# Robots to Make You FeelGood!: Supporting Autistic Youths in Managing Medical Visit Challenges with Robot-Assisted Therapy

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## ABSTRACT

The following paper provides an overview of the "Feel Good" project, including its objectives, methodologies and plans. The premise of the project is to explore the integration of social robots within therapeutic frameworks aimed at easing the anxiety and distress associated with medical appointments for autistic youth. Social robots have shown effectiveness in supporting autism therapies, enhancing engagement and therapeutic outcomes. The aim of this initiative is to improve communication between healthcare providers and autistic youth. Through the implementation of various strategies, the initiative seeks to enhance the children's capacity to identify and express their symptoms while also providing a comfortable healthcare experience. Furthermore, the initiative offers a secure environment where the children can work on their weaknesses and practice managing medical events. The activities are tailored according to their individual support needs and levels to ensure the best possible outcome.

## CCS CONCEPTS

• **Computing methodologies** → **Cognitive robotics**; • **Social and professional topics** → **Assistive technologies**.

## KEYWORDS

Autism, Social robotics, Video-modeling

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## 1 INTRODUCTION

Autism is a neurodevelopmental disorder that affects sensory processing, communication and social skills and leads to predictable and repetitive behaviours. Medical appointments can be challenging due to sensory difficulties, discomfort in social interactions, and struggles related to unfamiliar environments and procedures.[4, 22, 31, 34].

Social robots have shown effectiveness in supporting autism therapies, enhancing engagement and therapeutic outcomes.[1–3, 6–10, 13, 15–17, 21, 26, 28, 29].

The "Feel Good" project seeks to improve the interaction between autistic youth and healthcare providers, increasing children's ability to identify and articulate symptoms and improving comfort during medical visits for autistic children. The strategy involves serious games and Video Modelling (VM) techniques designed by a multidisciplinary team of experts in therapeutic and human-robot interaction fields. The objective is to allow patients to practice healthcare-related situations safely through robot interaction, simulating clinical assessment scenarios to mitigate anxiety and foster compliance. Interventions are customized based on each patient's support level and concurrent conditions. The robot will facilitate data collection and monitor participants' behaviour, reactions, and distress signals to assess children's progression and smooth the therapeutic process, helping therapists identify clues preannouncing meltdown episodes. Expected outcomes are identified in improved health communication and reduced anxiety during visits. Customized interventions and innovative use of social robots for data collection and behaviour monitoring have the potential to set a new standard in therapeutic care for autistic children.

## 2 CURRENT LANDSCAPE OF ROBOT APPLICATIONS IN AUTISM MEDICAL CARE

Autistic people might find it challenging to engage in medical visits due to multiple difficulties, all rooted in the characteristics that define the criteria for assessing autism diagnoses. Autistic individuals with communication deficits may struggle to effectively communicate with medical professionals to obtain proper health assessments [4, 25]. A significant portion of autistic children present as non-verbal[1], especially between individuals with high support

[1]Individuals who do not use spoken language to convey messages. Autistic non-verbal people might struggle to express themselves with spoken language. However, they can still communicate using other strategies, like pictures or gestures)[4]

needs[24], intensifying the barrier to expressing symptoms and needs.

Another aspect is the lack of body awareness, which translates into difficulties in understanding and describing feelings, sensations and emotions, leading to misunderstandings and compromising medical visits [30]. Finally, deficits in social clues understanding [27] and discomfort in new or unfamiliar situations can result in sensory overload, overwhelming the patient and causing meltdowns [25]. Studies have shown that utilizing robot-assisted therapies can enhance the effectiveness of interventions designed to develop social and practical skills. This is accomplished due to the robot's capability to promote greater participation and engagement among children during therapy sessions, as well as teaching them how to perform tasks through imitation. Such therapies have been demonstrated to yield superior results compared to interventions conducted solely by humans.[1, 2, 6, 7, 16, 17, 20, 21, 28]. Video Modelling (VM) is an evidence-based method where videos show a "model" demonstrating a desired behaviour [5, 35]. It can be implemented in different ways such as self VM, where one watches oneself, peer VM, with a peer as the model [23] and Video Prompting, which breaks down the behaviour into steps with feedback after each [14]. The latter approach is shown as particularly effective for autistic children who require high levels of support [17]. An innovative approach is the introduction of Serious Games[2] led by the robot. This strategy provides patients with the opportunity to rehearse the scenario in which the targeted skill is necessary within a controlled, supportive and immersive environment [19].

