

Neural Buffering via Virtual Intervention: Assessing the Efficacy of Immersive Simulations on Adolescent Social Resilience and Decision-Making

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Introduction

Literature Review: Chronic peer rejection during formative adolescent years is more than a social hurdle; it fundamentally alters neural development and often results in long-term psychological distress. Prior research using the Cyberball task and fMRI has monitored activity in the dorsal anterior cingulate cortex (dACC) to observe how virtual support influences the brain's reaction to exclusion. Specifically, individuals with a history of chronic rejection exhibit heightened activity in the dACC during exclusion tasks, confirming a biological sensitivity to social pain (Masten et al., 2013). Furthermore, access to virtual social support has been shown to effectively lower these neural distress levels (Stallmann et al., 2023)

The Present Study: This research seeks to utilize a digital intervention design to promote thoughtful sexual attitudes and responsible sexual behaviors among adolescents. We investigate how a digital game can serve as a tool to improve decision-making regarding sexual health, as well as how peer influences relate to decision-making. We explore whether digital interventions can improve sexual self-efficacy and decision-making skills to improve social competence.

Methodology

This project employs a dual-methodology involving a cross-sectional study and a separate intervention study. All surveys and activities are administered in an online, asynchronous format.

Study 1: Cross-Sectional Study

- Goal: To understand what shapes how young people think and feel about sex and relationships.
- Focus: Examining the relationship between sexual self-efficacy, sexual attitudes, and factors such as decision-making competency, peer norms, and parental autonomy.
- Participants: 100 participants.
- Assessment: A one-time online survey involving assessments of demographic information, sexual self-efficacy, and overall well-being.

Study 2: Intervention Study

- Participants: 50 college students (aged 18+) randomly assigned to either an intervention or control group.
- The "Zen" Intervention: An interactive, story-based digital game set in a coffee shop environment.
- Game Mechanics: Participants navigate three scenarios in which they make choices for their character about friendships, relationships, and future goals. The game includes short mini-games to practice decision-making and problem-solving skills.

Experimental Design: We compare the intervention and control groups using their pre- and post-intervention data.

- Intervention Group: Completes the entry survey, plays the 1-hour game, and completes post/follow-up surveys.
- Control Group: Completes the entry survey and the post-intervention surveys without playing the game to provide a baseline for comparison.

Assessment Timeline: Surveys are completed at three time points: baseline, immediately post-intervention, and at a one-month follow-up.

