Cognitive Representation in Large Language Models: Formalizing Psychological Constructs for Automated Questionnaire Generation

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Abstract

Understanding how psychological constructs are formalized into measurable representations remains a central challenge in cognitive science. This study examines large language models (LLMs) as cognitive artifacts capable of decomposing and formalizing such constructs. We evaluate LLMs' conceptual alignment with human cognition across three tasks: predicting psychological attributes from text, generating theoretical construct explanations, and creating psychometrically valid assessment items. Results show strong representational fidelity for personality traits (average r=0.582), moderate alignment for depression (r=0.515), and emerging capabilities for anxiety (r =0.259). Expert evaluations confirm that LLMs produce theoretically coherent construct explanations (mean rating=4.33/5), while generated questionnaires exhibit convergent validity with established measures. Our findings position LLMs as effective tools for exploring cognitive representation systems and suggest that theory-driven prompting enables reliable, automated questionnaire development. This work bridges AI formalization techniques with core questions in cognitive science, offering a scalable framework for studying and constructing psychological measurement tools.

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