## 3 FEELGOOD!: THE PROJECT

### 3.1 The Premise

The "FeelGood!" project has a mission to enhance the healthcare experience of autistic individuals. Through the development of interventions utilizing social robots, virtual reality, and serious games, the project aims to improve patients' body awareness, functional communication abilities, and coping strategies for handling stressful medical situations. The project acknowledges the difficulties that autistic individuals face in accessing appropriate healthcare, and seeks to create tailored interventions that can effectively address these challenges.

The session's planning is founded on a need for personalization and adaptation of intervention based on the patient's needs and peculiarities, incorporating different VM strategies, mainly peer and prompting modelling, and addressing specific situations and social contexts. In order to achieve a high level of customization, it is important to take a multidisciplinary approach that involves all stakeholders. Therefore, the team will consist of therapists, practitioners, health professionals, and specialists in human-robot interaction. Additionally, the intervention will be co-designed with a group of potential users, who are identified as autistic individuals of different ages and levels of support.

This research will include longitudinal studies to evaluate the intervention's effectiveness and refine the social robot's behaviour according to the therapeutic stage.

[2]Simulations or videogames designed to teach a particular skill [19]

### 3.2 Goals

The main goal of the project is to foster access to healthcare services for autistic youth, adopting strategies tailored to the needs of each support level (1, 2 and 3). The objectives concern the enhancement of how patients and clinicians communicate. There will be a focus on increasing patients' awareness of their bodies, encouraging the effective sharing of symptoms and health conditions, and creating coping strategies for the challenges faced during medical visits. These challenges include dealing with unfamiliar environments like clinics or doctor's offices, and managing the discomfort of physical examinations and the overall sensory overload that can occur.

The multidisciplinary team plans to use a serious game paradigm and social robots as mediators and game partners to help autistic children learn and practice a behavioural model. This strategy aims to reduce anxiety and improve compliance by providing a training stage and anticipating the clinical assessment setting through virtual reality. The serious games and VM interventions will be co-designed with a group of potential users, identified as autistic people of different ages and levels of support needed, and in collaboration with therapists and clinicians, aiming to structure customised interventions based on the patient's peculiarities and necessities.

Finally, the presence of the social robot in the therapeutic setting provides a mediator between the children and the therapist, leading to an expected improved interest, participation and engagement of the participants during the therapy sessions. The effectiveness of the intervention will be evaluated by considering improvements in communicative, behavioural and collaborative abilities.

The project will mainly focus on specialist visits, such as dental, ocular and gastrointestinal evaluations. This decision is strictly related to the registered common co-occurrence of periodic and chronic issues in these areas [12, 32, 36]. It is not clear whether there is a relationship between autism and certain physical conditions, as there is no empirical evidence to support it. However, individuals with autism often experience dental, visual, and gastrointestinal issues, which are often underestimated due to communication difficulties and the high vulnerability of the patients[25]. Additionally, there is a lack of documentation on how autistic people interact with the healthcare system. As a result, focusing on medical appointments for these specific conditions could be a good starting point for future projects

### 3.3 Methods

The project is structured to follow two longitudinal studies carried out with pre-post intervention and follow-up evaluation. Each will be assigned a control group.

Each study uses a robotic therapeutic assistant as a mediator and game partner to carry out activities using serious games and Video Modelling strategies tailored to the participant's needs and support levels. The goal is to achieve an attainable and desirable outcome for the specific demographic of children participating in the sessions by adapting each activity to the child's characteristics and impairments. The individuals selected to participate in the study are children 6 to 16 years old who received a diagnosis of autism according to the DSM-5 diagnostic criteria and did not present any

co-occurrent medical or neurological condition at the moment of the study. Therefore, in the first study, a group of children with a level 1 support diagnosis will participate in interventions aimed at improving social interaction skills and functional communication with healthcare professionals through serious games and video modelling. On the other hand, the second study will involve children with higher support needs (levels 2 and 3) who will participate in sessions employing Video-Prompting (VP) techniques.

