striking, even for those who are not specialists in acoustic analysis: Marco's mother has a very monotone voice, while Fabien's mother's voice has more intonation. Nevertheless, we can derive no etiological hypothesis from this remarkable difference, for two reasons. First, at the time of the earliest research into the prosody of motherese, A. Fernald (1982)²¹ showed out that a mother is incapable of producing this kind of prosody when her baby is not with her. Even if she knows that her baby is going to hear the recording afterwards and she tries her best, her prosody is not the same in front of the baby and in front of a microphone. We can therefore think that a baby who does not react much will eventually foster the "in-front-of-a-microphone" prosody in his mother. So there is no possibility of fabricating fake motherese. Secondly, recent work by Burnham²² at the University of Sydney, on the prosody of motherese with normal babies, show that the baby's reactions amplify the contours of prosody curves in the mother's voice. For many parents, then, this prosody is the result and the reflection of their relation to the baby.

²¹ FERNALD, A. & SIMON, T. 1980. "Expanded Intonation Contours in Mother's Speech to Newborns", *Development Psychology*, 20/1, p. 104-113.

²² BURNHAM, D.; KITAMURA, C. & VOLLMER-CONNA, U. 2002. "What's new, Pussycat? On talking to babies and animals", *Science*. 296, p. 1435.

Fabien (whose development we know to have been normal) and his mother present in this scene a fine example of what psycholinguists call “speech turns.” The mother speaks for the baby, in the first person, then answers him as though he were the one who had spoken. In this dialogue, the baby actively supports her with his gaze and his voice.

“I’m feeling better, my Mommy! I’m feeling better!”

(The baby, looking at his mother: “Wah.”)

“Yes, of course, yes, of course, it’s better!”

(The baby, still looking at his mother: “Aah.”)

The mother picks up the baby’s “aah”, adding: “Ah, yes! Ah, yes! Are you gargling?”

(The baby, looking at her: “Gah goo ghee.”)

“Ah, yes, I’m gargling, I’m making noises with my throat, I’m making noises ... You make noises with your throat!”

(The baby, smiling at her: “Ga goo.”)

The prosody of mother’s voice communicates the surprise and joy this situation makes her feel. The mother is speaking “motherese.” According to Dupoux and Mehler²³ (1990), motherese is the dialect of all the mothers in the world when they talk to their babies: the voice is a tone higher and the intonation is exaggerated.

Here is the image of the spectral analysis of little fragment of the mother’s speech, the “Ah, yes! Ah, yes!” that she says to her son. (Fig. 2)

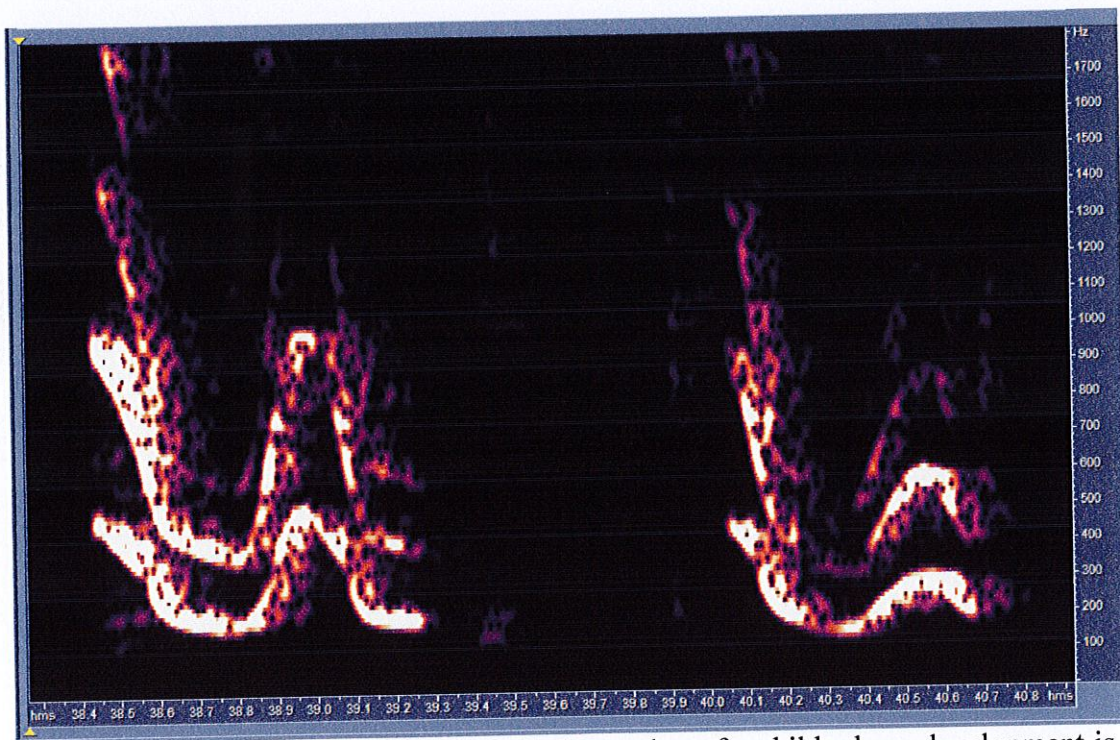


Fig. 2. Prosody of “motherese” in the mother of a child whose development is typical.

