

DOCUMENT SUMMARY

This research article from the *Journal of Communication* uses functional magnetic resonance imaging (fMRI) to demonstrate that an adolescent's neural response to an anti-smoking ad predicts how well that ad is recalled on a national scale. The study's core finding is that the relationship between ad exposure and recall is moderated by brain activity in regions associated with social processing and memory encoding. This is critically relevant to Enlitens' mission because it provides powerful evidence that (1) direct measures of brain processing are more predictive of real-world outcomes than simpler metrics, (2) cognitive engagement is not uniform and depends on the individual's motivational and social context, and (3) a "one-size-fits-all" model (like standardized testing) fails to account for the complex, conditional nature of human cognition, which neuroimaging is beginning to uncover.

FILENAME

KRANZLER_2019_fMRI_MessageRecall_CritiqueOfUniformity.md

METADATA

- **Primary Category:** RESEARCH
- **Document Type:** research_article
- **Relevance:** Supporting
- **Key Topics:** neuroimaging, fMRI, cognitive processing, alternative measurement, critique of uniform models, population-specific cognition, memory, social cognition
- **Tags:** #fMRI, #neuroscience, #assessment_critique, #standardized_testing_critique, #cognition, #adolescents, #memory, #social_processing, #alternative_methods, #predictive_validity

CRITICAL QUOTES FOR ENLITENS

"Campaign success is contingent on adequate exposure; however, exposure opportunities (e.g., ad reach/frequency) are imperfect predictors of message recall."

"We hypothesized that the exposure-recall relationship would be contingent on message processing."

"Average ad-level brain activation in these regions moderates the relationship between national TRPs and large-scale recall

($p < .001$), such that the positive exposure-recall relationship is more strongly observed for ads that elicit high levels of social processing and memory encoding in the brain."

"Findings advance communication theory by demonstrating conditional exposure effects, contingent on social and memory processes in the brain."

"Despite evidence that opportunities for message exposure (i.e., measures of ad dissemination) lead to recalled exposure... the strength of this relationship varies; not all content to which a person is exposed is equally likely to be recalled (Lang, 2000)."

"Content differs in the amount and quality of processing it engenders, which in turn influences motivation, memory encoding, storage (Henke, 2010; Lang, 2000), and persuasion more broadly (Cappella, 2006; Petty & Cacioppo, 1986)."

"This suggests that the relationship between exposure and recall is moderated by the extent to which a message engages certain cognitive processes."

"Measuring changes in neural response can elucidate the neurocognitive processes that occur during message exposure without interrupting the viewing experience for introspection (Falk & Scholz, 2018). Thus, a communication neuroscience approach provides a means to tap into those processes engaged during message reception that complement information available from other methods."

"Brain responses during message exposure predict message effects. Ad-elicited activity in brain regions tracking message value predicts message-relevant outcomes... and neural responses to health messages in small groups predict large-scale message effects."

"However, no prior studies have examined the conditions under which average, ad-induced brain responses (as inferred from a scanned sample) moderate the link between population-level exposure and recall. Likewise, studies that have linked brain responses in small samples to behaviors at scale have not typically accounted for levels of message exposure."

"As with all neuroimaging studies, our psychological interpretations of activity within the brain regions of interest are subject to the constraints of reverse inference (i.e., making inferences about the engagement of specific cognitions, based on the activation of specific brain regions; Poldrack, 2006; Weber, Mangus, & Huskey, 2015)."

"Though we acknowledge the utility of measuring content features and establishing their moderating effects for the purpose of producing memorable ads, we contend that brain response offers a distinct path to understanding the conditional relationship between exposure and recall. These analyses may approach understanding the underlying processes more directly, by showing that ads that activate brain regions implicated in social cognition are better recalled."

"Results provide evidence of a conditional relationship between message exposure and recall, such that ads that are more motivationally relevant and engage greater memory processing (as indexed by social-cognition and memory-encoding brain processes) show stronger relationships between exposure and recall."

