



**HAL**  
open science

## To Conceive Shared Affective Atmospheres Based on Discomfort Experiences for Autistic Children

Sana Layeb

► **To cite this version:**

Sana Layeb. To Conceive Shared Affective Atmospheres Based on Discomfort Experiences for Autistic Children. Proceedings of the 4th International Congress on Ambiances, Alloaesthesia: Senses, Inventions, Worlds, Réseau International Ambiances, Dec 2020, e-conference, France. pp. 348-352, 10.48537/hal-03220273 . hal-03220273

**HAL Id: hal-03220273**

**<https://hal.science/hal-03220273v1>**

Submitted on 14 May 2021

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial - NoDerivatives 4.0 International License

# To Conceive Shared Affective Atmospheres Based on Discomfort Experiences for Autistic Children

Sana LAYEB<sup>1</sup>

**Abstract.** *Autism is one of the most common developmental disorders in the world. It is defined by inadequate interaction and communication. This disorder induces an altered perception. We started from the sources of stress and discomfort in order to create a comforting atmosphere that allows the autistic child to progress in his care center. We so followed a multidisciplinary approach between teams of architects, engineers and child psychiatrists. Our methodology was based on the latest technologies in cognitive science in the capture of the emotional state correlated with the behavioral model, called sensory profile. We aim to propose an architectural space adequate to the sensitive particularities of autistic children in order to guarantee their well-being and comfort.*

**Keywords.** *Autism, Comfort, Well-Being, Discomfort, Technology, Affective Atmospheres*

## Introduction

The child is described as a sensory organ or sensory machine. Children with autism are characterized by their extreme sensitivity to various environmental factors due to their deficits in sensory information processing (Bevan, 2013). The diversity of scales and qualities of environments is therefore a main feature in the conception of spaces for children with autistic disorders. But the most important thing remains the control of these physical environments (lighting, acoustic, etc.) in order to increase the comfort and quality of life of the occupants. The primary challenge is to satisfy the diverse needs of children in order to promote their good development.

This chapter will be structured as follows: in the first part, we refer to some research that has dealt with the links of the child with autism with his external environment. In the second empirical part, we detail the experimental protocol used. In the third part, we present the main results collected. Then, we analyze and interpret the combined data. We will end with conclusions and perspectives.

## The Autistic Child's Relationship to the Outdoor Space

Since the second half of the twentieth century, several researchers from different disciplines have tried to define this disorder and identify its specificities. However, the studies that have focused on the relationship of children with autistic disorders to their environment remain limited and very recent. This issue was only discussed by psychologists, pediatricians and designers at the beginning of the 21<sup>st</sup> century. The preoccupations of some of this research have been focused on the sensory needs of children with autism. A. Brand (2010) and I. Scott (2011) assert the importance of the

---

<sup>1</sup> *Research Team on Ambiances (ERA), National School of Architecture and Urbanism, University of Carthage, Tunisia, sana.layeb@yahoo.fr*

natural environment as a stimulating environment. It is the most conducive environment for stimulating children's senses, enriching their daily experiences and developing failing senses. In fact, outdoor spaces offer a variety of stimulants appropriate to each season. Earth, sand, stone, wood and water offer rich and varied textures. Some specialists talk about the importance of indoor courtyards that offer a safe outdoor environment. The layout of the courtyard gives the children the opportunity to play freely without feeling obsessively supervised (Bevan, 2013). The apertures around these courtyards provide excellent visibility that allows staff to manage activities from a distance (Whitehurst, 2007). Mullick (2009) describes the impact of 'regular' classroom windows overlooking natural spaces on the behavior of students with autism.

However, architectural guidelines for this spatial quality are limited to quantitative standards. The recommendations found in the state of the art rather evoke the quantity and control of lighting. So, high windows (Whitehurst, 2007), skylights (Henriksen, 2010), awnings or sunshades were strongly prescribed, as they provide a good quantity of natural light.

## Methodology

This study examines the influence of different atmospheres on the perception and behavior of children with autism. We were interested in the child's sensitive experiences and more specifically in his perception of stress. From the beginning, this work has required a close collaboration with a multidisciplinary team of architects, engineers, statisticians, therapists and child psychiatrists, working on the observation of the physiological responses of children with autism to different stimuli in their environment. Our field of study was one of the pioneering centers of special education, affiliated to our associative partner, located in the city of Monastir. Our investigation involved 13 children, aged between 4 and 13 years old, including 2 girls and 11 boys.

