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LISTENING OTHERWISE: PLAYING WITH SOUND VIBRATION

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ABSTRACT

What does « listening otherwise » mean without ears? How to access and put into practice the vibratory domain, for persons who are either handicapped or not? The devices for “listening through touch” transmit sound signals *via* materials thanks to a custom-designed computer program and adapted interfaces. Henceforth, one can hear sounds through the body.

Listening by touch modifies sound and space representations and thus questions perceptual standards of sound signals transmission by air. How to put the practical and technical conditions which favours a sensorial elaboration and provides access to creative practices accessible to all sensory *dis/abilities*? I will present several aspects of an artistic and pedagogic project which has been realized at the National Institute of Deaf Youth (in Paris).

1. LISTENING OTHERWISE

The *Listening otherwise* sonotactile devices are the result of experience gained from many years in artistic events¹ and educational workshops, in particular when tested during the National Institute for Deaf Youth's project during the year 2013². Conducted in partnership with Hugues Genevois³, this artistic and educational

experience, as well as technical and scientific, is identified under the label *Ecouter Autrement*⁴.

Conceived with the aim of acute listening, giving attention to material specificities and caring sensorial diversity of users, the sonotactile devices⁵ offer an opportunity to build new relationships with the world of sound by the controlled vibration of objects or movable sets. Acoustic studies and critical experiments we conducted were used to develop rigorous specifications that led to the design of our hardware tools, furniture and software.



Figure 1. *Sound Table* © Art&Fact

These devices were first realised with the support of the Fondation Orange and publicly presented during the “accessibility days,” organised by the Centre des Monuments Nationaux at the Pantheon (Paris, October 18-24 2010). Today, thanks to the support of the National Research Agency⁶, a program of experimentation and development allows us to continue this experience of “listening through touch” and to work out the multi-sensorial potentiality of this experience through creative and pedagogic uses (individual and collective), together with improving software adapted to handicap situations. These individual and collective practices take into account the constraints and complementarities related to sensorial differences; they cater to all groups and are particularly suited to situations involving disabilities.

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¹*Écoutes croisées. L'espace de la Conciergerie, une expérience d'écoute*, Conciergerie, Centre des Monuments Nationaux, Arts et Médiations Humaines (Labex Arts H2H, Paris 8, Saint-Denis University 2014); *Ecouter Autrement*, GMEA, Centre National de Création Musicale, Albi (2014); Museum quai Branly (2014 et 2010); Bibliothèque publique d'information, Centre Georges Pompidou, Paris (2013); *Monuments pour tous*, Centre des Monuments Nationaux, Panthéon, Paris (2010); Villa Savoye, *Le Corbusier et la couleur*, CMN, Poissy (2009); *Auscouter, écouter le son dans l'espace du couvent de La Tourette*, Couvent de La Tourette, Eveux (2008), (Art&Fact production, Pascale Criton, artistic director).

²*Histoires sensibles*, pedagogic project designed by Pascale Criton (Art & Fact) in partnership with Hugues Genevois (LAM).

³Hugues Genevois is a research engineer in charge of the team Lutheries Acoustique Musique (LAM, Institut Jean-le-Rond-d'Alembert, UPMC, CNRS), Paris, France.

⁴*Ecouter Autrement* [Listening otherwise], Pascale Criton & Hugues Genevois, Art&Fact, Paris.

⁵Term used by Pascale Criton and Hugues Genevois to describe complex percepts mixing listening (air and solid conduction), and tactile sensations felt in contact with vibrating surfaces.

⁶ANR PANAM (Pédagogie Artistique Numérique Accessible Multimodale), Puce Muse, LAM, Art&Fact, Eowave, Paidéia.

2. THE SONOTACTILE DEVICES

The sonotactile devices used during the deaf youth's program include *Sound Tables*⁷ (see Figure 1) and *Listening station*⁸ (see Figure 2) that enable one to listen and communicate *via* materials. Unlike normal listening, which occurs through the air and channels through the ear's hearing system, these devices provide sound information through physical contact. The *Sound Tables* are equipped with devices that set the material itself of wooden planks in vibration. Unlike speakers, that set air in movement, these *Sound Tables* transmit information *via* the wood.

Likewise, the solid *Listening Stations* are devices that enable one to perceive sound through bone conduction. A vibrating metal rod, in contact with one's chin or other parts of the head, enable one to become aware of extremely precise sound information, without air conduction.



Figure 2. *Listening Station* © Art&Fact

Sonotactile listening is a mixed listening experience, which enriches usual listening linked to the air propagation of sound, providing access to vibration by contact and bone conduction. Therefore, invited to experience active listening, the listener, in all her/his sensorial and cultural diversity, explores new possibilities of perception, literally and previously unheard.

