

FROM METAPHOR TO MECHANISM: A NEURO-COGNITIVE AGENDA FOR COMMUNICATION RESEARCH IN AN ERA OF HEALTH MISINFORMATION

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ABSTRACT

Misinformation about health has escalated into one of the biggest issues of public health, disrupting informed decision making and trust in health sources. Traditional studies of communication have focused more on the persuasive mechanism (e.g., framing) without looking at the interventionist interaction of the mechanisms in the underlying processes in the brain. This paper will contend that effective health communication research can only make incremental progress with strategic integration with cognitive neuroscience. Given these interdisciplinary implications, scholars might not rely on inferences about cognitive activities anymore to directly observe the neurobiological activities during the belief formation, the processing of persuasive messages, and the processing of misinformation. Based on a thought-provoking analysis of the cognitive theories in (mass) communication research, this paper presents the common methodologies of cognitive neuroscience and integrates recent discoveries from neuro-communication discussions. Further, we propose a forward-looking research agenda, emphasizing three key areas, including the neuroscience of fact-checking, the neural basis of affective polarization in health problems, and how visual misinformation is cognitively processed. This agenda is expected to serve as a roadmap for the future development of a more brain informed communication science with the ultimate goal of developing interventions that can combat the effects of health misinformation based on empirical evidence. This approach also seeks to further our knowledge of the relationship between communication processes and their implications for the health of the population.

Keywords: Health Misinformation, Communication Research, Cognitive Neuroscience, Neuro-Communication, Belief Formation, Persuasive Messaging, Fact-Checking, Affective Polarization, Visual Misinformation.

Introduction: The Neuro-Cognitive Turn in Communication Science

In the intricacy of the modern media landscape, rapid proliferation of health falsehoods is an immediate threat to the health of the population, with far reaching consequences on both personal and community health. The ability of individuals to differentiate authentic health information and fake news will have an impact on their health-related choices and, furthermore, the resilience of the whole society. Due to the stakes involved in this issue, communication science must address this problem in a more successful manner, beyond traditional models and towards a more vigorous theory that incorporates cognitive processes and empirical neurobiological findings.

This paper also focuses heavily on a better comprehension of the relationship between communication processes and neural factors as the encouragement of a so-called neuro-cognitive turn of communication science. Modern theories of communication offer powerful descriptive explanations of persuasion and belief formation, most of them put the brain in a black box. This analogy dissuades subtle cognitive processing explanations of beliefs, information framing, and misinformation on neurological grounds. The approaches of cognitive neuroscience can help researchers to discover the neural processes behind the pattern human thought, hence giving them insights that extend beyond a metaphorical approximation of a strict understanding of communication as an active system of different neural engagement (Chan et al., 2018; Gruber, 2017).

The rest of the paper has the following structure in a bid to support this thesis. First, it criticizes the traditional cognitive models of communication in communication studies and weaknesses and strengths of this system are explained. It then explains key neuro-cognitive approaches that can be employed to mediate cognitive theory and cognitive neurobiological discoveries. The article ends by providing an agenda of new studies that are based on three areas of critical new interest: the neuroscience of fact-checking, the neural basis of affective polarization, and the cognitive processing of visual misinformation. This is an agenda that, based on integrating findings of cognitive neuroscience into well-established models of communication, will lead the way to a brain-driven communication science capable of driving the field towards more adaptive and evidence-based interventions (Bhat et al., 2019; Kern et al., 2011; Schmidt et al., 2011; Wu et al., 2020).

Inferring the Mind: A Review of Cognitive Approaches in Traditional Communication Research

The communication field could be traced back to the cognitive theories aimed at comprehending the complex interrelation of cognition and the way people interpret messages. These cognitive models have been very instrumental in informing research in the field, and offer overarching theories of encoding, decoding and use of information. However, most of these theories rely on largely indirect measures of

cognition, as opposed to the actual observation of processes of cognition in the brain. Framing Theory is one of the most basic theories of communication. According to the framing theory, the frames which are available offer a mode of perceiving a problem and play a significant role in determining what the rest of the society thinks. News organizations influence the manner in which the masses interpret complex political occurrences by covering the stories in a certain manner. In their article about the news coverage of the Panama Leaks, Siraj and Waheed (2019) offer an example of how the major Pakistani newspapers reported on the scandal and shaped the formation of opinions among people. This indicates that the news framing is effective in influencing how the audiences interpret and react to the issues by influencing the process of message interpretation.