The robot's role as mediator in the therapeutic setting expands with the implementation of Artificial Intelligence algorithms for behavioural understanding to infer markers of discomfort and advise the therapists about the child manifesting signals of distress and anxiety. This measurement will be useful to caregivers and therapists to monitor and prevent possible meltdown episodes or emotional distress during the sessions. At any moment, the therapist will have control over the robot's actions and can intervene by choosing stimuli classified as pleasant to assist in reducing stress levels and calming children. To select the robots to adopt for the interventions, it has been considered that robots used in therapies with autistic children should possess a specific set of characteristics [11, 16, 17]. Besides implementing sensors and software to recognise gestures and emotions and engage in the activities, it must also satisfy particular design requirements[33]. These specifications include a height that mirrors that of a child or a seated adult[28], a somewhat human-like physical appearance with pronounced social features to avoid triggering the Uncanny Cliff[3]. It is equally important for the robot to be equipped with the capability to process tactile inputs [8] and characteristics that enable it to convey non-verbal communication[18], such as through expressive gestures and the display of images. The activities will also be supported by an interface accessible to the operators through smartphones, tablets, and PCs, which will allow them to select the proper game or video to play according to the session plan and the therapy stage.

### 3.4 Outcome Evaluation

The effectiveness of the interventions will be evaluated using pre-intervention, post-intervention, and follow-up assessments to track the retention of skills learned, and these results will be compared with those of a control group. The robot will collect behavioural data through its sensors, including video cameras, microphones, and other sensors. This data will help customize the intervention according to the individual's needs and monitor the frequency and duration of eye contact, identify the individual's dominant emotions, and detect early signs of potential meltdown episodes.(see Figure 1).

Pre-post and follow-up evaluations will be conducted to estimate the state and eventual progress of the children participating in the studies. The evaluation includes examining cognitive functions, how well someone interacts socially, and their communication quality with medical staff. It also looks at emotional and physical self-awareness, including how well they manage personal care, their behaviour and willingness to cooperate with healthcare providers, and their level of anxiety or fear when facing medical treatments. During the interventions, some typical behaviours of ASD individuals will be measured to define standardised objectives and metrics for each participant in order to monitor each one's progress over time. Computer Vision and Artificial Intelligence techniques will be used to evaluate the distance between the children's actions and the target behaviour expected for the activity and estimate their emotional status. Furthermore, through the analysis of prosody, the robot is expected to infer signals of distress and anxiety and prevent meltdowns.

### 3.5 Expected Outcomes

As mentioned, the project involves two longitudinal studies designed to accommodate the difference in support needs of the two groups of participants, setting realistic and achievable goals for each group, considering their level of support and their eventual impairments. The expected results differ from the first and second studies based on the same premises. In the first study, involving autistic individuals diagnosed with level 1 support needs, we expect a significant improvement in collaboration and functional communication of health status with the doctor. In addition, enhanced social interactions and the development of adaptive skills will lead to a reduction in anxiety levels. In the second study, involving autistic individuals diagnosed with level 2 and 3 support needs, we anticipate a substantial development in personal care and adaptive daily skills. Furthermore, collaboration with doctors is expected to improve due to enhanced social interaction skills, which will lead to a reduction in anxiety levels.