This image shows very well how motherese is manifested by modifications of the voice and the prosody, by melodic forms that are soft, long, sweeping. The effect of the prosody’s rhythm is amplified over several repetitions. We also see clear breaks between two sound fragments. These breaks are an essential part of motherese.

Even though baby Fabien was obviously collaborating here, I asked myself the following question: what would happen if, in spite of everything, an adult managed to

²³ DUPOUX, E; MEHLER, J. 1990. *Naître humain*. Paris, Odile Jacob.

produce motherese prosody when faced with a baby who would later become autistic? Would the baby respond?

Pedro is another baby from the sample of Pisan home movies. He enables us to put this question to the test, and to discover that its answer is affirmative. Pedro is a baby who never looks at his mother or responds to any of her appeals. He sometimes responds to his father when the latter deploys a lot of energy, even resorting to strong-arm tactics to get his attention. A friend of the mother, who came to spend a vacation on their farm, couldn't enter into contact with him a single time.

We have analyzed the mother's voice during a poignant scene where she calls out to him with increasing desperation in the face of his indifference.

"Pedro? Pedro? Pedro?" She approaches, as the baby looks ostentatiously the other way. The tone of the mother's voice becomes ever more pleading: "Look at me! Look at me! Look at me!" She presses her face to the baby's belly and cries out her distress, "My baby! My baby! My baby!" Here is the result of the spectral analysis of this last fragment of maternal speech. (Fig. 3).

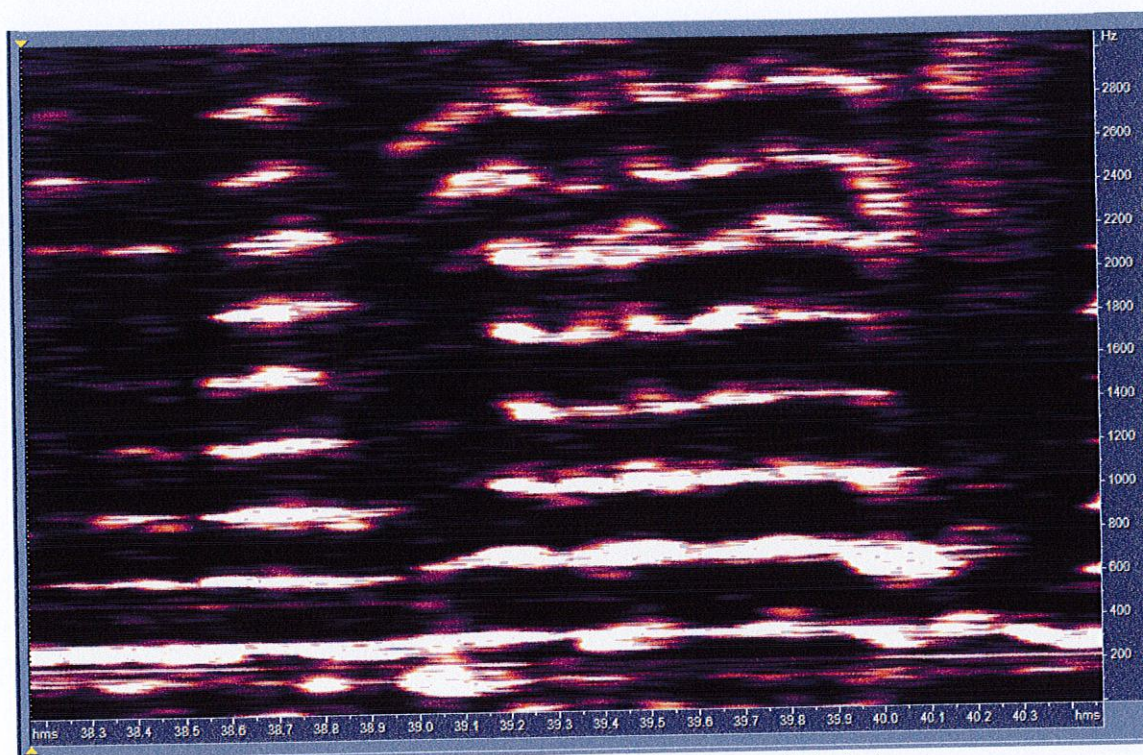


Fig. 3. Prosody of the mother of Pedro, an autistic baby

Despite the force of the mother's despair as she cries out to the baby – which led the father to intervene, by coming to take the baby in his arms and thus putting an end to the scene – we see that there is no prosodic peak. Her voice remains flat. We may also note the absence of breaks between the sound segments.