Elaboration Likelihood Model (ELM) is among the influential cognitive theories that are applied in investigation of communication. This approach asserts that people process persuasive messages in two channels: central and peripheral routes. The central route is followed when people are motivated and can engage in the processing of the message at a high level of scrutiny, and a lasting change is achieved. On the other hand, the peripheral route is governed by minimal cognitive functions, and follows surface cues, which, here, may be the attractiveness of the speaker or emotional appeal. The model concentrates on the interaction of message effectiveness and cognitive engagement to demonstrate what elements of cognitive processing define communication effectiveness (Gruber, 2017). These concepts are further reinforced by the cognitive priming mechanisms that propose that exposure to some stimuli can have a major influence on the future thoughts and behaviors as it uses the subliminal control process to manipulate the perception of the audience members without even their awareness.

Though these cognitive theories have proven to be most instrumental in enhancing our knowledge on the communication process, they have their own limitation. They are mostly founded on the self-reported, and behavioral means that are used to determine what occurs in the mind. Such a method, however, can possibly be prejudiced or inaccurate considering it is based on the explicit memory or interpretation of the mental experience of people, which is not always reliable or accurate. The reliance on the proxy variables makes it difficult to obtain the actual insight into the neural processes of belief, persuasion, and misinformation processing (Chan et al., 2018; Wu et al., 2020). Though the seminal theories like Framing and ELM present concepts of invaluable theoretical construct, they rely on indirect inference and strengthening of techniques that may directly observe the processes going on in the brain. The following section elaborates on the neuro-cognitive toolkit that will be used to address this gap in the methodology.

Observing the Brain: The Methodological and Theoretical Promise of Cognitive Neuroscience

Effective communication has come to be regarded as an intricate process of cognitive transactions taking place in the mind. In light of increasingly popular health misinformation in the contemporary media environment, communication scholars must integrate cognitive neuroscience into their research paradigms. Knowledge of methodological tools in this field is critical for being able to investigate the

neurobiology of information processing, persuasion, and belief formation.

The Neuro-Cognitive Toolkit: From fMRI to EEG

Numerous key methods comprise the neuro-cognitive toolkit. ‘Functional Magnetic Resonance Imaging’ (fMRI) is one of a number of neuroimaging methods which measure changes in blood flow in the brain and allow researchers to localise which areas of the brain are activated in relation to specific cognitive tasks. Although very fine spatial resolution can be achieved using this approach (comparable to some extant PET and fMRI methodologies), this technique can pinpoint precisely where in the brain particular cognitive functions are implemented. For example, fMRI research has demonstrated that regions including the medial prefrontal cortex (MPFC) are active during reception of persuasive messages, and that greater activation in these areas predicts subsequent attitude and belief change (Falk & Scholz, 2018). Thus, fMRI may also give insights into the neural substrates of persuasion and elucidate the way complex health messages are processed at a neuronal level.

While fMRI provides high spatial resolution, the complementary method of Electroencephalography (EEG) records electrical activity of the brain from electrodes placed on the scalp which facilitates an understanding of when brain activity occurs with millisecond time precision. This capacity, it can be argued, is profoundly advantageous, enabling researchers to monitor, in near real-time, attentional shifts or the immediate emotional responses elicited by various communicative inputs.

As an example, it has been shown that the real-time processing of persuasive appeals is very rapid and thus provides a quantifiable parameter of how quickly people can be influenced to take or reject health messages especially when they are given a mixture of cognitive and emotional appeals. EEG can provide information about the neural mechanisms of attention, cognitive load and emotional arousal when exposed to health messages through real-time monitoring of the brain response. All of these neuroimaging techniques hold strong prospects of explaining how messages affect belief systems because they bring together the complexities of the brain and behavioral data.

Early Findings: Neural Correlates of Persuasion and Misinformation

The initial attempt of neuro-communication has yielded significant information regarding the brain basis of persuasion and misinformation. Various research has demonstrated that brain activity such as the MPFC when exposed to persuasive messages are better predictors of behavior change than traditional self-reports. As an illustration, it is discovered that those who demonstrate the highest activity in these areas tend to change the opinion or behavior under the influence of persuasive messages more frequently (Falk and Scholz, 2018). This is loud testimony that cognitive neuroscience has the capability of enhancing our predictive insights into persuasion to the level that we transcend naive explanations on the premise of self-report data.

Cognitive neuroscience has also begun to give out the processes which occur within our heads when we are processing misinformation in addition to persuasion. Recent studies have found neural signs of such updating of belief, particularly in feedback when the participants received information that contradicted their previous belief.

This aha! moment, which is usually accompanied by neural activity in the ACC, is understood as the cognitive review of beliefs in the light of new evidence (Falk and Scholz, 2018). This knowledge is useful in the development of interventions to counter misinformation. The integration of cognitive neuroscience paradigms in communication research therefore presents an unprecedented opportunity to move beyond mere inference to the direct observation of cognitive functioning. This shift is crucial for developing more efficient communication strategies in an era of misinformation.

