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Waves of Information: Exploring the Analogy between Physical Wave Propagation and News Dissemination

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ABSTRACT

Objective: When a news item is first published (*the first wave of news*), it spreads rapidly but with limited reach, analogous to a short wavelength. As the dissemination continues (*the second wave of news*), the speed of propagation decreases, but the reach (wavelength) increases, covering a broader audience. This study aims to draw an analogy between the propagation of water waves generated by a dropped object and the dissemination of news within communication and broadcasting systems.

Materials and Methods: This study presents a conceptual framework that draws an analogy between the physical propagation of water waves and the dissemination of news within communication and broadcasting systems. By comparing the initial rapid spread of information to high-speed, short-wavelength waves and the subsequent slower, broader dissemination to longer-wavelength waves, the study highlights the dynamic and layered nature of information flow.

Results: The formation of waves in water serves as an effective analogy for the propagation of news in media and communication systems. When a news item is published, it resembles the formation of waves, where the first wave represents rapid propagation with a short wavelength, while subsequent waves propagate more slowly but with longer wavelengths.

Conclusion: This analogy between wave propagation in water and the dissemination of news offers a novel conceptual lens for understanding patterns of information diffusion. By applying physical principles such as wave speed, wavelength, and dispersion to communication dynamics, we can gain deeper insights into the mechanisms by which news propagates through various phases. While this model provides a compelling theoretical framework, further research is needed to validate its applicability through empirical analysis and to explore its implications for media theory, communication strategy, and public information flow.

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Introduction

The dissemination of news and information in society can be analogized to the physical propagation of "*waves*" in a medium. In physics, when a disturbance occurs, such as an object dropped into water, it generates concentric waves that radiate outward from the source. The initial wave propagates with high energy and speed, followed by successive waves that are slower and broader in reach. Similarly, when a news event breaks, the initial dissemination is rapid and intense, often through mass media or viral social networks, reaching a core audience quickly. Subsequent *"waves*" of information, such as analysis, commentary, and reinterpretation, propagate more slowly, reaching secondary audiences with diminished intensity but potentially wider scope. This analogy provides a useful framework for understanding the temporal and spatial dynamics of information flow, the role of media channels as propagation mediums, and the attenuation or amplification of content over time. It also highlights the complex interactions between source credibility, medium characteristics, and audience reception in shaping the overall impact of information in the public sphere.

The dissemination of news and information in the modern media landscape shares intriguing parallels with the physical phenomenon of wave propagation in water. When an object is dropped into water, it generates a series of waves. The initial wave propagates at a high speed with a relatively short wavelength. Subsequent waves propagate more slowly, but their wavelengths and the radius of the wave circles increase progressively. This physical behavior provides a compelling metaphor for how information spreads in communication and broadcasting systems. When a news item is first published (the *first wave of news*), it spreads rapidly during the initial phase, much like the first wave, characterized by high propagation speed but limited reach (short wavelength). In the subsequent phase (the *second wave of news*), the dissemination process slows down. As the news continues to spread, the speed of propagation decreases; however, it covers a broader audience (see Figure 1). In other words, the reach (wavelength) increases, analogous to the longer wavelengths observed in later physical waves. This pattern reflects the principles of *wave dispersion*, where the speed of a wave depends on its frequency or wavelength, and is supported by foundational studies in both information theory and fluid dynamics (e.g., Shannon, 1948; Lighthill, 1978).

Figure 1. Water Waves and Expanding Wavefronts: A Visual Representation of Radial Propagation

At the moment a news story breaks, it typically spreads rapidly among early recipients, analogous to the initial short-wavelength wave generated in water. However, this initial burst of information often has a limited range of dissemination. Over time, the same news continues to propagate (more slowly, yet reaching a broader audience) much like the slower, longer-wavelength ripples that follow the first wave. This progression reflects fundamental principles of wave behavior, such as *wave dispersion* and *energy propagation*, which can also help explain the dynamics of media coverage, audience engagement, and the eventual dilution or distortion of messages over time.

A review of the existing literature reveals no direct studies that examine the analogy between wave formation in water and its application to news propagation in communication. Nonetheless, the fundamental principles of wave propagation and their practical implications provide a basis for drawing meaningful parallels between the behavior of waves in water and the dissemination of news in media and communication. Drawing on established theories from both communications and physics, this study explores the parallels between wave mechanics and information diffusion, offering a novel perspective on how news propagates and evolves as it reaches broader audiences through diverse media channels.

