Painting Wonderland:

Multimodal Interaction in Digital Therapeutics for Children with ASD

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1 Introduction

Collaboration among stakeholders, technologies, and environments can improve the social well-being of children with Autism Spectrum Disorder (ASD) [1]. However, the mechanisms driving the interactions between individuals, technology, and therapeutic environments remain underexplored.

This study introduces a multimodal collaborative design approach integrating children with ASD, stakeholders, technologies, and scenes. Through the development of Painting Wonderland, a digital therapeutics (DTx) system, we explored pathways to enhance social interaction in human-computer relationships.

2 Methodology

We created a multimodal collaborative design approach that integrates interactions among children with ASD and different modalities to enhance their perception, cognition, and behavior. Following Fogg's Behavior Model, the design process consists of three stages: motivation activation, capability adaptation, and condition optimization [2].

- Develop a DTx system
- Administer questionnaire surveys and conduct expert interviews
- Perform user experience experiments for children with ASD

Category	Elements	
Motivation Layer	Visual	Auditory
	Tactile	Scene
Ability Layer	Stage tasks	Immediate responses
	Adaptive tools	Inclusive experiences
Prompt Layer	Prompt mechanisms	Reward modes
	Evaluation systems	Feedback functions

Table. Hierarchy and design elements of the multimodal collaborative design approach