Forging a Neuro-Communication Agenda for Health Research

The growing crisis of the need to tackle health misinformation, it should be admitted, pushes creators of novel communication interventions towards stringent reliance on the results of the cognitive neuroscience. The need to establish a special neuro-communication research agenda is becoming clearer with the increasing knowledge of the complex interaction between mind, brain, and behavior. It can be said that such an agenda must meticulously examine the exact nature of the application of cognitive processes on health behaviors. In turn, the section outlines a list of areas of high-priority research, which, arguably, have a significant potential to transform the future directions of health communication.

The Neuroscience of Fact-Checking and Belief Updating

Understanding how the conventional ways to debunk health misinformation are frequently ineffective is one of the keys to dealing with health misinformation. To effectively study how the brain responds to issues of challenge of strongly held (mis)beliefs, neuro-cognitive studies can be used. Introduced to information that contradicts already held beliefs, the brain can process it as a threat causing such phenomenon as cognitive dissonance: the mental conflict of having conflicting thoughts (Barron, 2021). Research has shown that beliefs do not simply shift when presented with facts the reaction of the brain may create emotions and defense mechanisms (Hill, 2022). An analysis of such responses can assist us to comprehend more about how persistence of beliefs occurs, and in what strategies we can formulate more effective fact-checks. Successful messaging strategies can be discovered using neuroimaging techniques including fMRI and EEG which can overcome defensive responses and promote belief updating to create a useful model of improving health communications.

The Neural Basis of Affective Polarization in Health

Affective polarizing is exceptionally pertinent when it comes to health communication wherein individuals can respond with high-affective levels such as negative emotions, such as anger or distrust, to health messages that interfere with their group identity. And the debates on vaccinations also represent one of the examples in which health guidance can be viewed through an ideological prism, as an fMRI-based study has revealed that MPFC is also critical in decoding self-relevant data and processing it in concert with the social identity, but the amygdala pertains to fear and aggression (Bennett et al., 2019). In these neural understandings, it is possible to study the effects of the health message that questions group identity in

terms of emotional involvement and balanced judgment. Such investigations may aid in the identification of the efficacy of interventions to disrupt ideological separations and foster constructive communication, and consequently, possibly empower to make health-related decisions in an ever-polarized environment.

Processing Visual and Multimodal Misinformation

The age of digital technology has created unprecedented possibilities of visual misinformation in ways never experienced before. The point of critical importance is to learn how the brain reacts to the fake charts, the content-doctored pictures or deepfake video in a different manner than the brain reacts to texts. EEG allows scientists to track attention and cognitive load at the moment of interaction with deceptive images and people and aids in illuminating the reasons behind the power of visual misinformation (Haim-Nachum et al., 2024). Moreover, cross-cultural research is also necessary to explore the reaction of the members of various cultures to visuals and the consequential meaning on belief (O'Leary and Fletcher, 2024). This intervention is culturally relevant because it develops effective health communication strategies that are culturally inclusive and community-specific. By highlighting these areas, scientists are able to develop a wide neuro-communication agenda that can facilitate the enhancement of public health interventions.

Conclusion: Toward a More Brain-Informed Communication Science

This paper has promoted the need to shift from conceptualizing communication through metaphor to understanding its underlying mechanisms in communication studies. Through the application of cognitive neuroscience to communication research we can perhaps have a better understanding of how beliefs, attitudes, and decisions occur (or are processed) in the brain regardless of whether we are using metaphorical expressions and basing our thinking on behavior. We have suggested a broad neuro-cognitive research agenda that focuses on three key areas, namely, the neuroscience of fact-checking, the neural basis of affective polarization, and the processing of visual misinformation. Concentrating on the processes of misinformation dispersion by using cognition helps find new means to communicate with more effectiveness and accuracy.

This research agenda is not only important in the academic field. A neuroscience-based communication strategy can significantly enhance the effectiveness of health campaigns in the field of public health through the development of messages that appeal to cognitive and emotional disposition of the individuals. This can lead to better health outcomes and improved public engagement. However, this convergence also has its ethical aspects of neuromarketing, and researchers are forced to do responsible things to ensure that the result is used to make sound decisions, and not manipulation.

It is also of immense importance to the journalism profession to know the role of the brain in processing news. Neuroscience provides an interesting alternative viewpoint to professional standards in the face of the obstacles that the media practitioners have to address when covering health issues. The news media also has a role to play by understanding how the audience is receiving health news, and acting as an

information provider, train the citizens to be more skeptical about the received information.

Lastly, cognitive neuroscience and research on communication can offer possible solutions to certain issues in the society. A little insight into the neural mechanisms behind the beliefs, emotion and misinformation processing would be beneficial in creating more effective strategies of communication that operate at multiple levels. This cross-disciplinary convergence is not confined to academia, but is a natural process that has the potential to result in more efficient public health communication and ultimately improved health. Interdisciplinary insights can be applied in making the way to address the great health communication problems of our era.

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