

자폐 스펙트럼 장애 아동의 사회적 소통 능력 증진을 위한 모아(母兒) 관계 중심의 가정용 VR 소프트웨어

At Home VR Software for Children with Autistic Spectrum Disorder to Enhance Social Communication Skills through Mother and Child Based Interaction

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1. Introduction

This paper suggests VR therapy software for children with ASD (Autistic Spectrum Disorder), which abides by the principles of ABA (Applied Behavioral Analysis) through mother and child-based interaction. ASD is a neurodevelopment disorder that manifests deficiency in social communication skills as its core impairment (Hong. K.-e, 2014, pp. 146-149). We have selected ABA as our fundamentals of the software, for it is proven to be the most efficient treatment to ameliorate the symptoms among diverse options (Lovaas, 1987), (Masi, A., et al, 2017). However, the current state of ABA therapy has critical challenges regarding formidable expense and inaccessibility (Masi, A., et al, 2017). Moreover, considering the etiological cause of the core impairment of ASD, induced as a result of insufficient communal experience between the mother and child (Hong. K.-e, 2014, pp. 146-149), the mother's absence during medical center-based ABA therapy needs revision. We have developed a prototype software using VR, which has four

significant features taking these overriding issues into account.

2. Body

2.1 Program Description

The program we developed is prototype VR software that aims to enhance social communication skills for children with ASD. By providing a chance encounter situation at a corridor that everyone is likely to confront daily, we intend to reach three learning objectives of basic greeting, emotion interpretation, and emotion expression.



<그림 1> Mockup of User's Point of View Greeting the Counterparts (Cartoonfactory, 2017), (Cartoonfactory, 2017), (Meta Platforms, 2021) in the Original Virtual Space

The user will meet two counterparts who greet the user in a simple hallway. We selected different age group and gender to diversify the counterparts for the user to practice real-life situations meeting strangers. Moreover, considering that children with ASD are very susceptible to external stimulation (Autism Speaks, n.d., p. 12), we created an original VR environment to minimize unnecessary stimulation to help the child concentrate on the learning objectives. The three learning objectives are provided in three-phased learning courses. A guideline thoroughly designed by medical experts will be provided to help the mother supervise the entire course abiding by the principles of ABA. The chance encounter situation will be repeated when the child shows an incorrect response or does not react in time. However, when the child shows a correct response in time, the mother will offer the child a reinforcer (physical contact and compliments). To implement this interaction, the mother will observe the child's point of view

through a computer monitor and manipulate the learning course in real-time. Simultaneously, the child will carry out the learning process beside the mother.

2.2 User Target

The user group targeted for this software is children with ASD who have developed receptive language, but have distinctive impairments in expressive language. We did not sort the age range because the gravity of deficiency varies considerably by individuals. Since the age cannot be defined concretely, we offer a standard based on the objective severity of ASD. According to the APA (American Psychological Association), the severity can be classified following the level of deficiency of social communication skills and restricted, repetitive behavior (Masi, A., et al, 2017). The severity of the user group's impairment, which the program targets, is the 'Level 1 Requiring Support' provided in (Masi, A., et al, 2017).

2.3 Significant Features of Our Software

The former preceding researches and commercialized products present valuable features for people with ASD, but also carry some breaking points. However, our program possesses four significant features that make the research meaningful.

- 1) Vitalization of Mother and Child based Interaction
: Targets to alleviate the core deficiency considering the etiology of ASD.
- 2) Easiness of Dissemination
: When digitized by VR, the replicability of the software will ameliorate the expense and accessibility.
- 3) Modifiable Stimulation
: Considering that children with ASD tend to resist change and are edgy to sensory input in reality (Autism Speaks, n.d., p. 12), our software can provide an optimized environment for the child to focus and gradually adapt.
- 4) Expandable Learning Environment
: Unlike offline medical centers, VR software can offer various surroundings and even give access to dangerous environments such as crosswalks for educational use.

3. Conclusion

Our paper provides a distinct approach by conducting an ‘At Home VR Therapy’ based on the ‘Mother and Child Interaction.’ At the same time, we are aware of extant obstacles, such as motion sickness and amblyopia that the HMD (Head Mount Device) possesses. However, considering the VR industry’s rapid development, we believe these technical problems will be resolved shortly. Henceforth, we plan to specify the therapy program’s guidelines with a medical expert and structure the technical details to ensure the replicability of the program. Moreover, after passing the IRB (Institutional Review Board), we plan to conduct a clinical demonstration to verify the program’s efficacy.

The further plan to enhance the program is to phase not only the learning objectives but phasing the learning space analogously to the natural environment to progressively apply the user’s learning objectives in real life.

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References

- Hong, K.-e (2014). Korean Textbook of Child Psychiatry (pp. 146–149). Seoul, Seoul: Hakjisa.
- Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of consulting and clinical psychology*, 55(1):3. doi:10.1037/0022-006X.55.1.3
- Masi, A., et al. (2017). An overview of autism spectrum disorder, heterogeneity and treatment options. *Neuroscience bulletin*, 33(2): 183–193. doi:10.1007/s12264-017-0100-y
- Autism Speaks. (n.d.). Autism Speaks 100-Day Kit (p. 12). Retrieved from https://www.autismspeaks.org/sites/default/files/100_day_kit_korean.pdf
- CartoonFactory. (2017). Cartoon Girl Rigged [3D Model]. LA; Turbosquid. Retrieved from <https://www.turbosquid.com/ko/3d-models/3d-cartoon-girl-rigged-1317956>
- CartoonFactory. (2017). Cartoon Man Rigged [3D Model]. LA; Turbosquid. Retrieved from <https://www.turbosquid.com/ko/3d-models/3d-cartoon-man-rigged-1213928>
- Meta Platforms. (2021). Horizon Worlds [Video]. CA; Meta Platforms. Retrieved from <https://www.oculus.com/horizon-worlds/>