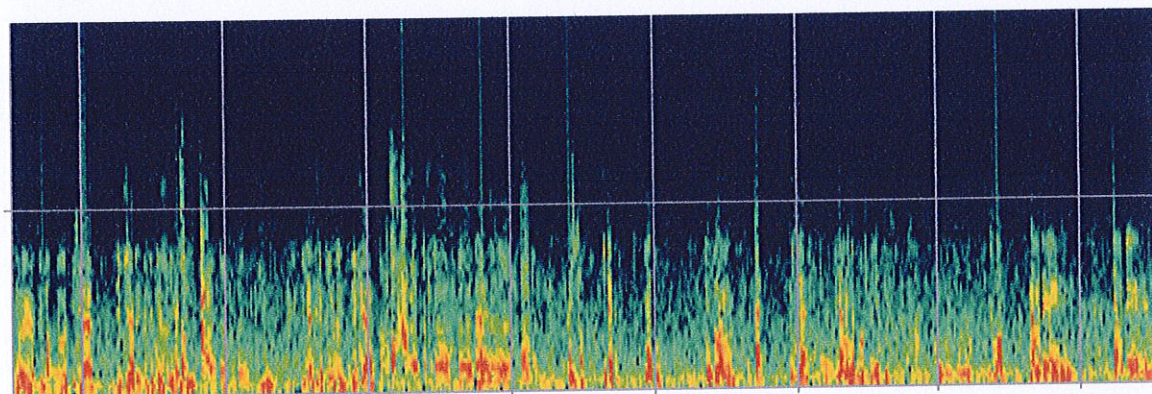
Nevertheless, in this long home movie, there is one extraordinary little scene. This baby, who practically never responds, will enter into a visual and tonal dialogue – an inter-modal dialogue – with his uncle, who happened to stop by. This scene took place when the baby was about six months old. It occurred in the barnyard where the father and the uncle, who have separate houses, were working together. The farm produces organic cow milk. This detail is important because the men's workload is very heavy in the spring, when they must not only take care of the animals and the milking, but also plant the forage they use to feed the animals. It is not difficult to imagine that the uncle has little opportunity to become aware of

his nephew's communication problems, since he probably doesn't meet with him very often. Now, the uncle's voice does presents the prosodic characteristics of motherese. Moreover, it is interesting to note that in English one speaks not only of *motherese* but also of *parentese* (Fernald & Kuhl, 1987),²⁴ which seems more fair, given that fathers, too, and even uncles, can address babies in this way.

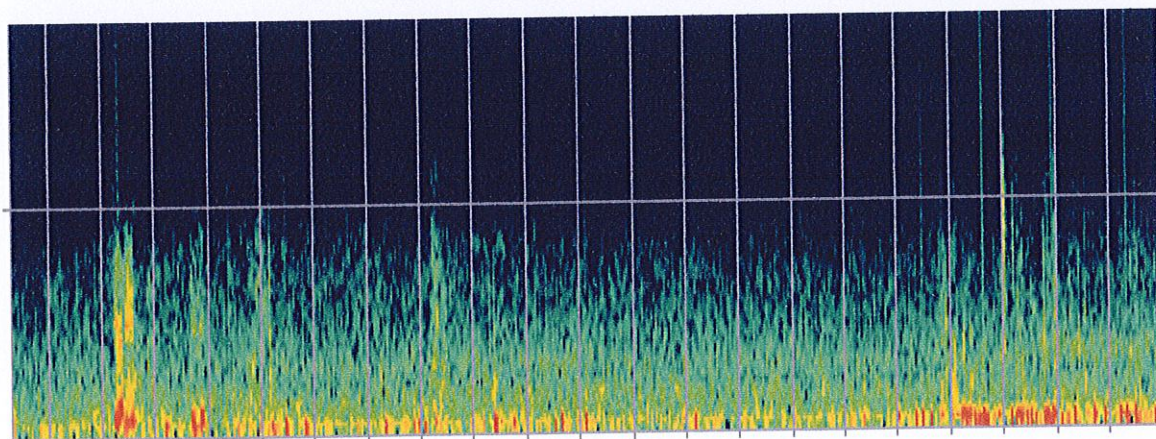
Two minutes before the uncle intervenes, the mother once again attempted to enter into contact with baby. Her voice indicated that she was doing this out of a sense of duty; she didn't much believe in it, but would try all the same. Not only did the baby not enter into contact with her, he also flopped down on his side in the little cloth bed his mother had set up in the garden for him.

The uncle starts by extending his hand to the baby, eliciting no response from him. But as soon as the uncle's voice is heard, it wrests the baby out of his state of prostration; Pedro, smiling, begins gazing at and vocalizing to his uncle, like a completely normal baby. The change in the baby is sudden and surprising.

When we compare the spectrograms of the voice of the mother and the voice of the uncle, the difference is striking.



Pedro's uncle (Fig. 4a)



Pedro's mother (Fig. 4b)

Fig. 4. Comparison of the uncle's voice (a) and the mother's voice (b)

²⁴ FERNALD, A. & KUHL, P. K. 1987. "Acoustic determinants of infant preference for parentese speech", *Infant Behavior and Development* 10, p. 278-293.

Here is another presentation of a little fragment of the discourse (Fig. 5) that the uncle addresses to his nephew, as he plays with the baby's pacifier and asks him which of them it belongs to, himself or the baby? The uncle seems to be in ecstasy over the pacifier as he asks playfully "De chi è? De chi è questo, ein?"