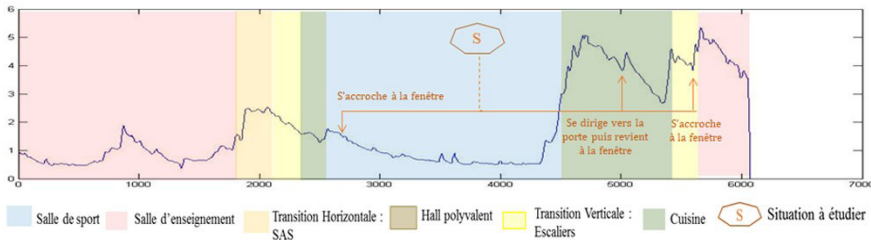
We chose to follow the autistic child during his typical daily journey in the care center from his arrival in the morning until his departure in the early afternoon. We follow him during his different pedagogical courses, psychomotricity, speech therapy and in the different spaces he goes through. Simultaneously, we capture information on his perception of his environment, through the capture of his emotions. This approach has allowed us to apprehend a reality that is not usually expressible. It is based on a measurement of a physiological signal, corresponding to the child's electrodermal activity (EDA), which varies according to his emotional state and excitement (Boucsein, 2012). It is performed thanks to an innovative technology that supports the individualized nature of autism (Picard, 2009). This technology makes it possible, in real time through an application that can be downloaded via smartphone, to assist the respondent's awakened-state. It consists on an on-board biological sensor, worn on the wrist, from Empatica® and called E4 (Layeb, 2019). At the same time, the morphology of the premises, materials, proportions, colors, ambient effects and all the physical phenomena or environmental factors to which each autistic person was subjected during his or her journey are also identified. Beforehand, we drew up a sensory profile of each investigated child (Dunn, 1997). This is a questionnaire that allows us to understand the behavioral model of these children as well as their hyper or hypo-sensitivity.

The second part of our work consisted of a phase of dividing up the path studied, then analyzing and correlating the various data collected. This allowed us to identify the significant environmental and ambient situations that generate different emotional states. This correlation allowed to propose our spatial corrections and recommendations.

Only the crossing of the different data (physical, physiological), permits to reveal the different connections between the ambient factor, the environmental factor and the emotional state of the person (Layeb, 2016).

## Results

We present an illustrative example of the application of this approach to a typical survey, of a 7-year-old boy. The behavior of the electrodermal curve in this case example was typical of all the children in his study profile. For ethical reasons, we have chosen to refer to him by the abbreviation (Di). He is a child with a multiple sensory profile and hypersensitivity. The segmentation and interpretation of his EDA signal reveals three significant electrodermal variations, indicated by (S) in Figure. 1, related to his passage near windows and his reaction to the outside.



**Figure 1.** Segmentation and interpretation of the EDA signal of the typical profile (Di), Layeb, 2019

In situ observations have shown that these physiological variations correspond to the repetition of the same behaviour: clinging to a window and looking outwards. Indeed, we noticed that with each movement and in each space we occupy, the little boy (Di) was always attracted by the window. We noted this attitude in the sports hall, the multi-purpose hall and even in the stairwell. Only the sill of the unique window in the central hall corresponds to the child's height, otherwise the others are located at 1.4m. The child always manages (even in uncomfortable situations) to be able to stop and contemplate the outside. All the windows have a spatial and visual clearance. This contact transports the child to new visual atmosphere by contemplation, clear field of vision, new luminous atmosphere by his relationship with the sun's rays, lighting level, new sonic atmosphere by moving away from the interior sounding ambiances, tactile atmosphere on contacting the glass and the aluminium of the window and thermal atmosphere related the climate. We believe that the window represents an emotional and ambient escape for this child. It allows him to escape from all nuisances: noise, lighting and others, towards an alternative atmosphere that allows him to evacuate his emotional overload coming from his multi-sensoriality. The window then becomes, for him, a pretext to escape from disturbing stimuli and an opportunity for an emotional discharge.

## Discussions and Recommendations

The relationship with the outside seems to influence the behaviour of some children. Indeed, in our field of investigation, the inside/outside relationship is ensured through doors and windows. The glass windows offer these users a visual escape to the outside landscape. They allow contact with weather conditions (climate), new thermal factors (air, temperature...), with natural light and new sound sources... This experience seems to confirm the importance of opening and inserting the outside into the inside. As we have already mentioned in paragraph III, some researchers recommend designing

spaces with high windows to prevent the disturbance of the child and his escape (Whitehurst, 2007)! Others propose spaces with little glazing, mono-oriented, under the pretext that the bay windows reduce the concentration of children and that the practice of some care's centers install opaque barriers in front of transparent opening to block views.

We have noticed during our bibliographical investigation and our observations in different fields, that the comfort and well-being of these users (suffering from a communication deficiency), are often sacrificed at the expense of the session's progress, thermal comfort, quantitative standards or safety and hygienic reasons. It seems to us that a qualitative reflection favouring the feelings of the child with autism is very desirable (hence the objective of this research) in future designs.

We invite future designers to give priority to spatial arrangements and devices that ensure both adequate natural lighting and openness to the outside. The architectural reflection-oriented atmosphere can also be inspired by introverted devices, such as patios, which ensure both openness to the outside, natural light but while filtering certain undesirable inputs (such as nuisances from neighbours...). This courtyard offers an outdoor space, contained with defined limits. It generates an outdoor space, enclosed inside: this configuration facilitates its understanding by children (Charras, 2012). In order to be able to be interested in the outside, the child with autism wishes to be enveloped by the sphere of the familiar. For them, what is outside the familiar is a source of anxiety and discomfort.

