The Ongoing Cognitive Processing of Exclusionary Social Events: Evidence from Event-Related Potentials

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Introduction

Social Exclusion and ERPs

Social exclusion is theorized to influence cognition by reallocating attention toward exclusion and away from other processes. Accordingly, this additional processing of exclusionary events should be exhibited in neural indices of attention allocation.

- Previous research has shown N2 differences at the moment that an individual can identify being included or excluded within an ongoing social interaction regardless of the larger nature of the social exchange.
- Further, research has shown that exclusion draws attention away from other cognitive control processes, suggesting that additional processing of exclusionary events should be evidenced in ongoing interactions.

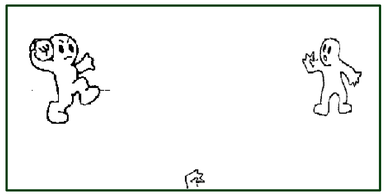
Current Study

To examine the potential of ongoing differences in neural activity following social exclusion, we utilized the Cyberball paradigm to assess participants' event-related brain potentials (ERPs) to both inclusionary and exclusionary events occurring within two social interaction blocks (inclusion, exclusion). Each event consisted of a series of throw frames that showed a ball moving across the screen from player to player. This study specifically examined the frame following the informational frame that informed participants about the recipient of the throw.

Procedure

Cyberball Paradigm

- Participants completed two blocks of the Cyberball paradigm, throwing the ball with the other players. In each interaction, the human participant was represented by the hand at the bottom of the screen (see below).
  - In the first block (inclusion), participants had an equal probability of receiving the ball as the other players throughout the interaction.
  - In the second block (exclusion), participant had an equal chance of receiving the ball for the first 20 throws, but were then ignored for the remainder of the interaction.

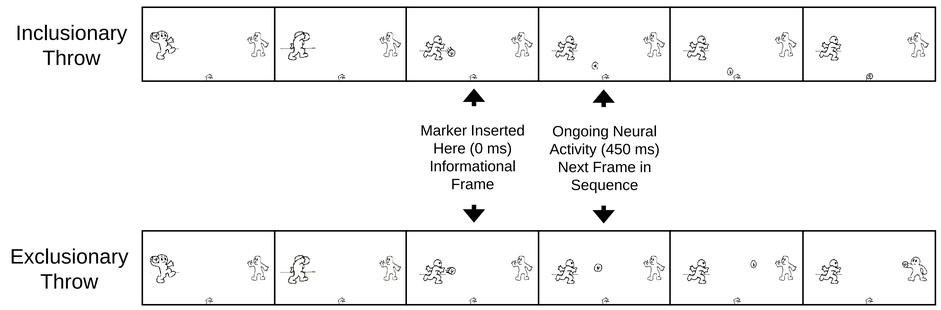


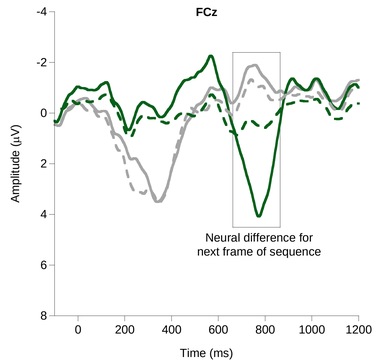
Neural Assessment – Informational Frame

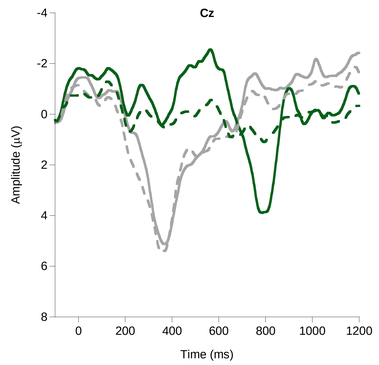
- EEG activity was measured from 64 midline and lateral sites.
- N2 was quantified as the average negative deflecting amplitude between 200-320 ms post-stimulus at the FCz electrode site.
- P3 was quantified as the average positive deflecting amplitude between 320-450 ms post-stimulus at the Pz electrode site.
- The stimulus was defined as the first informational frame in the ball toss that indicated where the ball was being thrown. Throws to the participant were defined as inclusionary throws and throws to the computerized players were defined as exclusionary throws.