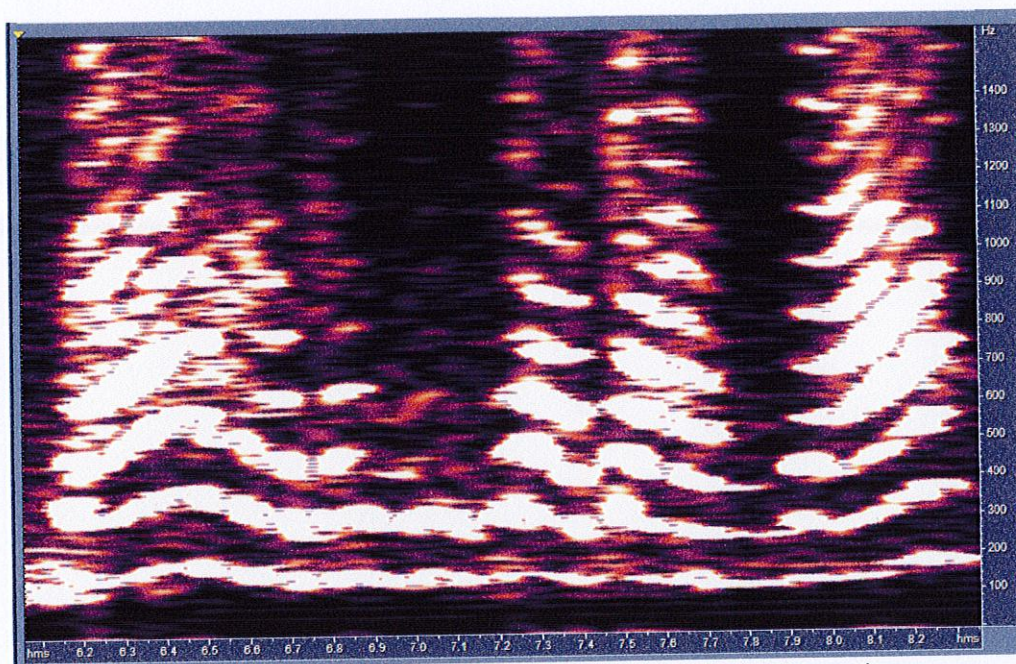


Fig. 5. Fragments of the uncle's voice, addressed to the nephew

Here we can see the outlines of the contours of the prosodic curves, as well as the empty spaces between the blocks of sound. This baby shows us that the presence of prosodic peaks proper to "parentese" in the voice of the adult that is speaking to him can induce a response even in babies who later turn out to be autistic. Which means that even if the baby does not spark this type of relation with his Other, he is equipped to receive it. But we should proceed with caution, for even if Pedro cannot help but respond to the siren voice of his uncle speaking "parentese" in this scene, he does not re-initiate the conversation. No where in this home movie do we see him provoking his interlocutor. This concept of "provocation", implying a dimension proper to the appeal to the other, has been developed by Emese Nagy (2003),²⁵ a researcher in developmental theory. His concept gives clinical support to the research of Laznik (2000)²⁶ concerning the third phase of the drive circuit, the phase when the baby *makes himself heard*, for example, by another person. There is one exception in the film: when Pedro was around fifteen months old, his mother became completely silent. She settles for simply filming Pedro as he tries, in vain, to enter into verbal contact with the farm dog, offering it his Legos and a long speech. The dog goes away, perfectly indifferent, and the mother is now unable to pick up for her own use the "discourse" that the child has addressed to the dog. If there is an "invocatory drive" in this child, it could only be addressed to a dog that made nothing of it.

Alfredo also belongs to the sample from Pisa of babies who later became autistic. When his parents speak to him, they sometimes produce prosodic peaks. Nevertheless,

²⁵ NAGY, E. & MOLNAR, P. 2003. "Homo Imitans or Homo Provocans? Human Imprinting Model of Neonatal Imitation". *Infant Behavior and development*, to be published in 2004.

²⁶ LAZNIK, M. C. "La théorie lacanienne de la pulsion permettrait de faire avancer la recherche sur l'autisme", *La célibataire*, Automne-Hiver 2000, p. 67-78.

throughout the first three months of his life, Alfredo seems to avoid perceptions come from his parents, or even his grandparents when they come to visit. Here we could also speak of an apparently voluntary avoidance, of the kind that Selma Fraiburg describes.²⁷ If we do a micro-analysis of a scene between the baby and his mother when the baby was aged one month and twenty days, we hear the modification in the maternal voice, which grows weary as all its sweet and tender attempts fail. Even little caresses around his mouth cannot win her the attention of her son. The father, who is filming them, asks her to try again. She makes another attempt, with the father's support. In vain. A freeze-frame at the end of this scene allows us to perceive a slight crease of bitterness forming at the corner of the mother's mouth, surely unbeknownst to herself. The parents, faced with this absence of response from their baby, or indeed, with his active refusals²⁸ – he ostentatiously turns in the opposite direction to where his mother is – mutually sustain each other and seem to remain confident.

We have closely analyzed the scene in which, for the first time, the baby looks at one of his parents: his father. The baby is then three months old. The movies are made mainly during the weekend when the father is there. This time, the father is holding the baby in his lap while the mother films. As is usual with them, they keep up a repartee as a way of facing this blatantly absent baby. They are heartened by their repartee, and at one point the beginning of parentese appears. The baby answers it with a smile that is not addressed to anyone; the parents are so pleasantly surprised by this that it gives rise to a new prosodic peak in the father's voice. The baby looks at him and smiles. This event is welcomed by a concert of surprise and joy in the parental prosody, which enables the baby to keep looking and smiling. The father, his voice choked with joy repeats, "He's looking at me, he's looking at me." But he accepts it very well when the baby wants to break the contact; he is in harmony with his son.

Ten minutes later – as is indicated on the video – the mother takes her baby in her arms and starts talking to him. Her voice is still imprinted with her surprise and joy at the event that has occurred, as can be seen in the prosodic curves.