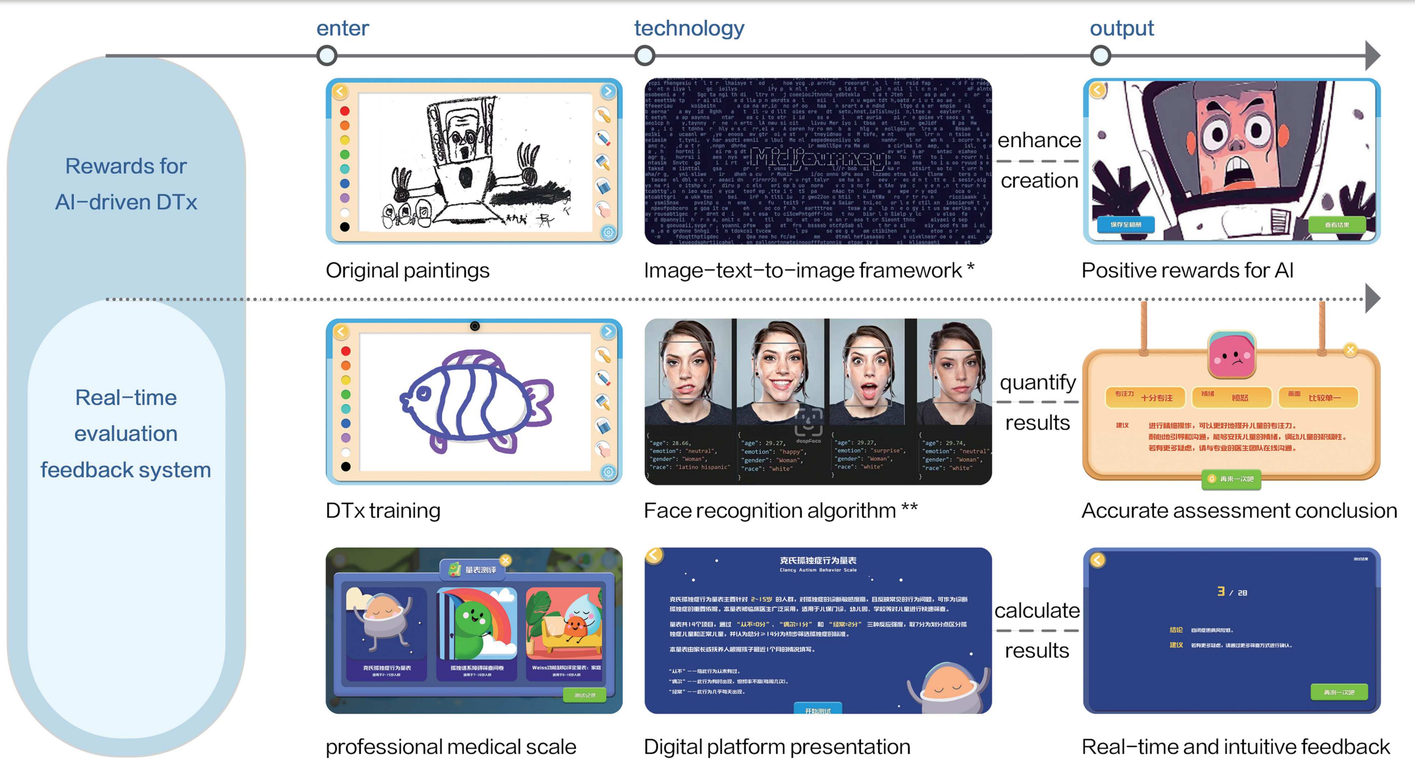
3 Application of Painting Wonderland

Painting Wonderland is a multimodal DTx system for children with ASD, designed to aid rehabilitation workers in dynamic treatment and behavior change through a screening——intervention——feedback——re-screening process. It utilizes AI image generation to enhance participation, facial recognition technology to assess children's states accurately, and integrates parental and doctor modes for remote digital therapy.

The process of collecting and processing multimodal data from children with ASD in Painting Wonderland is shown in the figure.

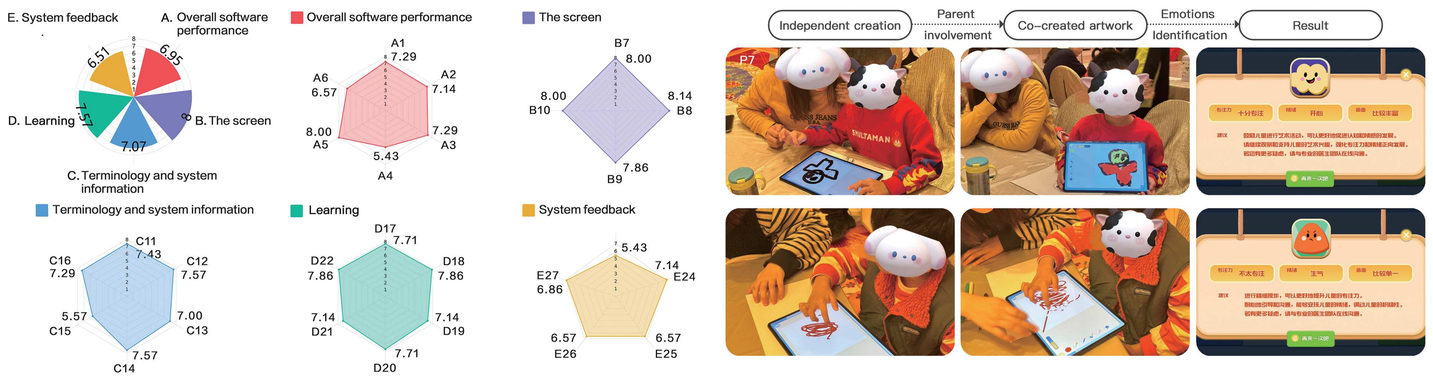
*Picture from Midjourney official website.

**Picture from DeepFace official website.



4 Results

- From experts' perspectives, Painting Wonderland is an auxiliary rehabilitation tool that simplifies DTx and fosters parent-child relationships. For children with ASD, it feels more like a fun game than a traditional therapeutic resource.
- The multimodal collaborative design method enhances the sensory aspects of DTx and enables remote connections between families and treatment institutions. Furthermore, AI's role as a stakeholder strengthens collaborative networks, providing additional support for children with ASD.



- Experts were quite satisfied with the overall performance of Painting Wonderland (M=6.95).
- 6/10 participants showed positive emotions in Painting Wonderland with their parents.

5 Conclusion

The DTx system, Painting Wonderland, explores behavioral expressions in children with ASD during multimodal interactions and their impact on social engagement. The multimodal collaborative design approach fosters connections among individuals, technology, and the environment. By leveraging the collaborative potential of design, it creates platforms for shared actions that center on individuals and enhance societal well-being.

6 References

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