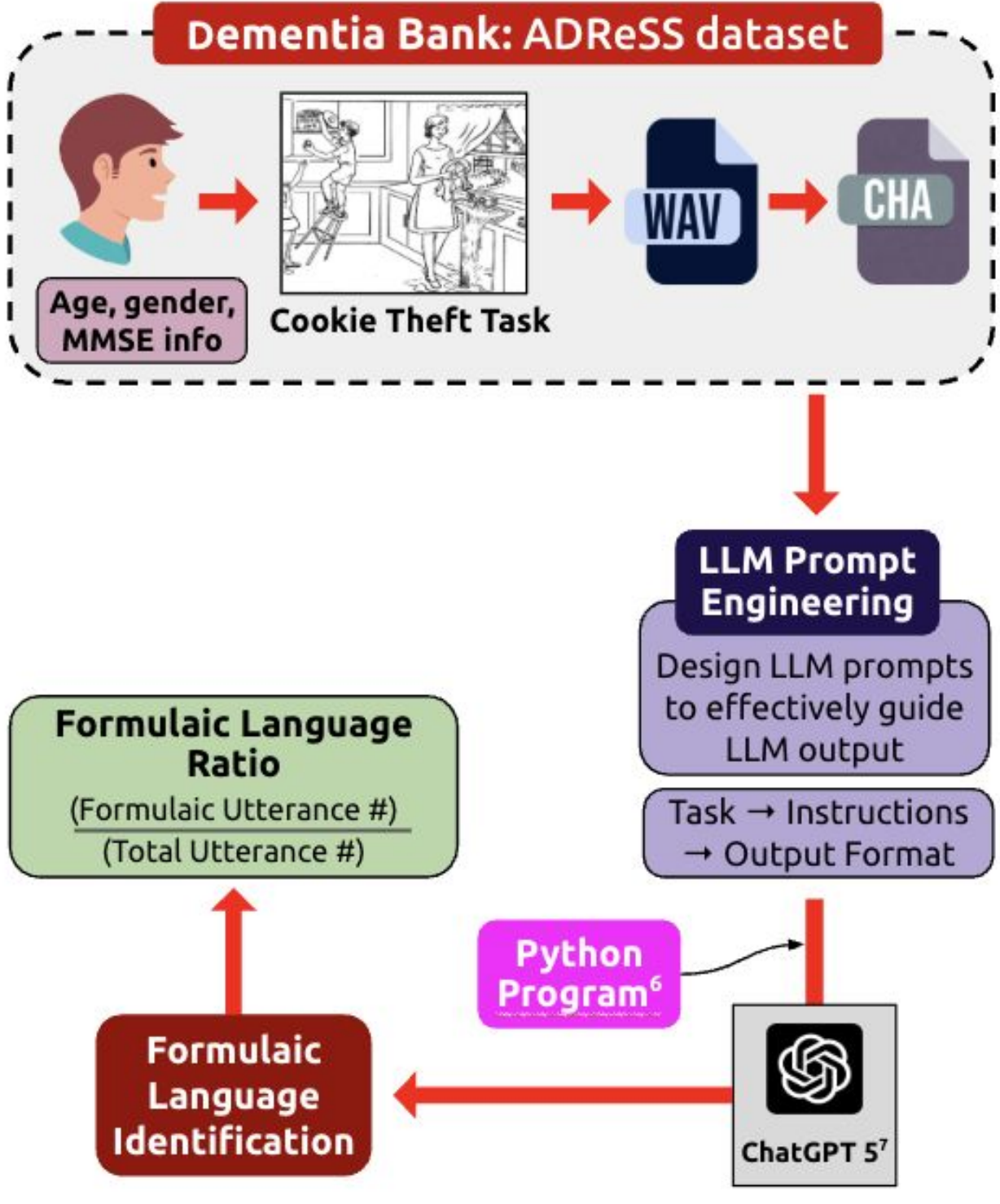
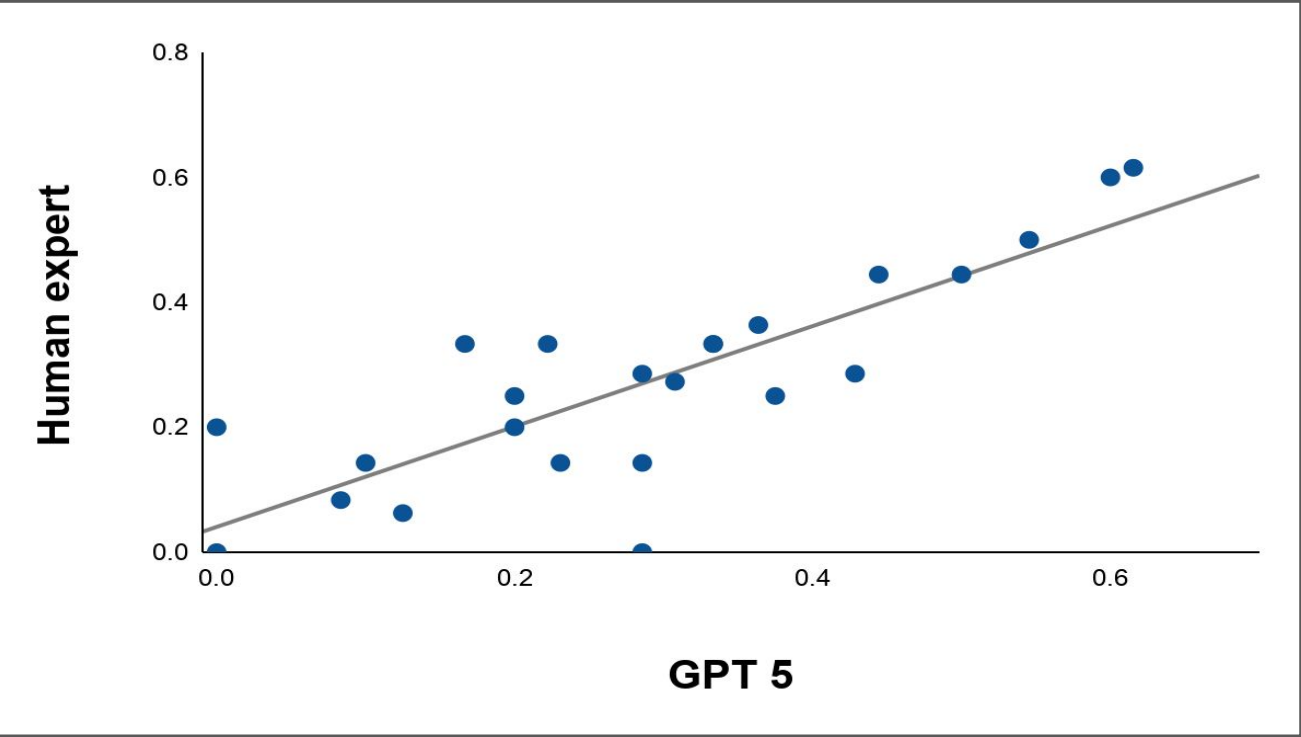
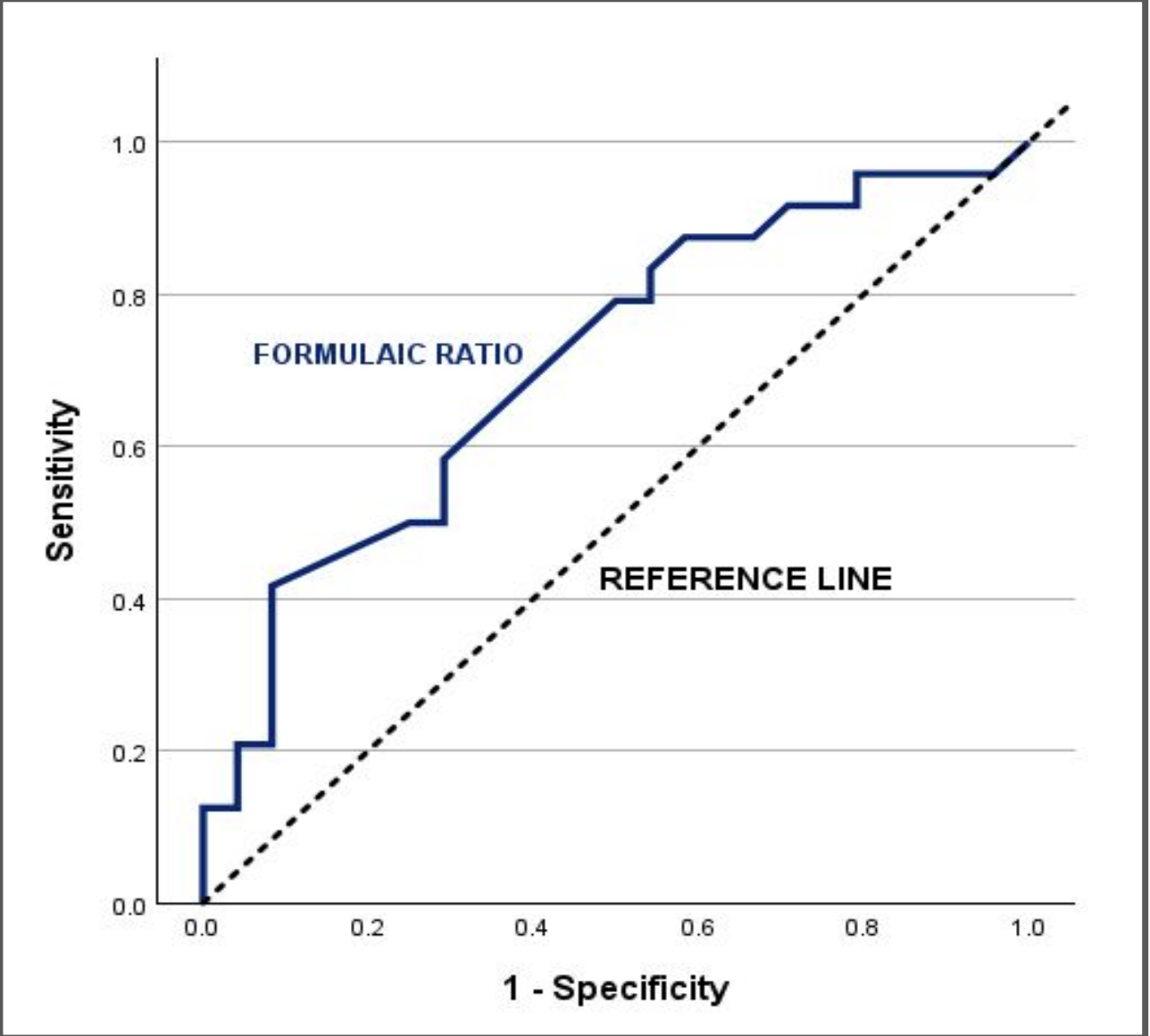


LLM-based Identification of Formulaic Language in Alzheimer’s Disease: Reliability and Clinical Utility

#6031

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- AD participants used more formulaic language than healthy controls, supporting formulaic language as a potential speech-based marker for AD diagnosis.
- LLM-based analysis offers a scalable way to detect formulaic language patterns, extending prior manual annotation work and supporting the Dual-Process Model of Language.