## 4 CONCLUSIONS

In conclusion, the "FeelGood!" project, which leverages the capabilities of social robots, Video Modelling (VM), and serious games, aims to address the significant challenges that autistic children face during medical appointments. The project proposes a practical method to design solutions fostering communication between ASD individuals and healthcare professionals, potentially mitigating unexpressed health issues. One of the strengths of this project is the evaluation of prior verbal skills via standardized assessment to tailor activities for each participant according to their needs, offering achievable and effective interventions for all the recognized support levels (1, 2 and 3). The expected outcomes include enhanced health communication, reduced anxiety during visits, and a more comfortable experience for both the children and their healthcare providers. The "FeelGood!" innovative approach, introducing technology for personalised therapeutic interventions, reflects a deep understanding of the unique needs of autistic individuals. The use of social robots not only facilitates therapy sessions by enhancing the participation and engagement of the children but also enables continuous monitoring and assessment of the child's progress. This data-driven approach ensures that the children receive the most appropriate and beneficial support. Furthermore, it showcases the potential of technology-assisted interventions in enhancing therapeutic outcomes. Aiming to prevent meltdowns and addressing a wide variety of needs underscores the complexity of autism and the necessity for innovative solutions to improve the quality of life for autistic people. It highlights the importance of a multidisciplinary

[3]This concept suggests that ASD individuals may have a unique perception of the uncanny valley phenomenon, indicating atypical focus point that causes the discomfort in front of a humanoid object [33].

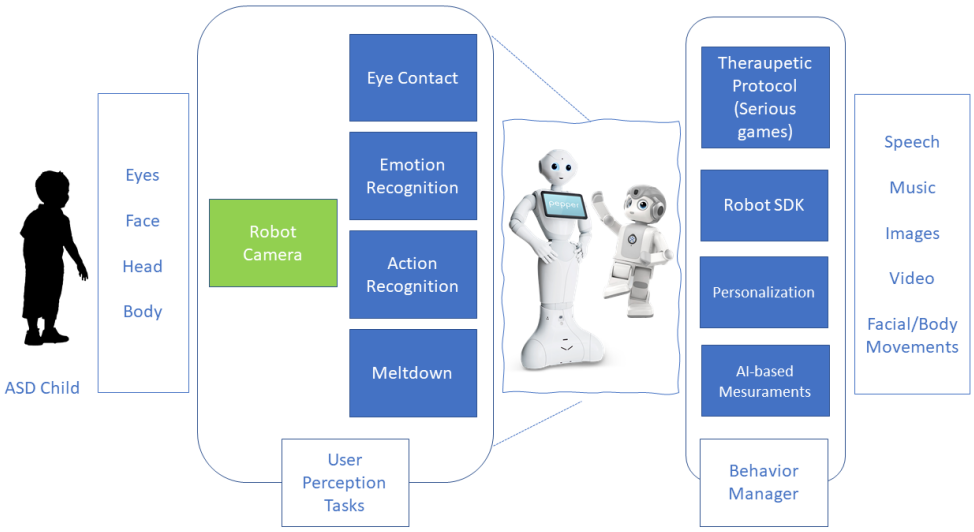


**Figure 1: A Schema of the FeelGood! Architecture**

approach and direct collaboration with patients and other stakeholders in developing innovative solutions that address the variety of needs associated with ASD, facing the challenges simultaneously from multiple points of view. As this project progresses, it will be essential to closely monitor its impact and outcomes, continually refining and adapting the approach based on feedback and results. The insights gained from the "Feel Good" project could inform future initiatives, contributing to the broader field of autism care and support. Ultimately, the success of this project could pave the way for broader adoption of similar technologies in therapeutic settings, benefiting autistic individuals with varying support needs.

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## REFERENCES

[1] Fadi Abu-Amara, Ameur Bensefia, Heba Mohammad, and Hatem Tamimi. 2021. Robot and virtual reality-based intervention in autism: a comprehensive review. *International Journal of Information Technology* 13 (10 2021), 1879–1891. Issue 5. https://doi.org/10.1007/s41870-021-00740-9

[2] Amal Alabdulkareem, Noura Alhakbani, and Abeer Al-Nafjan. 2022. A Systematic Review of Research on Robot-Assisted Therapy for Children with Autism. *Sensors* 22 (1 2022), 944. Issue 3. https://doi.org/10.3390/s22030944 Number: 3 Publisher: Multidisciplinary Digital Publishing Institute.

