Pleasure in Play: Hyperscanning Shared Card Game Experience

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EXTENDED ABSTRACT

"To be able to grasp the complexity of today's societal challenges, we need multiple perspectives and methods. A critical approach to the present requires more than a singular perspective, it needs the interdisciplinary approach of artistic and scientific research to create a better understanding and come up with solutions for the future." Gerald Bast (2022)

This interdisciplinary project investigates how game mechanics shape players' emotional, social, and neural responses — combining artistic game design, cognitive neuroscience, and empirical aesthetics to study collaboration and experience in play.

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Games and play have long been used as structured yet engaging way to investigate social interaction, cooperation, competition and prosocial behaviour, from classic experimental games to cooperative and competitive analog and digital games (e.g., Pruitt & Kimmel 1977; for review on digital games see Gonçalves et al. 2023; Zhang et al. 2025). Card and especially trick-taking card games with more than two players (e.g. German Skat or Bavarian Schafkopf) are particularly suited to this end: roles of partner and opponent often shift every round, which—from the perspective of ludic experimental investigation (Jahrmann 2024)—offers the unique opportunity to disentangle collaborative roles from individual players.

Therefore, building on traditional analog role-switching trick-taking games, the Psycholudic-Approach project team (Experimental Games Lab, University of Applied Arts Vienna) created 501, a card game with experimental game mechanics, allowing cooperative or solo play. From this a multiplayer computerized version was designed, to be employed in a three-people electroencephalography (EEG) hyperscanning paradigm (Jahrmann et al., 2025), in which brain activity of multiple individuals is recorded simultaneously during gameplay. Prior work employing hyperscanning has suggested that inter-brain synchrony, the degree to which people's brain activity aligns, during joint tasks is closely related to cooperation, shared understanding and team performance, making hyperscanning an intriguing method for studying collaboration in games (Balconi & Vanutelli 2017, Carollo et al. 2024, Czeszumski et al. 2020). However, to the best of our knowledge, this approach has only been applied once to a card game paradigm (Babiloni et al. 2007).

Against this background, our study investigated in a first step if and if so how brain activity and shared resonance of the participants–operationalized as inter-subject coupling of neural signals–can be systematically linked to game events and experience. Beyond this mapping of game events to neural and experiential responses, we ask (how) does shared brain resonance vary between cooperative and solo player roles, and to what extent may such neural coupling be shaped by individual differences (e.g. trait empathy, players preferred play style: team player vs. solo player, players game experience). Finally, we explore how affective and social wellbeing measures – such as changes in mood, prosocialness and felt connectedness – are related to both single- and shared brain activity during play, allowing us to connect specific game processes and game roles to patterns of game and social experience.

To investigate these questions, participants' brain activity (N=66) was recorded via a 32-channel EEG LiveAmp system while playing two rounds (each ≈20-minute) of 501. All event markers and EEG streams were synchronized, enabling complete reconstruction of card order, choices, and role shifts for context-dependent analyses of event-related potentials and activity. Additionally, behavioral data was collected using pre- and post-session questionnaires, assessing positive/negative mood, and general arousal, prosocialness (Caprara et al. 2005), empathic concern (Davis 1983), pictorial social closeness, perceived connectedness and collaboration, empathic concern, cognitive/affective empathy and perspective-taking (QCAE, Rainer et al. 2011) as well as participants emotional–aesthetic experience (16 items by Miller et al., 2025) during and with the game, from which one of five experience types can be derived (Harmonious, Novel, Transformative, Disengaged, Negative).

Preliminary data analysis shows consistent event-related potentials (ERPs) for game relevant actions (e.g. card turn, buttons pressed) and significant differences in ERPs

between player roles (player who played card, current player, observing player) across several electrodes in frontal, central, and lateral regions. Further, preliminary behavioral results suggest a significant increase in players positive mood (M_{pre} = 7.23, M_{post} = 8.06, t(51) = -3.00, p = .004, d_{Cohen} = 0.42), and general emotional arousal (M_{pre} = 4.47, M_{post} = 5.53, t(50) = -2.96, p = .005, d_{Cohen} = 0.41) from pre to post play, which both also survived bonferroni correction (α_{adj} = .01). However, we did not find significant overall changes for reported prosocialness, empathic concern or social closeness. Notably, when differentiating between the five emotional-aesthetic experience types (ExT), we do indeed find meaningful differences: players in the Harmonious experience type did show increased empathic concern post-play, however as only group, while Transformative ExT-Players reported feeling less close to others — highlighting that how a game is experienced, not merely that it is played, shapes its emotional and social impact. When connecting ExT to game mechanics, results showed significantly different decisions times across ExT groups, (χ^2 = 12.635, p = .013), with Novel ExT taking the longest (M = 3.951, SE = 0.339), and Harmonious the shortest, (M = 2.465, SE = 0.223). Results also showed that players' final score deviation from the average final score differed depending on ExT (F(4, 54) = 2.128, p = .090).

Together, these findings suggest that both player experience and event-specific player roles can indeed be linked to behavioral and neural responses during gameplay, offering unprecedented possibilities to investigate collaboration, risk taking, and other game-related concepts. We hope, with this study, not only to contribute to better understanding subjective responses to game mechanics and their neural correlates, but also to discover mechanisms that help in designing and testing pleasurable, collaborative play experiences that, when culturally transferred, could inform how people interact with and relate to one another and how shared play might mediate social impacts even beyond the game.

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