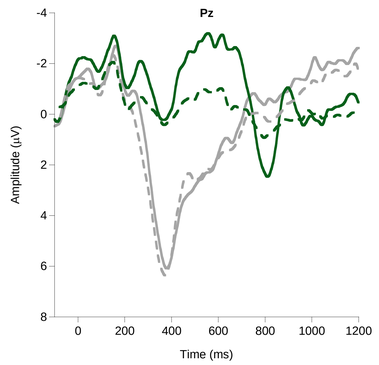
Neural Assessment – Next Frame in Sequence

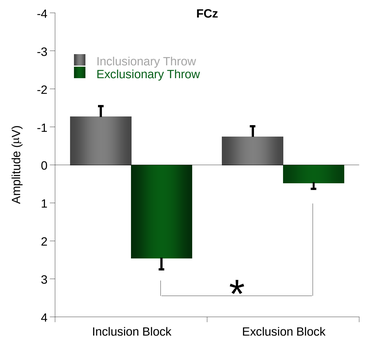
- P3 amplitude was quantified as the average activity from 660 – 860 ms following the informational frame in the stimulus-locked ERPs.











Variable	Δ P3f	Δ % Included	Δ NA	Δ STAI State	Δ BDI
Δ P3f	-----				
Δ % Included	.31*	-----			
Δ NA	-.35*	-.15	-----		
Δ STAI State	-.39*	-.21	.65*	-----	
Δ BDI	-.31*	-.28*	.42*	.44*	-----

Results

Neural Measures – Informational Frame

- Similar to previous research, both N2 and P3b amplitude showed amplitude differences for exclusionary throws compared to inclusionary throws regardless of the overall context of the social interaction, with larger (more negative) N2 amplitude and smaller (less positive) P3b amplitude for exclusionary throws compared to inclusion throws.

Neural Measures – Next Frame

- A significant throw type x Cyberball block interaction was found at Fz, FCz, and Cz, with the largest effect at FCz.
  - The interaction revealed a larger frontal P3 (P3f) amplitude for exclusionary throws in the inclusion block compared to the exclusion block and no block effect for inclusionary throws.

Relationship between Neural and Behavioral Measures

- Change scores were calculated for neural and behavioral measures obtained for each Cyberball block. Correlations revealed significant relationships between changes in P3f and changes in scores on the:
  - Percentage of perceived inclusion
  - Negative Affect (PANAS)
  - State Anxiety (STAI)
  - Beck Depression Inventory (BDI)
- In sum, larger decreases in P3f from inclusion to exclusion were associated with larger decreases in perceived inclusion and greater increases in negative affect, state anxiety, and depressive symptoms.

Conclusion

This study examined the relationship between social exclusion and event-related brain potentials. Results replicated previous research indicating both N2 and P3 differences between inclusionary and exclusionary events regardless of the larger contexts (overall inclusion, overall exclusion) of the interactions. Additional differences between inclusionary and exclusionary events were present in the next frame of the throw sequence.

- Larger frontal positivity (P3f) for exclusionary events compared to inclusionary events, with a greater P3f amplitude within the inclusion block compared to the exclusion block.
- Modulation of the P3f from inclusion to exclusion was associated with the modulation of self-reported social involvement, negative affect, state anxiety, and depression symptoms from inclusion to exclusion; indicating that the processes indexed by the P3f are enhanced when the exclusionary events do not match the larger context of the social interaction.

These findings suggest that discrete exclusionary events within social interactions are associated with additional attentional processing compared to inclusionary events and this processing is related to the degree of dissimilarity between context-driving expectancies and the specific nature of the social event.

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