Indeed, in one of his first articles on the prosody of "motherese", A. Fernald²⁹ had pointed out that this particular form of mother's prosody is virtually never found in the language of one adult speaking to another adult, except in extremely rare conditions where great surprise is combined with great pleasure. The author did not draw any conclusions from this, but I have been extremely interested by these two terms: surprise and pleasure. They encompass the notions of bewilderment and enlightenment that Freud found so interesting in the role of the third person of the joke.³⁰ I have revisited them in reference to my psychoanalytical treatments of autistic children.³¹

Alfredo's mother speaks to him in a voice that has this prosody; he can not help but look at her, at the precise moment when she produces an especially significant peak (Fig. 6)

But as soon as the baby sees his mother's face, he starts to cry.

²⁷ FRAIBURG, S. "Pathological Defenses in Infancy", *Psychoanalytic Quarterly*, vol. LI, n° 4.

²⁸ The idea that there is, from the moment of birth, a prototype subject capable of willfully refusing is rather rare in psychoanalysis. Dolto may be the only one to have made this hypothesis, without, in my opinion, supporting it enough. Current research on the infant's competencies tend to support this idea. Trevarthen asserts that there is an innate intersubjectivity in the newborn, and thinks that the latter can conceive of himself as separate from the adult who cares for him. We could say that he hypothesizes that he is subject. See: Trevarthen, C. "Intersubjectivité chez le nourrisson: recherche, théorie et application clinique", in *Devenir*, vol. 15, n° 4, 2003, p. 309-428.

²⁹ FERNALD, A. & SIMON, T. "Expanded Intonation Contours in Mother's Speech to Newborns," in *Developmental Psychology*, 1982, 20 (1), p. 104-113.

³⁰ FREUD, S. *Jokes and Their Relation to the Unconscious*, Standard Edition, 8.

³¹ LAZNIK, M. C. (1995) *Vers la parole: Trois enfants autiste en psychanalyse*, Paris, Denoël.

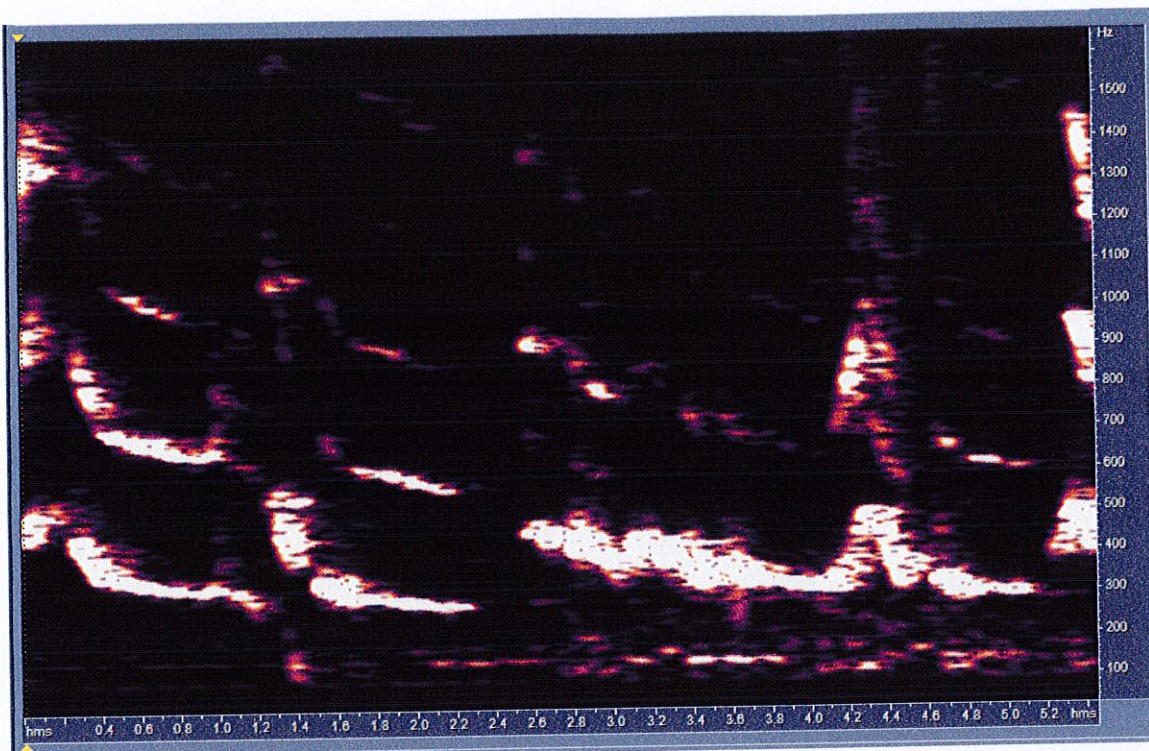


Fig. 6. Peak preceding the moment when the baby starts to cry

What hypotheses can we make here? Is there already a problem with inter-modality? With moving from the *heard* to the *seen*? But with his father, ten minutes earlier, the baby did not present this problem. Could he have seen something so unpleasant? Perhaps the features of the mother's face? Worries about an unresponsive baby are perhaps erased more slowly from a face than from a voice. Let us not forget the slight crease of bitterness that was starting to show at the corner of her mouth.