INTRODUCTION	METHODS	METHODS (cont.)	RESULTS (cont.)	DISCUSSION
Formulaic Language - Individuals with Alzheimer’s Disease (AD) show increased use of formulaic language, including overlearned expressions such as idioms and social formulas.¹⁻³ - This pattern may be explained by the Dual-Process Model of Language: formulaic language relies more on basal ganglia/right-hemisphere networks, while novel language depends more on cortical language area.² - Because basal ganglia systems are relatively preserved until later stages of AD, formulaic language may remain accessible even as generative language abilities decline.	Participant Dataset - Speech samples were obtained from a publicly available, de-identified ADReSS dataset from DementiaBank⁵, containing recordings from individuals diagnosed with AD and HC speakers. - Samples included Cookie Theft picture description transcripts from 48 participants: 24 with Alzheimer’s disease (AD) and 24 healthy controls (HC), matched by age (AD: 66.1 ± 7.4 years; HC: 66.1 ± 7.1 years) and gender. The transcripts were obtained from DementiaBank as CHA files. - All analyses, including LLM use, followed DementiaBank data-use policies.⁵	AD vs HC Classification Analysis Formulaic language ratio achieved an AUC of .71, indicating fair and statistically significant classification of AD vs HC ($p = .005$). Fig 1. LLM-Driven Formulaic Language Analysis Pipeline 	Formulaic Language Ratio & MMSE - Across all participants, formulaic language ratio was negatively associated with MMSE scores ($r = -.421$, $p = .003$) and significantly predicted MMSE, accounting for 17.8% of the variance in cognitive status ($R^2 = .178$, $p = .003$). - Among individuals with AD, formulaic utterance ratio was not a significant predictor of MMSE scores ($R^2 = .123$, $p = .093$). Fig 2. Scatterplot of formulaic language ratio from GPT-5 and human expert 	AD vs HC Classification Analysis - AD participants produced higher overall formulaic language ratios than HC, consistent with previous studies. - Formulaic language showed potential as a biomarker for AD diagnosis but limited utility for predicting cognitive severity (MMSE). - These findings support the Dual-Process Model of Language³, where cortical systems process novel/non-formulaic language and subcortical system process formulaic language.
Large Language Models - Manual identification of formulaic language is labor-intensive, time-consuming, and dependent on expert judgment. - Recent studies suggest that Large Language Models (LLMs) can reliably analyze discourse- and pragmatic-level language features, offering a scalable alternative to manual annotation.⁴	Procedure - Formulaic language was identified and counted using a structured, prompt-guided GPT-5 procedure. - Formulaic language ratios were calculated for each participant sample. Mini-Mental State Examination (MMSE) scores from the dataset were used to examine the relationship between formulaic language use and cognitive status to evaluate its predictive value (AD: 19.5 ± 5.4; HC: 28.8 ± 1.5). - Agreement between the researcher and GPT-5 was assessed using Intra Class Coefficient (ICC) on 50% of randomly selected samples.	Inter-rater Reliability Inter-rater reliability analysis revealed excellent agreement between the GPT-5 and the human expert for formulaic language ratios (ICC = .91)	AD vs HC Classification Analysis  Fig 3. ROC curve showing the ability of the formulaic language ratio to distinguish AD from HC	REFERENCES - Bridges KA, Van Lancker Siddis D. Formulaic language in Alzheimer’s disease. Aphasiology. 2013;27(7):794-804. - Van Lancker Siddis D, Choi J, Alken A, Siddis JJ. Formulaic language in Parkinson’s disease and Alzheimer’s disease: Complementary effects of subcortical and cortical dysfunction. J Speech Lang Hear Res. 2015;58(5):1493-1507. - Van Lancker Siddis D. When novel sentences spoken or heard for the first time in the history of the universe are not enough: Toward a dual-process model of language. Int J Lang Commun Disord. 2004;39(1):1-44. - Yu D, Li L, Su H, Fuoli M. Assessing the potential of LLM-assisted annotation for corpus-based pragmatics and discourse analysis: The case of apologies. Int J Corpus Linguist. 2024;29(4):534-561. - MacWhinney B. TalkBank: Open sharing of conversational data. J Pragmat. 2019;140:99-114. - Python Software Foundation. Python, version 3.x. Python Software Foundation; 2024. https://www.python.org - OpenAI. ChatGPT [large language model]. OpenAI; 2024. Accessed June 14, 2026. https://www.openai.com
Purpose of Study This study examines formulaic language use in AD and healthy controls (HC) using a LLM to enable scalable linguistic analysis.			Formulaic Language Ratio & MMSE - Across all participants, formulaic language ratio was negatively associated with MMSE scores ($r = -.421$, $p = .003$) and significantly predicted MMSE, accounting for 17.8% of the variance in cognitive status ($R^2 = .178$, $p = .003$). - Among individuals with AD, formulaic utterance ratio was not a significant predictor of MMSE scores ($R^2 = .123$, $p = .093$).	CONTACT Seung-Yun Yang¹ seung-yun.yang@brooklyn.cuny.edu Daniel Chang² dachang2401@gmail.com ALZHEIMER’S ASSOCIATION AAIC 26