RECENT ADVANCES ON INDOOR COMFORT FOR AUTISTIC INDIVIDUALS

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abstract

Autistic Spectrum Disorder – ASD – is a developmental disorder estimated to affect 1 out of 160 children. It involves repetitive behaviour, a lack of communication skills, a complex sensory perception, and individual peculiarities. ASD begins in childhood and tends to persist into adolescence and adulthood. For some ASD individuals, it is possible to live independently, but housing services for special needs conventionally deal with issues of physical access and rarely with their complex and sensory needs.

This paper aims to produce an overview of what has been characterized on the overall sensory perception of ASD individuals. Furthermore, the European SENSHome Project is presented.

keywords

Indoor Comfort; Acoustics; Thermal; Visual; Autism.

Autism Spectrum Disorder – ASD – is the definition of pervasive neurodevelopmental disorders characterized by impaired social and communication skills along with repetitive and restrictive behaviour. The clinical presentation is highly heterogeneous, including individuals with severe impairment and Intellectual Disability – ID – as well as individuals with above-average Intelligence Quotient – IQ – and high levels of academic and occupational functioning. ASD affects 1–1.5% of individuals and is highly heritable and both common and rare variants contribute to its aetiology.

Over-reactivity to sensory stimuli and tendency to engage sensory stimulation and/or motor activities are common clinical issues for ASD people. According to some researchers, these disturbances in sensory modulation are caused by brainstem abnormalities. Studies of autonomic and vestibular responses have provided support for such abnormalities. Communication is strikingly impaired so that the function of the hearing system has been discussed. Indeed, the disorder diagnosis by many clinicians includes behavioural descriptive of abnormal sensory sensitivities.

In a multi-sensory world, we are constantly undergone to information reaching us through our different senses. The brain has to process this mix of sensory information into one coherent multi-sensory perception. What happens if the brain is impaired in integrating this mix of sensory input? This is one of the main issues related to ASD. In addition to traditional impairments in communication, social behavior and repetitive movements, abnormalities in sensory processing are often reported.

Several researches focused on the biological and neurologic study to understand the perception of ASD people, but only few studies focused on the comfort perception and sensitivity.

In this paper, an overview of the research and studies on the acoustic perception and sensi-

tivity of people with Autism Spectrum Disorder is depicted, providing a comparison between those approached with a qualitative procedure and the ones with a quantitative analysis.
To raise awareness and to create and adapt a house to the sensory demand and needs of ASD people an Interregional Project has been funded by the European Union. The SENSHome project aims to design a user-centred indoor environment for people with ASD to involve them, their needs, and their sensory perception in all the phases of the project. The sensibility of the users plays a key role in all the customization of the design phase. The main aim of the project is to permit to combine independency and security.

Materials and methods.
In order to characterize the sensitivity to environmental factors, anonymous questionnaires were prepared. People with a high severity of autism, especially individuals who cannot live a normal life, could not be able to properly answer the questions concerning their own well-being. Indeed, they often have difficulties in interacting with other individuals and they rarely answer direct questions, such as “How are you feeling?”. Neglecting this aspect may, for instance, provoke a crisis. Therefore, it was necessary to ask the questions focusing on individuals’ sensitivity to specific environmental stimuli.
In this view, it was essential to include a “third-party approach” – proxy –, developing the questionnaires focusing on diverse respondents:
1. caregivers working in care units;
2. parents of autistic individuals.
A complete description of the process can be found in Caniato et al. (2022a) and Caniato et al. (2022b). After initial instructions and explanations, questionnaires’ respondents were asked to indicate whether they were caregivers or parents. In each questionnaire filling, the respondent was required to report the main information about the ASD individual he/she was referring to: data such as gender – male, female or other –, age, level of ASD and comorbidities – obsessive-compulsive disorder, depressive disorder, anxiety disorder or other psychiatric or neurocognitive disorders – needed to be reported. The indication of the level of autism was asked according to The Diagnostic and statistical manual of mental disorders of the American Psychiatric Association, which identifies three main levels:
1. Level A, requiring support;
2. Level B, requiring substantial support;
3. Level C, requiring very substantial support.
In addition, questions regarding the date of questionnaire completion and the environment where the described individual was – family house, apartment, assisted facility, etc. – were included in the introduction of the questionnaire.
The four comfort domains were analysed according to the percentage of respondents giving a specific answer. A preliminary analysis was made on all the four samples – control, local, online and overall – by means of descriptive statistics, identifying the common and different trends in the percentages of answerers indicating a specific sensitivity. When analysing the online survey, the local survey and the control samples, parents’ and caregivers’ answers were considered separately. The Mann-Whitney test was used to evaluate if the differences found were statistically significant.
Descriptive statistics and Mann-Whitney tests were additionally used with the ‘overall sample’ to identify association of sensitivities to the four main comfort domains using:
1. Gender – females or males;
2. Presence of co-morbidities;
3. Level of autism – level A or higher levels;
4. Age.