"These findings suggest that capturing ad-specific brain responses in small groups of people may facilitate the selection of campaign messages that are more motivationally relevant, better encoded, and better remembered at large scales."

KEY STATISTICS & EVIDENCE

- **Primary Finding:** Brain activation in social processing and memory encoding regions significantly moderates the relationship between ad exposure (TRPs) and ad recall on a national scale, with a significance level of $p < .001$.
- **Sample Sizes:** The study powerfully links data from a small, intensive neuroimaging sample with a large-scale population survey.
 - National Survey Sample: 5,110 adolescents aged 13-17.
 - fMRI Sample: 40 adolescent non-smokers aged 14-17.
- **Moderation Effect (Social Processing):** The interaction between TRPs and neural response in social-processing regions was a significant predictor of cued recall ($\beta = 0.041$, $p < .001$).
 - Interpretation: For ads with high social-processing brain response, 300 additional TRPs were associated with 2.82 more reported exposures. For ads with low response, the same exposure increase was associated with only 0.84 more reported exposures.
- **Moderation Effect (Memory Encoding):** The interaction between TRPs and neural response in memory-encoding regions was also a significant predictor of cued recall ($\beta = 0.049$, $p < .001$).
 - Interpretation: For ads with high memory-encoding brain response, 300 additional TRPs were associated with 2.75 more reported exposures. For ads with low response, the same exposure was associated with only 0.40 more reported exposures.
- **Predictive Power:** The inclusion of the fMRI-derived interaction terms significantly improved the statistical models compared to models with only exposure data, demonstrating the added predictive value of measuring neural processes.

METHODOLOGY DESCRIPTIONS

This study employed a novel approach by synthesizing three distinct and large-scale datasets to test its hypotheses.

- **1. Survey Data Set:**
 - A national, rolling, cross-sectional phone survey of 13- to 17-year-olds ($n = 5,110$) conducted from June 2014 to June 2017.
 - The dependent variable was cued ad recall, measured by asking respondents "about how many times in the past 30 days have you seen or heard of each of the following?" followed by brief descriptions of 12 ads from "The Real Cost" campaign.
- **2. Target Rating Points (TRP) Data Set:**
 - This dataset contained national television TRPs for "The Real Cost" campaign, provided by the FDA.
 - TRPs measure the opportunity for exposure and are calculated as the product of media content reach and frequency of exposure. The study used aggregated 8-week TRP totals prior to each survey interview as the independent variable.
- **3. Functional Magnetic Resonance Imaging (fMRI) Data Set:**
 - **Participants:** Neural responses were measured in a sample of 40 nonsmoking adolescents aged 14-17.

- **Task:** Participants viewed 12 ads from "The Real Cost" campaign during an fMRI scan while their brain responses were measured. The study focused specifically on brain activity during the 30-second ad exposure period.
- **Brain Regions of Interest (ROIs):** The moderating variables were the mean neural responses in two key brain networks, identified meta-analytically using the Neurosynth database. This provides an objective, data-driven method for defining regions associated with specific cognitive functions.
 - **Social Processing:** Defined by the brain map for the term "mentalizing". These regions include the bilateral temporal parietal junction; dorsal, middle, and ventral regions of the medial prefrontal cortex; precuneus; and the right superior temporal sulcus.
 - **Memory Encoding:** Defined by the brain map for the phrase "memory encoding". This primarily involves the hippocampus/medial temporal lobe system.
- **Data Analysis:** Neural response was operationalized as percent signal change from baseline for each ad. To isolate the effect of the ad itself, the analysis controlled for whole-brain activity outside of the ROIs.

THEORETICAL FRAMEWORKS

The study draws on and integrates several key theoretical frameworks that are highly relevant to critiquing simplistic assessment models.