[3] Nuria Aresti-Bartolome and Begonya Garcia-Zapirain. 2014. Technologies as Support Tools for Persons with Autistic Spectrum Disorder: A Systematic Review. *International Journal of Environmental Research and Public Health* 11 (8 2014), 7767–7802. Issue 8. https://doi.org/10.3390/ijerph110807767

[4] American Psychiatric Association. 2022. *Diagnostic and Statistical Manual of Mental Disorders: Fifth Edition Text Revision DSM-5-TR™*. Vol. 5.

[5] Scott Bellini and Jennifer Akullian. 2007. A Meta-Analysis of Video Modeling and Video Self-Modeling Interventions for Children and Adolescents with Autism Spectrum Disorders. *Exceptional Children* 73 (4 2007), 264–287. Issue 3. https://doi.org/10.1177/001440290707300301

[6] Jaishankar Bharatharaj, Loulin Huang, Rajesh Mohan, Ahmed Al-Jumaily, and Christian Krägeloh. 2017. Robot-Assisted Therapy for Learning and Social Interaction of Children with Autism Spectrum Disorder. *Robotics* 6 (3 2017), 4. Issue 1. https://doi.org/10.3390/robotics6010004 Number: 1 Publisher: Multidisciplinary Digital Publishing Institute.

[7] Stefania Brighenti, Federico Buratto, Fernando Vito Falcone, Cristina Gena, Claudio Mattutino, and Matteo Nazzario. 2022. Social Assistive Robotics for Autistic Children. arXiv:2209.12289 [cs.RO]

[8] Rachael Bevill Burns, Hasti Seifi, Hyosang Lee, and Katherine J. Kuchenbecker. 2020. Getting in touch with children with autism: Specialist guidelines for a touch-perceiving robot. *Paladyn, Journal of Behavioral Robotics* 12 (12 2020), 115–135. Issue 1. https://doi.org/10.1515/pjbr-2021-0010

[9] Berardina De Carolis and Domenico Argentieri. 2020. iBall to Swim. *Proceedings of the International Conference on Advanced Visual Interfaces*, 1–5. https://doi.org/10.1145/3399715.3399917

[10] Berardina De Carolis, Nicola Macchiarulo, Francesca D'Errico, and Giuseppe Palestra. 2021. Social Robots to Support Gestural Development in Children with Autism Spectrum Disorder. *Companion Publication of the 2021 International Conference on Multimodal Interaction*, 376–380. https://doi.org/10.1145/3461615.3485421

[11] Berardina De Carolis, Nicola Macchiarulo, Francesca D'Errico, and Giuseppe Palestra. 2021. Social Robots to Support Gestural Development in Children with Autism Spectrum Disorder. *Companion Publication of the 2021 International Conference on Multimodal Interaction*, 376–380. https://doi.org/10.1145/3461615.3485421

[12] Melinda Y. Chang, Danielle Doppee, Fei Yu, Claudia Perez, Anne L. Coleman, and Stacy L. Pineles. 2021. Prevalence of Ophthalmologic Diagnoses in Children With Autism Spectrum Disorder Using the Optum Dataset: APopulation-Based Study. *American Journal of Ophthalmology* 221 (1 2021), 147–153. https://doi.org/10.1016/j.ajo.2020.08.048

[13] Valerio Cietto, Cristina Gena, Ilaria Lombardi, Claudio Mattutino, and Chiara Vaudano. 2018. Co-designing with kids an educational robot. In *2018 IEEE Workshop on Advanced Robotics and its Social Impacts (ARSO)*. 139–140. https://doi.org/10.1109/ARSO.2018.8625810

[14] David Cihak, Paul A. Alberto, Teresa Taber-Doughty, and Robert I. Gama. 2006. A Comparison of Static Picture Prompting and Video Prompting Simulation Strategies Using Group Instructional Procedures. *Focus on Autism and Other Developmental Disabilities* 21 (5 2006), 89–99. Issue 2. https://doi.org/10.1177/10883576060210020601

[15] Rossana Damiano, Cristina Gena, Andrea Maieli, Claudio Mattutino, Alessandro Mazzei, Elisabetta Miraglio, and Giulia Ricciardiello. 2022. UX Personas for defining robot's character and personality. *Anonymous Journal* (3 2022). http://arxiv.org/abs/2203.04431