Three days later, the mother manage to enter into a long exchange with her baby. They are lying together on the parents' bed and the baby has to make an effort to turn towards the mother's face, which is partially hidden by the mattress they are resting upon. It is possible that the mother's very relaxed position contributed to the quality of her prosody, but one could also imagine that the the mother's position prevented too close a reading of the discreet worry lines on her face. As soon as the baby responds by looking at her, the mother's outburst of surprise and joy improves her prosody even more. She says lots of nice words to him, declares her love to him in every possible way and laughs joyfully at her son's responses. But though she can echo some of her vocalizations, she does not allow herself to speak in the first person singular. She does not attribute to him phrases supposed to be addressed to herself, the mother. Because of this, it may be necessary here to speak of a pseudo proto-conversation. That dimension of madness which consists of speaking in place of the other – in the Winnicottian sense of mothers' necessary madness – is perhaps only possible when a mother feels sure of her maternal capacities. An unresponsive baby must put a great strain on its mother.

Here are two little fragments of maternal speech (fig. 7) wherein we see how prosodic peaks, repetition, empty spaces between phases of speech, are all quickly constructed as soon as the baby responds.

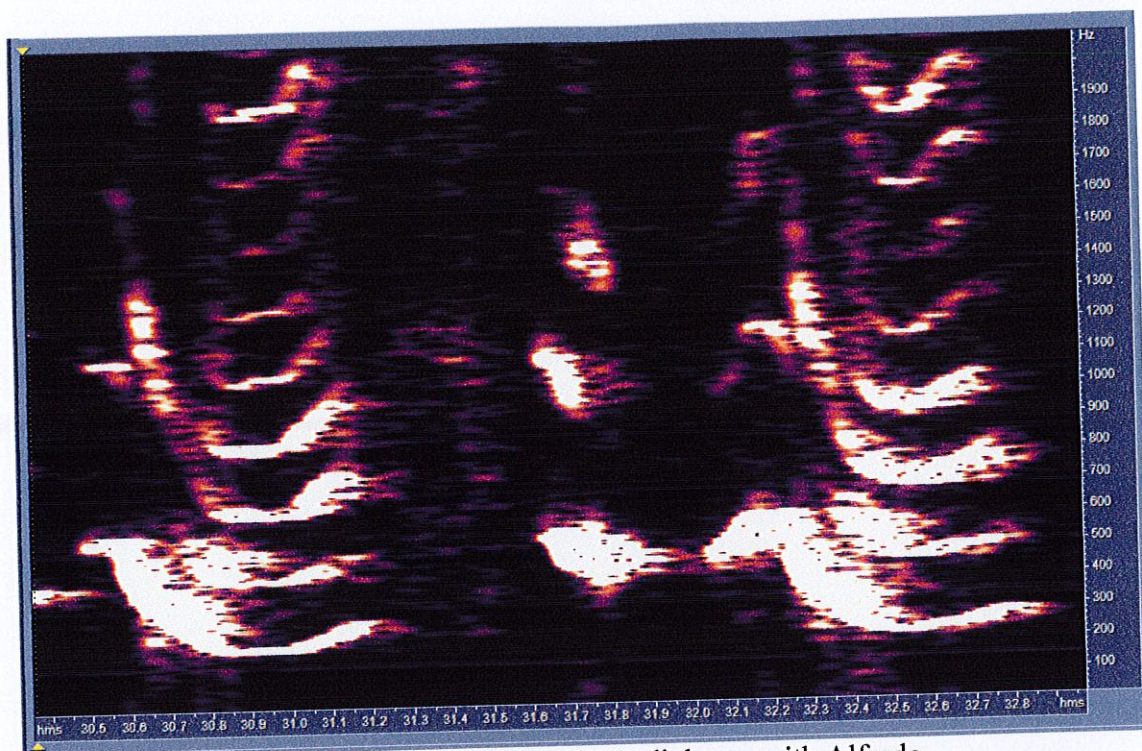


Fig. 7. Fragments from the mother's dialogue with Alfredo

Perceptual acoustic analysis, carried out by E. Parlato, indicates that throughout this scene the mother's speech presents energy variations and a prolongation of vowels characteristic of motherese. E. Parlato compared these results with work on motherese published in Italian. But it is important to know that while the sequences in the film where the baby responds to his mother coincide with those where the mother produces motherese, in 100 percent of the cases, the baby does not respond every time that the mother produces it.

But above all, nowhere in all the film available to us does Alfredo show any sign of a third phase of the drive circuit. Not only does he not try to be heard but, even when stimulated by his mother, he does not try to make himself the object of her drive. One instructive scene occurs when Alfredo is on the changing table, and his mother playfully stimulates her son. She shows him how appetizing his little foot is, even inviting him to taste it, which the baby does, not without pleasure. But it never occurs to him to offer this little foot to his mother's mouth, as close as it is. This is not a baby who likes to get nibbled by the Other. He does not seem to be interested in what could give pleasure to this other. Trevarthen likes to say that babies are born with "a motif for the motif of the other." But this is not the case for the babies, who became autistic, in these home movies.

Back to Marine: Interweaving treatment and research

As a psychoanalyst, research is of interest to me insofar as its hypotheses can make me imaginative in difficult clinical situations, like those involving babies at risk for autism. It is obvious that Pedro laughing for his uncle is in my mind when I undertake to resuscitate the relation with Marine. Also, when she stops responding to my play, it makes me think that I have lost the freshness of real surprise with her, so I try to refresh myself with representations that occur to me. But will this show up in the voice analysis?