3. A MULTIMODAL INSTRUMENT

The sonotactile devices *Ecouter Autrement*, *Sound tables* and the solid *Listening station* are all controlled by software that enables an audio-visual range and a potential for electro-acoustics associated with vibratory return. Thus connected, devices form a "multimodal instrument" designed to give everyone the possibility of *vibrasonorous*⁹ reception adapted to her/his sensory situation.

⁷ Designed by Hugues Genevois, team Lutherie Acoustique Musique (LAM, Institut Jean-le-Rond-d'Alembert, UPMC, CNRS), Paris, France.

⁸ Designed by Francois Gautier, Hervé Mézière, Marie-Hélène Moulet (engineers) & Thomas Bonnenfant (design) Acoustic Laboratory of Maine University (LAUM) and National Superior School of Engineers of Le Mans (ENSIM), France.

⁹ Term used by Pascale Criton and Hugues Genevois to describe mixed listening (air and solid conduction).

The goal is to provide access to individual and collective creative musical practices, allowing the mixing of sensorial differences. In this perspective, we have developed an approach based on multimodal sensorial elaboration combining audio, tactile and visuals. Vibratory reception made possible by the sonotactile devices combines multiple and reciprocal sensorial skills. The goal is to develop active listening through contact and to access the ability to produce, visualize, recognize and transform the vibratory and sound contents.

To meet these goals, the process incorporates the interrelationship between microphones, recording, video projector and vibratory devices. The software allows linking the recording, diffusion and visualization of sound, as well as direct access to the analysis, editing and processing thereof. The software features always take into account the needs of combined integration of signs and senses (feelings), in reference to vibratory reception. Software adaptability enables a great transitivity adapted to the constraints related to sensorial differences, but also to their potential mixing.

4. VIBRASONOROUS MEDIATION

Parallel to such corporal exploration, it is also possible to transform vibratory sound contents and to modulate them in relation to one's own perception. Tactile interfaces (tablet, joysticks, etc.) allow one to convert sound and play devices like an "instrument" with one player or more; the listening and sound producing devices enable one to 'enter' the sound, by filtering it, speeding it up, adjusting effects to elaborate proper sensations [1].

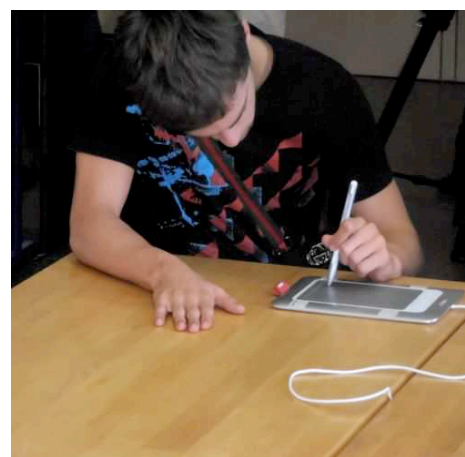


Figure 3. Pedagogic workshop at the National Institute of Deaf Youth (Paris) © Art&Fact

Experience with young deaf persons has allowed us to measure how vibratory mediation is a relevant vector for cognitive integration [2]. For example, the functionality of recording associated with vibratory return allows the hearing deficient to elaborate a recognizable and storable memory of *vibrasonorous* imprints. Visualization combined with tactile reception will recall and allow the analysis of imprints, but also the possibility of their transformation (treatment) and thus new *vibrasonorous* distributions. Features usually identified from the hearing perspective are here involved in a sensitive process moving

to bone conduction receptors and mechanical skin receptors. The sensorial association renewed by the tactile dimension [3] awakens open *vibrasonorous* representations. The role of interfaces becomes that of an adjustment of the feel, a regulation of complex sensations, but also of an accessible exploration of non-standardized association.

5. LISTENING TROUGH TOUCH

If the functioning of the ear has been extensively studied, our sensitivity to sounds and vibrations through touch is much less well known, perhaps because touch is based on very complex and various mechanisms [4]. Experience with sonotactile devices shows that listening through touch is different depending on the shape, material and body positions that the device suggests. Depending on one's posture, the imagination as well as sensations will be stimulated differently [5].

5.1 Postures and Solid Listening

Each participant explores "solid listening" by placing either their hands and/or their elbows on the *Sound Tables* (see Fig.1 & 4) or their upper body (forehead, chin) on the solid *Listening Station* (see Fig. 2).

Listening on the wooden table calls for relaxation. The body surrenders, with the chest resting, and head and arms in contact with the wood. Exploring listening through touch leans towards musing: objects speak to us, transmit signals from elsewhere. Reception on *Sound Tables* is mixed: both diffusion - as a speaker -, and solid reception (see Figure 4). The table allows several persons to gather, invites to share her/his feelings and promotes interactivity between participants.



