Social Companionship for Children with Autism: A VR System with Force-thermal Feedback and Immersive Visual Display

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Research Background: Autism spectrum disorder (ASD) is a neurodevelopmental disorder and the present global prevalence of child autism is severe. Companion methods are typically time-, resource-, and labor intensive, and can put substantial strain on families and caregivers. Technology-based interventions, and virtual reality systems in particular, for ASD have been emerging as a potential approach for reducing the heavy burdens on their families. Research Purpose: This project applies haptic feedback and virtual reality technologies to accompany children with autism, aiming to explore how to motivate children's active communication desire through haptic interaction tasks, activate both sensorimotor cortex and cognitive brain network including attentional and emotional brain network, and thus achieve the purpose of accompanying autism children. Research Procedures: Neuroscience literature survey, ASD articles survey, haptic feedback glove survey, mechanics modeling and manufacturing of a force and thermal feedback haptic glove, single-chip microcomputer control system programming and debugging, designing interaction scenarios based on social psychology, VR software development, development of virtual scene based on the Pepper Pig's home as the theme, and the experiment was carried out by 8 autistic children. Experimental Data: Soft haptic glove can achieve 0-4N force feedback and 0-60℃ temperature feedback, supporting natural interaction gestures with five fingers. Conclusion: Based on social psychology, interaction scenarios with gradual difficulty levels are designed, and a VR system with audio-visual-haptic multisensory feedback is constructed, which can enhance the autonomous communication intention of autistic children and accompany them.