Figures

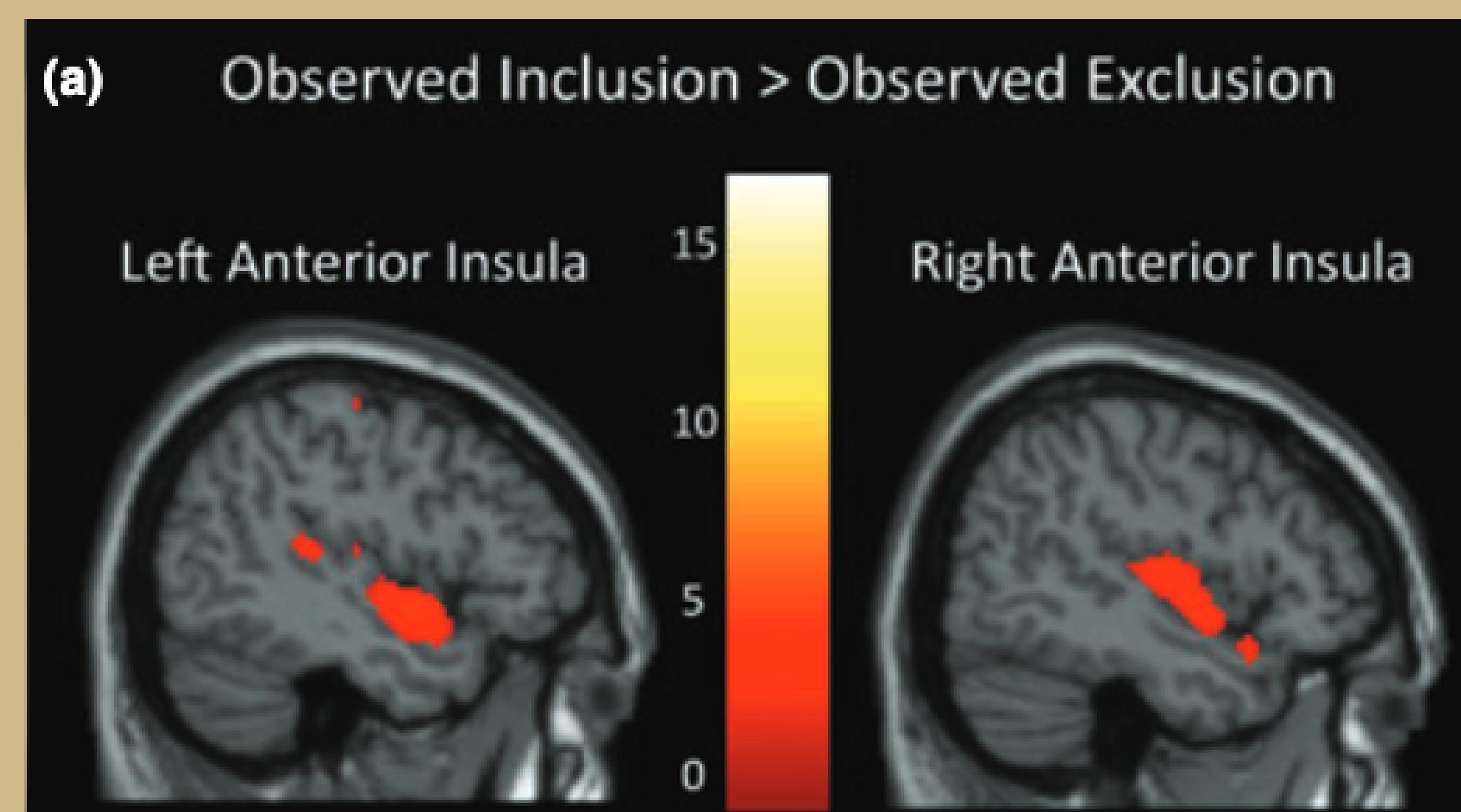


Figure 1: Adapted from Masten, C.L., Eisenberger, N.I., Pfeifer, J.H. and Dapretto, M. (2013). Neural responses to witnessing peer rejection after being socially excluded: fMRI as a window into adolescents' emotional processing. *Dev Sci*, 16: 743-759. <https://doi.org/10.1111/desc.12056>

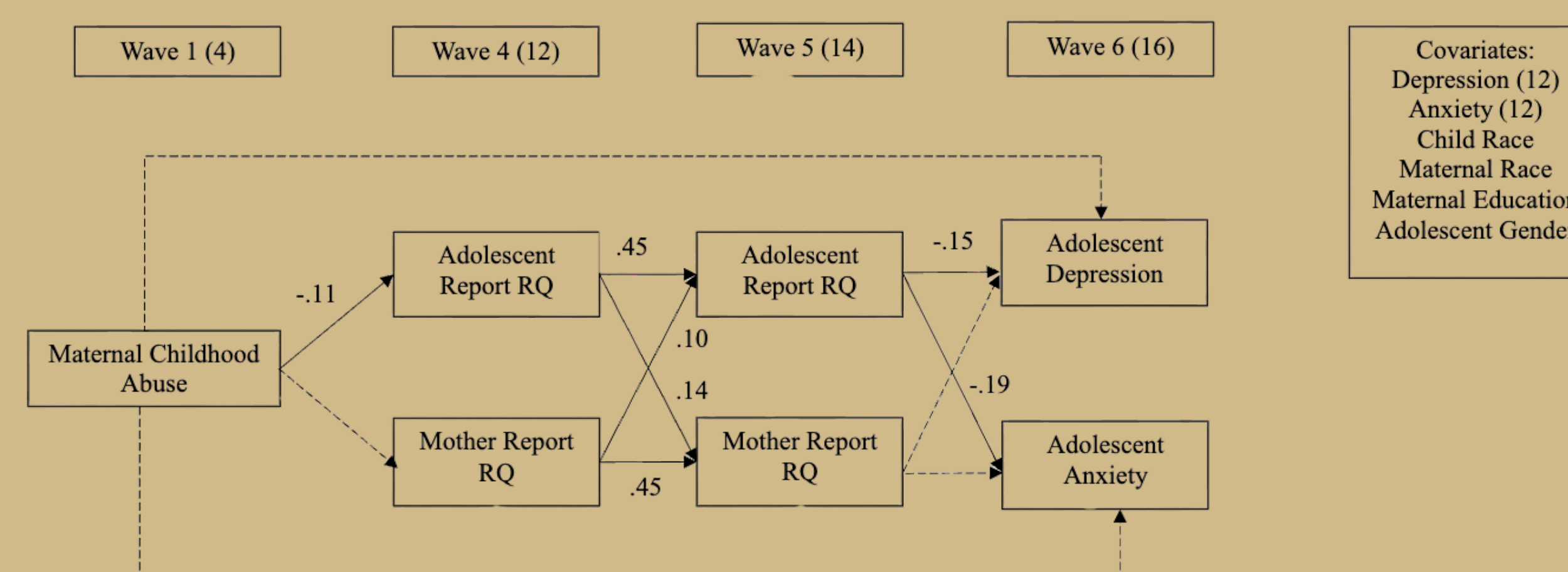


Figure 2: Adapted from Fitzgerald, M., Esplin, J., Wright, L., Hardy, N., & Gallus, K. (2022). Dyadic parent-adolescent relationship quality as pathways from maternal childhood abuse to adolescent psychopathology. *Journal of Marital and Family Therapy*, 48(3), 827-844. <https://doi.org/10.1111/jmft.12555>

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Results

Data collection is currently ongoing. Based on existing literature and preliminary frameworks, we hypothesize the following:

- Heightened Sensitivity: Prior research indicates that individuals with a history of chronic rejection exhibit heightened neural activity in the dorsal anterior cingulate cortex (dACC) during exclusion, confirming a biological sensitivity to social pain (Masten et al., 2013).
- Behavioral Gains: We predict the intervention group will show marked improvements in decision-making confidence and sexual health literacy compared to the control group.
- Practical Application: We expect participants to report feeling better equipped to resist negative peer pressure and navigate real-world relationship conflicts.
- Mediation Effects: We hypothesize that sexual self-efficacy and decision-making skills will mediate the relationship between the intervention and improved sexual attitudes.

Conclusion / Future Directions

Our preliminary framework suggests that virtual interventions provide a scalable and effective training ground for adolescent social competence.

- Educational Integration: Our goal is to implement the "Zen" game into the school curriculum as a standardized tool for teaching social-emotional skills.
- Public Awareness: We aim to use these simulations as a resource to inform the public on the importance of neural resilience.
- Future Directions: While not part of the current study, future research could include neurobiological mapping using fMRI to physically observe how this specific intervention influences the dACC's reaction to exclusion.