Figure 4. Posture on *Sounding Table*. Pedagogic workshop at the National Institute of Deaf Youth. © Art&Fact

Listening on the *Station* calls a tonic posture: standing or sitting, the upper chest remains straight. This position incites a tendency to move, a swaying of the whole body, a desire to dance. Concentration is focused on a point of contact – forehead, cheeks, chin – and the individual actively seeks out sound propagation in her/his body (see Figure 5). The *Listening station* enable one to receive very precise sound information – the voice, noise, music – and to plunge into it. The sound transmitted to the cranial region and skeleton, manifested by an intimate listening sensation as "internal" body reminiscent of listening

to our own voice [6]. This feeling is very present here and modifies the usual representation of our body in space, moving borders from outside and from within [7].



Figure 5. Posture on *Listening Station* © Art&Fact

6. HISTOIRES SENSIBLES, AN ARTISTIC AND PEDAGOGIC PROJECT

Histoires sensibles is an artistic and pedagogic project that has been realized at the National Institute of Deaf Youth in Paris during the 2012-2013 academic year [2]. This artistic and educational project designed by Pascale Criton was offered to young persons with hearing impairment to three classes of the Institute (6th, 4th, 3rd), to participate to a *vibrasonorous* creation using an ensemble of custom-made sonotactile devices¹⁰.

6.1 Multimodal Sensory Development

As we have seen, sonotactile devices have been designed for a *vibrasonorous* sensorial approach and meet the requirements of multimodal learning (audio, visual and tactile) adapted to different situations of disability (mental, motor and sensory) and, in this case, to hearing impairment. These instruments, both receivers and transmitters, allow participants to perceive and control vibrations and achieve interactive sound productions.

For this pedagogic project, and thanks to such innovative tools, we aim to establish conditions for sensorial elaboration and search of musical possibilities for young people with hearing impairment: cognitive development, practices, creativity. In this particular context tool's

¹⁰ *Histoires sensibles* received a state commission from the French Ministry of Culture and Communication.

flexibility, such as linked functionalities as well as parameters's regulation, are very sensitive. The expected result of *feelings* level is decisive for a deaf participant in order invest and trust the possibility of doing, repeat and share.

Thereby, our creative pedagogic approach pays a great attention on mouvement, dynamical events and sensorimotor awareness, which are particularly relevant for people who do not use verbal language [8]. The sonotactile propagating develops close listening, which engages the whole body and awakens deep dynamics, often carrying "vital functions"[9]. The surprise can be great to discover unknown expressive materials such as solid vibratory perceptions under signs usually associated with vision for a deaf person: to *feel* a rustling of paper, recognizing a voice through touch.

6.2 Performances and Mixed Audiences

Each class has realized and performed an *Histoire sensible* structured with the projection of an animated film for driving the *vibsonorous*¹¹ performance. This playful approach, linking vibratory events to dynamic patterns observed in animation drawings, aims to capture the vibratory imprints and to be able sensorially recognize them in order to name and share them. It establishes their expressive potential for their re-articulation in rhythmic sequences, parameter variations and creative elaboration of various types of narration, with or without images [9]. It is not a question here, for the deaf from birth, to "discover" hearing, but to involve different sensorial modalities and experience the creative fields that can be joined together.

Histoires sensibles were publicly presented to a mixed public - hearing and deaf. These public presentations showed the possibility of combining usual listening (air conduction) with the experience of "listening through touch" (solid conduction), allowing deaf and hearing audiences to share the reception of these *vibsonorous* achievements.

7. PERSPECTIVES

The sonotactile devices render one aware of new sensations and representations, regardless of age or aptitude. The practices born of vibratory and sound mediation are likely to take on different meanings depending on the situation and pathologies, because of their proprioceptive and kinesthetic bases. We can measure the importance of sound information transmitted through corporal contact, with or without the auditory system, by the "containing" nature of listening it promotes, particularly conducive to multi-sensorial association [10]. The imaginative and sensory-motor awakening opens a transition space for situations of deafness or blindness, as well as motor impairment or autistic disorders.

Today, software development becomes able to take into account the specificities and constraints of different sensorial conditions, their logic and semiotic couplings. Con-

trol interfaces and software tools related to basic functionalities such as recording sound, treatments and spatialization, now allow one easily to connect and fluidly organize many features. However, to develop interactive practices working on vibratory contents allowing access to specific sensorial creativity requires technical adjustments and an attentive re-evaluation of perceptual standards. Our research focuses on developing and experiencing technical tools adapted to specific uses and collective practices related to vibratory and sound mediation, directly with stakeholders.

Beyond "specific" situations, workshop sessions and artistic manifestations allow us to measure how vibratory sensation and sonotactile listening generate a shared interest¹². This is a renewal of listening which puts into perspective both potential polysensoriality and the search for new listening scenographies.

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¹¹ *Vib-sound* is the term invented by deaf children (INJS) and coined in LSF.

¹² Art & Fact produces *in situ* concerts, installations, workshops involving the experience of listening to the discovery of spaces and materials. Invited to an active experience, audiences are exploring new possibilities of perception. Art & Fact is involved in research "sound reception and sensorial *dis/abilities*." with the support of the National Research Agency (ANR) and SACEM. Artistic Director: Pascale Criton.