[16] Cristina Gena, Rossana Damiano, Claudio Mattutino, Alessandro Mazzei, Andrea Meirone, Loredana Mazzotta, Matteo Nazzario, Valeria Ricci, Stefania Brighenti, Federica Liscio, and Francesco Petriglia. 2023. Preliminary results of a therapeutic

lab for promoting autonomies in autistic children. arXiv:2305.02982 [cs.RO]
[17] Cristina Gena, Claudio Mattutino, Stefania Brighenti, Andrea Meirone, Francesco Petriglia, Loredana Mazzotta, Federica Liscio, Matteo Nazzario, Valeria Ricci, Camilla Quarato, Cesare Pecone, and Giuseppe Piccinni. 2022. Sugar, Salt and Pepper – Humanoid robotics for autism. arXiv:2203.07543 [cs.RO]
[18] Cristina Gena, Claudio Mattutino, Andrea Maieli, Elisabetta Miraglio, Giulia Ricciardiello, Rossana Damiano, and Alessandro Mazzei. 2021. Autistic Children's Mental Model of an Humanoid Robot. *Adjunct Proceedings of the 29th ACM Conference on User Modeling, Adaptation and Personalization*, 128–129. https://doi.org/10.1145/3450614.3463422
[19] Charline Grossard, Ouriel Grynspan, Sylvie Serret, Anne-Lise Jouen, Kevin Bailly, and David Cohen. 2017. Serious games to teach social interactions and emotions to individuals with autism spectrum disorders (ASD). *Computers and Education* 113 (10 2017), 195–211. https://doi.org/10.1016/j.compedu.2017.05.002
[20] Charline Grossard, Giuseppe Palestra, Jean Xavier, Mohamed Chetouani, Ouriel Grynszpan, and David Cohen. 2018. ICT and autism care: state of the art. *Current opinion in psychiatry* 31 (11 2018), 474–483. Issue 6. https://doi.org/10.1097/YCO.0000000000000455
[21] Vasiliki Holeva, V. A. Nikopoulou, C. Lytridis, C. Bazinas, P. Kechayas, G. Sidiropoulos, M. Papadopoulou, M. D. Kerasidou, C. Karatsioras, N. Geronikola, G. A. Papakostas, V. G. Kaburlasos, and A. Evangeliou. 2024. Effectiveness of a Robot-Assisted Psychological Intervention for Children with Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders* 54 (2 2024), 577–593. Issue 2. https://doi.org/10.1007/s10803-022-05796-5
[22] Micah O. Mazurek, Eleonora Sadikova, Nancy Cheak-Zamora, Amber Hardin, Kristin Sohl, and Beth A. Malow. 2023. Health Care Needs, Experiences, and Perspectives of Autistic Adults. *Autism in Adulthood* 5, 1 (2023), 51–62. https://doi.org/10.1089/aut.2021.0069 arXiv:https://doi.org/10.1089/aut.2021.0069
[23] Kathleen McCoy and Emily Hermansen. 2007. Video Modeling for Individuals with Autism: A Review of Model Types and Effects. 30 (2007), 183–213. Issue 4. https://www.jstor.org/stable/42899952 Publisher: West Virginia University Press.
[24] Maria Mody and John W. Belliveau. 2012. Speech and Language Impairments in Autism: Insights from Behavior and Neuroimaging. *American Chinese Journal of Medicine and Science* 5 (2012), 157. Issue 3. https://doi.org/10.7156/v5i3p157
[25] Rae Morris, Andrea Greenblatt, and Michael Saini. 2019. Healthcare Providers' Experiences with Autism: A Scoping Review. *Journal of Autism and Developmental Disorders* 49 (6 2019), 2374–2388. Issue 6. https://doi.org/10.1007/s10803-019-03912-6
[26] Alessandro Di Nuovo, Daniela Conti, Grazia Trubia, Serafino Buono, and Santo Di Nuovo. 2018. Deep Learning Systems for Estimating Visual Attention in Robot-Assisted Therapy of Children with Autism and Intellectual Disability. *Robotics* 7 (6 2018), 25. Issue 2. https://doi.org/10.3390/robotics7020025