Statement of the Problem

Despite advancements in communication and broadcasting technologies, the dynamics of how news disseminates through various media channels remain complex and not fully understood. While existing models of *information diffusion* frequently emphasize factors such as virality, network topology, and user behavior, they often neglect foundational physical analogies that can offer a deeper understanding of the temporal and spatial dynamics of news propagation. One such underexplored analogy is the parallel between wave propagation in water and the dissemination of information. This perspective suggests that, like physical waves, information may exhibit patterns of dispersion, energy attenuation, and expanding reach over time.

Despite its potential, this analogy has not been investigated within communication and media studies. There remains a significant gap in the literature regarding conceptual frameworks that capture the dual-phase nature of *information spread*, characterized initially by rapid dissemination with limited reach (analogous to short-wavelength, high-speed waveforms), followed by slower diffusion that extends to broader audiences (analogous to longer-wavelength, lower-speed wave propagation). It should be noted that this analogy is commonly discussed in the context of communication theories, particularly within the frameworks of the "*two-step flow of communication*" and "*diffusion of innovations*" models (Katz & Lazarsfeld, 1955; Rogers, 1962).

The current study aims to address this gap by proposing a novel conceptual model that draws on principles of physical wave behavior, including wave dispersion, energy decay, and multipath propagation, to explain the mechanisms underlying news dissemination. By applying this framework, we seek to enhance our understanding of *media impact*, *message longevity*, and *audience engagement* across both traditional and digital platforms. Ultimately, integrating insights from wave physics into communication theory may offer a more nuanced explanation of how information flows, evolves, and resonates over time and space.

Wave propagation in communications involves the transmission of analog or digital information from one point to another, and it is based on wave theory and particle theory. Understanding the principles of wave propagation is essential for the design of reliable communication systems, especially in the contexts of radio wave propagation, microwave frequencies, and electromagnetic wave transmission (Fernandes & Alves, 2009; Bryan & Power, 2020; Kochańska et al., 2024). The propagation of electromagnetic waves can be achieved through guided structures such as transmission lines and waveguides, as well as through free space, with different models for theoretical and empirical understanding (Kochańska et al., 2024).

Materials and Methods

This study adopts a conceptual-analytical approach to investigate the analogy between physical wave propagation and the dissemination of news and information in society. The analytical framework is grounded in established theories from both physics (wave mechanics) and communication studies (information diffusion and media theory). Key concepts, including wave dispersion, energy attenuation, multipath propagation, and Huygens' principle, are mapped onto analogous processes in information dissemination.

Relevant Theories

1. **Wave Dispersion**: The speed of wave propagation depends on the wavelength, with longer wavelengths generally propagating more slowly (Fernandes & Alves, 2009; Bryan & Power, 2020). This physical principle can be analogously applied to information dissemination, where an initial phase of rapid spread is followed by a slower but broader diffusion of content.
2. **Energy and Propagation**: In water, wave energy is proportional to the square of the wave height and propagates at the group velocity, which can be influenced by factors such as water depth and friction (Bryan & Power, 2020). Similarly, the energy or impact of a news story may diminish over time as it spreads to a wider audience.
3. **Multipath Propagation**: In communication systems, multipath propagation can lead to time dispersion and inter-symbol interference, thereby affecting the speed and clarity of signal

transmission (Chavhan & Sarate, 2018; Kochańska et al., 2024). This phenomenon can be likened to the way news may become distorted or lose its impact as it spreads across different channels and over time.

4. **Huygens Principle**: Christiaan Huygens (1629–1695) developed a fundamental method for determining the propagation of wavefronts with precision. According to Huygens' principle, every point on a wavefront acts as a source of secondary wavelets that spread outward in the forward direction at the same speed as the original wave. The new wavefront is formed as the envelope (or tangent surface) of these secondary wavelets (Huygens, 1690).

Discussion and Conclusion

The formation of waves in water serves as an effective analogy for the propagation of news in media and communication systems. When a news item is published, it resembles the formation of waves, where the first wave represents rapid propagation with a short wavelength, while subsequent waves propagate more slowly but with longer wavelengths (Fernandes & Alves, 2009).

Consider a scenario in which an object is dropped into water. This action generates a series of waves: the first wave propagates rapidly with a short wavelength, while subsequent waves propagate more slowly, exhibiting longer wavelengths and expanding wave fronts. This physical phenomenon can serve as an analogy in the field of media and communication. When a news item is first released, it spreads quickly during the initial phase, similar to the first wave, with a high propagation speed but limited reach (short wavelength). In the subsequent phases, the rate of dissemination slows, yet the information reaches a broader audience, corresponding to longer wavelengths. This analogy illustrates fundamental principles of wave dispersion and energy propagation. Further research is required to explore this conceptual model and to identify theoretical or empirical studies that support the analogy within the context of information diffusion.

Data Availability Statement

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Ethical considerations

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