The recordings of Marine's sessions were given to the psycholinguist Erika Parlato, for laboratory analysis. More than a year will pass before the hypotheses I am formulating during this session will be confirmed. They are:

- 1- If the first time I mimic my surprise and my joy at the yogurt, the child looks at me, doesn't this indicate that my voice has the prosodic characteristics of *parentese*?
- 2- If the mother has no success when she plays, it must be because her voice is flat, which is noticeable when one listens to the tape, but about which one can never be sure.
- 3- If the little girl becomes so enthusiastic when I pretend to feed her mother, laughing at us both and making rudimentary applauding gestures, it is because our two voices must then have these same prosodic peaks.
- 4- If she looks at me during my two scenes of playacting, there must be elements of *parentese* in my prosody.
- 5- On the other hand, if, during the following attempt, she didn't deign to look at me, couldn't I imagine that repeating the same scene had diminished my ability to let myself be surprised? The absence of surprise must have eroded my prosodic peaks.
- 6- If she followed me again in my invitation to look at the fragrant vanilla bush, it was because my surprise and pleasure were genuine.

When Parlato analyzes the spectrum of vocal prosodies, she will find that these hypotheses are confirmed. During my fourth repetition of the scene, Marine no longer responds because there is no more *parentese* prosody. This shows that there is so such thing as fake *parentese*. So it would be absurd to suggest that anyone try to imitate *parentese* in their speech – it results from a subjective state of surprise and pleasure. It can't be forced. But in the last scene, the one with the flowering bush, Erika Perlato says that she observes – at the moment when I say "Look at the smell" – a rounding of intonation, a prolonged use of vowels, along with a heightened intensity, which is characteristic of *parentese* prosody.

The Amélie Nothomb's novel *La métaphysique des tubes*³² contains a magnificent narrative of a two year-old child's emergence from massive autistic withdrawal. After the research that I've been speaking of here, we can consider that something analogous is happening in the scene with the white chocolate, wherein the narrator recounts her passage from the state of a digestive tube to that of a subject capable of saying "I". Her grandmother, who is making her first visit to Japan, where Amélie was born, goes to see this two-year old baby in her bedroom. She has been told that no one has been able to catch the eye of this child or hold her attention. Ten minutes later the grandmother returns, holding a baby who is looking and smiling at her.

We are told that, in the intervening scene, the grandmother has let the baby taste some white chocolate, a chocolate she is crazy about – like any good Belgian. I think that the structure of this scene is analogous to that of the vanilla flower bush. The grandmother has offered the baby an object that she herself enjoys, and one can suppose that, in a movement of anticipatory illusion, her voice had the prosody of surprise and pleasure that she supposed would be elicited from the baby.

The interest of psycholinguist's research

How can these graphs prove interesting for the psychoanalyst? In my view, they confirm that there is an element of bewitchment in the voice of the Other which, like the voice of the sirens, can not be received without provoking an irresistible attraction in the listener.³³ The Greeks were aware of this from the time of Homer, who speaks explicitly of it in the *Odyssey*. This probably corroborates the alienating dimension of the constitution of the

³² Nothomb, Amélie. : *The character of rain*, St. Martin's Press, USA, 2002.

³³ I am indebted to Hervé Bentata for this idea. See: "Sirènes et chofar: Incarnation mythique et rituel de la voix" in *Quand la voix prend corps*, L'Harmattan, 2001.

subject, as long as we don't forget the dimension of separation, which plays in the other direction.

But what is fascinating is that this specific prosody only works when the coordinates of the Other's pleasure are present. We can think that, from the moment of the baby's birth, the pleasure and surprise provoked in the mother by the sight of the baby will enable her to produce a prosody of *motherese* right away³⁴. We have seen that these two elements produced well-differentiated peaks in this prosody (N. Reissland 2002).

Also, on the strictly clinical level, Roland Gori (2002)³⁵ has emphasized the importance of a state of distress, just before the blossoming of passionate love. I have written that this state of lack, of inner emptiness, is always necessary if the massive libidinal investment of a new being is to become possible. The most striking example is that of the *baby blues*, the moment when the loss of usual points of reference, and the extreme fragility in which women find themselves after the birth of a child can enable them to fall in love with their infant, and to invest the infant in the place of the Ideal. If this process is usual, it is nonetheless dangerous. We know that some women can prolong this state into post-partum depression.

But when everything happens normally, the infant shows a drive appetite for this kind of prosody: he literally feeds off it.³⁶

Lastly, in the meta-psychological register, it should be noted that surprise and pleasure hark back to what Freud was able to formulate concerning the *third person*.³⁷ This is the person who, faced with a truncated, mispronounced word, can – after a moment of surprise and amazement – let himself be invaded by the pleasure that suddenly illuminates him, the pleasure of the *joke* that he hears in what the first person has unwittingly proffered, which bewilders and delights the one who hears. The prosody of *motherese* is, I think, the perceptible translation of this state in the mother: she marvels, even as she is upset, bewildered. In the case of the infant, we can think that in the first days this is played out in the register of the gaze. What makes one marvel is not only what one can see in the infant, but also the infant's own gaze. But very quickly, sonic, gestural and mimetic responses coming from the baby will come to support the mother's prosody. This is why I insist that the prosody is a function of the drive interplay between a future subject and the one who at the same time becomes his Other.

