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Perceived Human-Likeness in Embodied AI Agents Elicits Heightened Physiological Arousal: Evidence from Linear Mixed-Effects Modeling

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ABSTRACT

Humanlike features in embodied artificial intelligence (AI) agents are theorized to evoke stronger emotional and physiological responses; however, empirical findings have been inconsistent. The present study investigated whether perceptions of human-likeness in AI agents predict autonomic arousal, using linear mixed-effects models to account for the nested structure of repeated measures. Participants (N = 92; Mage = 21.78 years, SDage = 5.15) evaluated 23 images of AI agents selected from the ABOT Database to vary in perceived human-likeness. Perceptions were assessed via a semantic differential item and used as a predictor of physiological responses, including skin conductance, heart rate, respiration rate, and blood volume pulse amplitude. Separate linear mixed-effects models were fitted for each outcome, with perceived human-likeness entered as a fixed effect and participant ID modeled as a random intercept. Greater perceived human-likeness significantly predicted increases in skin conductance ($F(1, 84.72) = 12.31$, $p < .001$) and heart rate ($F(1, 88.10) = 8.47$, $p = .005$). No significant effects emerged for respiration rate, while a marginal, non-significant trend was observed for blood volume pulse amplitude ($p = .086$). Although effect sizes were modest, the use of multilevel modeling enhanced the robustness of the findings by appropriately addressing within-subject dependencies. These results provide evidence that even subtle variations in perceived human-likeness can reliably modulate physiological arousal, offering both theoretical insights and practical implications for the design of socially engaging AI agents.

Keywords: ABOT Database; Anthropomorphism; Autonomic Arousal; Repeated Measures; Semantic Differential