The architect's task in this case would be to widen the scope of the familiar by integrating it in a progressive way, to create atmospheres according to the child's preoccupations and anxiety. The aim is then to strengthen the autistic child's ability to live the changes in his or her living space, in order to prepare him or her for progressive social inclusion. For a better adaptation, we think that the architectural dispositions should inflect a controlled qualitative dimension that can be adapted and modulated, for and by the child. As it can resort to old scholar architectural paradigms, such as garden schools and outdoor or open-air schools (Roth, 1966), which ensure the compromise between teaching and enjoying the outdoors. Two conditions are necessary, which are the possibility to modulate the space and its relationship with the outside. The concept of improving the capacity and spatial readjustment of shared spaces should not be done intuitively, but rather through a therapeutic approach derived from environmental psychology (Charras, 2012). The role of the architect is then to propose a flexible and modular space able to meet the different sensorial needs of all.

## Conclusions and Prospects

We believe that any spatial configuration that ensures a balance between the different ambient and functional constraints can provide the well-being and sensory requirements of children with sensory dysfunction. The contribution of the users (children or educators), in an inclusive design, can be solicited in the organization of school spaces in the choice of colors, textures, lights..., to provide transformable, modular and flexible spaces. The role of the architect is then to be able to manage the contribution of future users in order to propose the accommodate space which can appropriate the spatial and ambient transformations and readjustments to be adapt to the needs and sensorial capacities of all. We should note that these architectural guidelines, dedicated to children with cognitive and assimilated handicaps, contribute to the therapeutic recommendations of the educational environments. They respond also to the new concepts of 'ordinary' modern school architecture such as the 'articulated class', the 'open school', or the 'learning street', developed by Herman Hertzberger.

## Acknowledgment

The author would like to thank Dr. Naoufel Gaddour, child psychiatrist, associate professor in child and adolescent psychiatry at the Vulnerability to Psychosis Research Laboratory, Monastir Faculty of Medicine, University of Monastir, Tunisia, for his collaboration. We are particularly grateful to the members of the Signal and Systems Unit (U2S) from the National School of Engineering of Tunis (ENIT), especially to Professor Meriem Jaidane and Ms. Raja Ghozi, Assistant Master, Signal Processing Specialists for their help and cooperation. We would also like to express our sincere thanks to Mr. Jean Pierre Péneau, honorary professor of the Schools of Architecture, for having supervised this work and Mrs. Faten Hussein, Assistant Master at the National School of Architecture and Urban Planning of Tunis (ENAU) for her co-supervision.

## References

- Bevan, Mina. *Exploring the efficacy of design interventions in a day care center for autistic adults*, Floride: Mastère de design intérieur, université de Floride, 2013.
- Boucsein, Wolfman. *Electrodermal activity*. Allemagne: Université de Wupperta, 2ème édition, 2012.
- Charras, Kevin. "Architecture environnement et maladie d'Alzheimer," Undergraduate Research Journal for the Human Sciences, vol. 9, 2012.
- Henriksen, Kresten. *Supportive learning environments for children with autism spectrum disorders*. Kansas State University, 13 pages, 2010.
- Layeb, Sana. and al., "Q Sensor for the City on the Threshold of Stress: Degenerative Dimension of the Sound Atmosphere", In *Handbook of Research on Digital Research Methods and Architectural Tools in Urban Planning and Design*, H. Abusaada, C. Vellguth, & A. Elshater (Eds.), 121-137, Hershey, PA: IGI Global.
- Layeb Sana. and al. The Sonic Ambiance as a Transforms Operator of our Cities and our Architecture. The case of autistic children and elderly. Nicolas Réemy (dir.) ; Nicolas Tixier (dir.). *Ambiances, tomorrow*. Proceedings of 3rd International Congress on Ambiances, Sep 2016, Volos, Greece. International Network Ambiances ; University of Thessaly, vol. 1, p. 177 - 182, 2016, hal-01409725.
- Layeb, Sana. and al., Caractérisation ambiante des espaces d'accueil pour enfants autistes : vers une projectuelle des ambiances, , 7-9 Septembre 2016, Toulouse, France, pp.163-172.
- Mullick, Rachna. "Incorporating the behavioral dimension in designing inclusive learning environment for autism," Archnet-IJAR, International Journal of Architectural Research, Volume 3, Issue 3, pp. 45-64, 2009.
- Picard, Rosalind. "Future affective technology for autism and emotion communication," Philosophy Transactions of the Royal Society, Biological Sciences, vol. 364, no. 1535, 3575-3584, 12, 2009.
- Roth, Adolf. *La nouvelle école*. Zurich: Editions Girsberger, 1966.
- Whitehurst, Teresa. "Evaluation of features specific to an ASD designed living accommodation". Research and Development Officer Sunfield Research Institute, 12 pages, 2007.