This prosody produces a trace in the memory of the infant, which will be re-activated with each new excitation. It can then be relived by him, primarily in an hallucinatory way. In the moments when the baby daydreams while sucking his thumb, these traces of the coordinates of the primordial Other's pleasure make me certain that Eros is present and that we are really faced with an auto-eroticism. If we remove the Eros, then we find ourselves faced with autism. With all the consequence that this brings, among which is a lack of motivation for *becoming an expert in the human voice and face*, as Zilbovicius says.

Annex

2) Two MRI studies in 2004³⁸

³⁴ This was proven in 1982, for normal mothers of normal babies. See: Fernald A., Simon T. : "Expanded Intonation Contours in Mother's Speech to Newborns", in *Developmental Psychology*, 1982, 20 (1), p. 104-113.

³⁵ Gori R. *Logique des passions*, Paris, Denoël, 2002, p. 65.

³⁶ Voir Laznik M. C. : "La voix comme le premier objet de la pulsion orale" in *La revue Psychanalyse et Enfance du Centre Alfred Binet*, Paris, 2000.

³⁷ S. Freud: *Jokes and their relation to the Unconscious*, S.E, vol 8.

³⁸ This annex is extracted from Golse B. "Les précurseurs du langage et de la communication: structure d'état ou structure de processus", in *Le langage, la voix et l'autisme infantile* Joly, Touati et Laznik org. Paris, PUF, 2006.

Reminders about the functional MRI

This is a non-invasive technique, derived from tomodensitometrics (scanner technology) and based on the technique of nuclear magnetic resonance. This technique enables us not only to give an anatomical image of the organ being studied (as in the so-called anatomical MRI), but also to learn about the modifications in volume linked with the activity of the organ under examination, modifications of volume that are essentially link to variations in blood flow due to the state of inactivity or inactivity of the zones involved.

In the brain, the MRI can thus enable us to approach modifications in cerebral motor zones when there is motor activity, or modifications in different cerebral sensorial zones when some sensorial flow (auditory, visual ...) is being received.

One should know however that as things are now, the functional MRI cannot be performed in a free situation, since the subject's head must be placed in the MRI apparatus, which necessitates many constraints (the subject must be lying down, relatively immobilized, and have his head inside the device, which obviously creates even bigger difficulties with more or less agitated autistic children; they may need pre-medication, or even a general anesthetic.)

Recognition of the voice by autistic subjects

- Recent studies with functional MRI have shown that the Superior Temporal Sulcus (STS) represents, in normal adults, the zone specifically devoted to the treatment of vocal signals, and that Fusiform Face Area (FFA) is the one devoted to the recognition of faces: the recognition of the human voice and the recognition of faces constitute two strong axes of social interaction.
- This functional MRI study proceeded to compare five autistic male adults (25.8 years old, plus or minus 5.9 years) with eight adult male control subjects of equivalent age (27.1 years old, plus or minus 2.9 years).
- The diagnosis of autism was made according to the criteria of the ADI and the DSM IV.
- The device used was of the type 1.5 Tesla Magnetic Resonance Scanner.
- The experiment consisted of passively listening to two types of sound samples (separated by ten-second intervals of silence in order to avoid artifacts due to contamination):
 - 21 blocks of vocal sounds (of which 33% were language vocal sounds and 67% non-language vocal sounds)
 - 21 blocks of non-vocal sounds emanating from various environmental sources
- The return to the basic flow (volume of the Superior Temporal Sulcus zone) was awaited between one sound stimulation and the next.
- In the control group, it was observed that there is a greater activation of Superior Temporal Sulcus by vocal than by non-vocal sounds ($P < 0.001$) while non-vocal sounds do not activate any other region in a specific way in comparison to vocal sounds.
- In autistic subjects, the following observations were made:
 - There was no activation of the STS in four out of five subjects by the vocal sounds, and one unilateral activation of the STS in one subject.
 - There was an identical cortical activation for vocal signals and non-vocal signals, in relation to the base level (silence)

- There was a normal cortical treatment of non-vocal sounds

Golse then cites one of the conclusions of the authors, stressing its importance: *“Future studies will need to investigate whether this lack of salience of vocal stimuli causes, or is a consequence of, the abnormal pattern of cortical activation.”*

Anomalies in the Superior Temporal Sulcus in autistic subjects

- This is a study with static (not functional) MRI
- The technique for analyzing images that was used was that of the Wholebrain Voxel-based Morphometry (VBM), or a mathematical analysis voxel by voxel with possible accumulation of MRIs.
- Thus this study rests on a high-resolution 3-D technique.
- The authors proceeded to compare twenty-one primary autistic children (9.3 +/- 2.2 years) with a control group of twelve children (10.8 +/- 2.7 years).
- They noted a significant reduction, in the autistic children, of gray matter in the STS as well as a significant reduction, in autistic children, of white matter in the right temporal pole and the cerebellum ($P < 0.05$)
- These results seem compatible with the hypothesis of a hypo-perfusion of these different zones in autistic children.

Two questions remain unanswered:

- Can one be autistic without presenting these anomalies of the STS on the MRI?
- Does emergence from autism entail a gradual normalization of the VBM, or does it occur through a process of compensation related to the question of the brain's plasticity?

Here again, Golse cites one of the authors' conclusions:

“The multimodal Superior Temporal Sulcus areas are involved in the highest level of cortical integration of both sensory and limbic information.”