- **Levels-of-Processing Approach:** "Classical psychological models, such as the levels-of-processing approach, hold that depth of processing, typically operationalized as the type of cognitive activity carried out during encoding, has a substantial influence on memory, such that deeper information processing is expected to lead to more durable memory traces (Craik & Lockhart, 1972)." This supports the Enliten's view that the quality of cognitive engagement (fostered by a clinical interview) is more meaningful than the superficial response measured by a standardized test.
- **Limited Capacity Model of Motivated Mediated Message Processing (LC4MP):** "According to this model, messages that are motivationally relevant elicit more resource allocation to message encoding and storage processes, leading to greater recognition and recall... there is agreement that more motivationally relevant messages should be better remembered and recalled if exposure and other factors are held constant (Cohen & Parra, 2016; Lang, 2000)." This framework directly implies that assessments lacking personal relevance for the individual (like most standardized tests) will fail to elicit cognitive processing that reflects their true capabilities.
- **Social Relevance and Motivation:** The paper argues that for adolescents, social relevance is a key driver of motivation and, therefore, cognitive processing.
 - "Social relevance (e.g., social norms and the conferral of social approval) strongly influences motivation and behavior (Cialdini et al., 2006; Cialdini & Trost, 1998; Fishbein & Ajzen, 2011; Glanz, Rimer, & Viswanath, 2008)."
 - "Given the heightened salience of social cues for adolescents (Crone & Dahl, 2012) and the role of social cognition in memory formation (Lieberman, 2012), messages that feature social information or prompt adolescents to consider the social consequences to themselves and others should be more motivationally relevant and better recalled." This highlights the inadequacy of asocial, decontextualized testing environments.

POPULATION-SPECIFIC FINDINGS

The study's focus on adolescents provides key evidence for the necessity of population-specific considerations in any cognitive assessment.

- **Adolescent-Specific Brain Development:** "Adolescence is marked by rapid changes in social and brain development, such that adolescents' increasing sensitivity to social cues substantially influences their actions (Crone & Dahl, 2012; Steinberg & Monahan, 2007)."
- **Social Cognition and Memory:** "Moreover, social cognition enhances memory formation in this population (Lieberman, 2012), suggesting that information that engages social thought should facilitate recall."
- **Mentalizing in Adolescents:** The study highlights that processes like "mentalizing," or considering the perspectives of peers, are particularly important for motivation and message effects in this age group. This underscores that cognitive processes are not universal but are shaped by developmental stages, a fact ignored by standardized tests that are often normed across wide and heterogeneous age bands.

PRACTICAL APPLICATIONS

The study's discussion of its implications offers powerful arguments for Enliten's mission to move beyond outdated assessment methods.

- **Complementing, Not Replacing:** "Findings from this study suggest that further exploration of measurement of brain responses to ads at the moment of reception is worthwhile. That information might complement self-report measures to help predict which messages will be more readily encoded and recalled, supporting the dissemination of messages that are ultimately more effective." This directly supports the idea of using multiple, more direct forms of evidence (like a clinical interview) rather than relying on a single, fallible instrument.
- **Getting Closer to the Underlying Process:** The authors argue that measuring brain response is superior to simply coding surface-level features of a stimulus. "Though we acknowledge the utility of measuring content features and establishing their moderating effects... we contend that brain response offers a distinct path to understanding the conditional relationship between exposure and recall. These analyses may approach understanding the underlying processes more directly, by showing that ads that activate brain regions implicated in social cognition are better recalled." This is a direct parallel to Enliten's argument that understanding the *how* and *why* of an individual's thinking through an interview is superior to simply scoring the *what* of their answers on a test.
- **Predicting Real-World Effectiveness:** The ultimate goal is to predict real-world outcomes. "Finally, these findings provide new understanding of the cognitive mechanisms that account for enhanced message processing, complementing existing theory and research and aiding the development of messages that are more readily processed, recalled, and, ultimately, more effective." This study's success in using a small fMRI sample to predict national trends provides a proof-of-concept for using more nuanced, process-oriented measures to gain a more valid understanding of an individual.