The following age groups were selected: 1. “7-9” 2. “10-17”; 3. “18-29”; 4. “30-39”; 5. “40-49”; 6. “≥ 50”. These age groups were chosen in order to differentiate among age decades, as well as between childhood and adolescence and adolescence and adulthood.
In all cases, the Mann-Whitney test was selected due to the independence and the unknown distribution of the samples. Moreover, as the analyses were explorative, a 10% level was used in addition to the conventional 5% level of significance.

Results and discussion.
A total of 71 and 67 questionnaires were collected during the “online” and the “local survey”, respectively. Particularly in the latter, caregivers were the highest number of respondents – 32 parents and 39 caregivers in the “online survey”, 26 parents and 41 caregivers in the “local survey”.
The gender and the age of the respondents of the two surveys were analyzed. Both in the “online” and in the “local survey”, the majority of subjects are males – 63% and 76% respectively. Moreover, subjects are younger in the “local survey”, with 100% and 97% of the subjects under 30 for females and males respectively. Results show that the majority of the answers regard individuals with Levels B and C.
Intellectual disability was the co-morbidity detected most often, both in “online” – 58% of the questionnaires – and “local” – 33% of the questionnaires – surveys. More co-morbidities were detected in the “online survey”, consistently with the stronger forms of autism of the subjects involved.
The results of the statistical tests used to investigate the association of answers with the type of respondent and the type of survey are analyzed.
These findings can be highlighted:
1. The percentages of “average” and “extreme” sensitivity to the acoustic environment are quite high in both cases – 35% “average” and 20% “extreme” by parents, 30% “average” and 20% “extreme” by caregivers. In the extended-care unit the number of subjects who rated “absent” sensitivity to this field is higher – 25% by caregivers vs. 0% by parents. Even though some sound absorbing panels are present in order to reduce reverberation in the rooms, they still do not prevent acoustics from being the most stressful comfort domain for individuals on the spectrum.
2. In terms of the visual indoor environment and indoor air quality, the results show a major sensitivity to visual environment in the everyday life environment – households –, in the range of “minor” sensitivity – 60% by parents vs. 10% by caregivers. These differences are due to the design of the extended care unit, specifically designed to be utilized by ASD people, such as the presence of mechanical ventilation, proper illumination, lamps and light colors, or proper daylight exploitation. This is in contrast with normal conditions in domestic environments.
3. The statistical analysis shows that, with the exception of visual environment, the differences between answers in the everyday life and care environments are not significant. Differences between the two groups are meaningful and are most likely due to the different environments – care facility or households – where the surveys were completed. Nevertheless, these differences are mainly in lower and similar levels of sensitivity. Since there are few major differences, the two groups do not seem to show different levels of reliability.

Conclusions.
A methodology to study global indoor environmental comfort related to impaired people was applied in this research, focusing on ASD individuals. Questionnaires were designed so that they could be completed by parents and caregivers. One “online survey”, involving different international stakeholders from different assistance associations and one “local survey”, involv-

ing a specific extended care unit were developed. The study is expressed more in details in Caniato et al. (2022a) and Caniato et al. (2022b).
In all the cases considered, acoustic was the most stressful comfort domain, constituting a strong nuisance both in the extended care units and in households, in all the surveys considered. The other environmental issues, namely thermo-hygrometric, visual and IAQ were in general much less disturbing, with similar trends in all cases, with percentages of respondents decreasing as the sensitivity scale increases. The sensitivity to acoustics seemed to depend on the level of autism, being higher when the autism level was higher.

references

Caniato, M., Zaniboni, L., Marzi, A., & Gasparella, A. (2022a). Evaluation of the main sensitivity drivers in relation to indoor comfort for individuals with autism spectrum disorder. Part 1: Investigation methodology and general results, 'Energy Reports, 8', 1907–1920. https://doi.org/10.1016/j.egyr.2022.01.009

Caniato, M., Zaniboni, L., Marzi, A., & Gasparella, A. (2022b). Evaluation of the main sensitivity drivers in relation to indoor comfort for individuals with autism spectrum disorder. Part 2: Influence of age, co-morbidities, gender and type of respondent on the stress caused by specific environmental stimuli, 'Energy Reports, 8', 2989–3001. https://doi.org/10.1016/j.egyr.2022.01.011