[27] Maria Chiara Pino, Francesco Masedu, Roberto Vagnetti, Margherita Attanasio, Chiara Di Giovanni, Marco Valenti, and Monica Mazza. 2020. Validity of Social Cognition Measures in the Clinical Services for Autism Spectrum Disorder. *Frontiers in Psychology* 11 (2 2020). https://doi.org/10.3389/fpsyg.2020.00004
[28] Mohd.A. Saleh, Habibah Hashim, N N Mohamed, Ali Almisreb, and Benjamin Durakovic. 2020. Robots and autistic children: a review. *Periodicals of Engineering and Natural Sciences* 8 (2020), 1247–1262. Issue 3. https://doi.org/10.21533/pen.v8i3.1457.g610
[29] Sunagül Sani-Bozkurt and Gulden Bozkus-Genc. 2023. Social Robots for Joint Attention Development in Autism Spectrum Disorder: A Systematic Review. *International Journal of Disability, Development and Education* 70 (7 2023), 625–643. Issue 5. https://doi.org/10.1080/1034912X.2021.1905153
[30] Iris Schneid and Aviad E. Raz. 2020. The mask of autism: Social camouflaging and impression management as coping/normalization from the perspectives of autistic adults. *Social Science and Medicine* 248 (3 2020), 112826. https://doi.org/10.1016/j.socscimed.2020.112826
[31] Maria Strömberg, Lina Liman, Peter Bang, and Kajsa Igelström. 2022. Experiences of Sensory Overload and Communication Barriers by Autistic Adults in Health Care Settings. *Autism in Adulthood* 4, 1 (2022), 66–75. https://doi.org/10.1089/aut.2020.0074 arXiv:https://doi.org/10.1089/aut.2020.0074
[32] Laura Turriziani, Arianna Ricciardello, Francesca Cucinotta, Fabiana Bellomo, Giada Turturo, Maria Boncoddo, Silvestro Mirabelli, Maria Luisa Scattoni, Maddalena Rossi, and Antonio M. Persico. 2022. Gut mobilization improves behavioral symptoms and modulates urinary p-cresol in chronically constipated autistic children: A prospective study. *Autism Research* 15 (1 2022), 56–69. Issue 1. https://doi.org/10.1002/aur.2639
[33] Yuki Ueyama. 2015. A Bayesian Model of the Uncanny Valley Effect for Explaining the Effects of Therapeutic Robots in Autism Spectrum Disorder. *PLOS ONE* 10 (9 2015), e0138642. Issue 9. https://doi.org/10.1371/journal.pone.0138642
[34] Kate E. Wallis, Daniel Fichter, and Alexander G. Fiks. 2023. In Support of Addressing Sensory Differences to Improve Preventive Dental Care Among Autistic Children. *JAMA Network Open* 6, 6 (06 2023), e2316355–e2316355. https://doi.org/10.1001/jamanetworkopen.2023.16355 arXiv:https://jamanetwork.com/journals/jamanetworkopen/articlepdf/2805518/wallis_2023_ic_230081_1684861147.22846.pdf
[35] Connie Wong, Samuel L. Odom, Kara A. Hume, Ann W. Cox, Angel Fettig, Suzanne Kucharczyk, Matthew E. Brock, Joshua B. Plavnick, Veronica P. Fleury, and Tia R. Schultz. 2015. Evidence-Based Practices for Children, Youth, and Young Adults with Autism Spectrum Disorder: A Comprehensive Review. *Journal of Autism and Developmental Disorders* 45 (7 2015), 1951–1966. Issue 7. https://doi.org/10.1007/s10803-014-2351-z
[36] S Önol and Z Kırzıoğlu. 2018. Evaluation of oral health status and influential factors in children with autism. *Nigerian Journal of Clinical Practice* 21 (2018), 429. Issue 4. https://doi.org/10.4103/njcp.njcp_41_17