

ORIGINAL ARTICLE

Intermediality and the Diffusion of Innovations

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Interpersonal and mediated communication both play important roles in the diffusion of innovations, as part of the process, as well as the content, of diffusion. Yet the diffusion of new media has blurred the boundaries across interpersonal and mediated communication, and emphasized the decoupling of media from their attributes, summarized in the concept of intermediality. This article briefly considers implications of this intermediality for new media as process and content in five major components of the diffusion perspective: sources, rate and categories of adoption, attributes, communication networks, and consequences.

Keywords: Communication Networks, Diffusion of Innovations, Innovation Consequences, Intermediality, Media Attributes, New Media.

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Concerns about, explanations of, and recommendations for the interpersonal-mass media divide were well described in the 1988 special issue of *Human Communication Research* and associated publications (Berger & Chaffee, 1988; Reardon & Rogers, 1988; Rubin & Rubin, 1985). There were, of course, precedents for considering the interrelation of interpersonal and mass communication, such as the concept of parasocial interaction (Horton & Wohl, 1956), the two-step flow model (Katz & Lazarsfeld, 1955), diffusion studies (Rogers & Shoemaker, 1971), agenda-setting (McCombs & Shaw, 1972), and others (see Lievrouw's review, 2009).

The primary catalyst for this new focus on the shifting boundaries was the diffusion of new media, especially their interactivity (Reardon & Rogers, 1988). Others also proposed interactivity as a primary catalyst (Cathcart & Gumpert, 1983; O'Sullivan, 1999) for challenging the interpersonal-media divide. By now, aspects of new media that blur the boundaries include far more than interactivity. Due to digitization of information, pervasive wired and wireless networks, and platform-crossing software programs, people can switch content and media (or have multiple flows available), can generally view or retrieve content at their convenience, and forward, comment on, and mash up others' content. Portability, miniaturization, and customizable software all

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foster more individualistic and personalized devices, content, social interaction, and identities (Carey & Elton, 2010, chap. 1). Lüders (2008) described how personal media have destabilized the boundaries between mass and interpersonal communication.

Interpersonal, mass, and new media are becoming integrated, seamless, and permeable; everything is mediated (Livingstone, 2009). Experiences, from small to large, now involve multiple, multitasking, interdependent, layered, and blended media (Hilbert, Vásquez, Halpern, Valenzuela, & Arriagada, 2017; Raney & Ji, 2017). Interpersonal, peer, and media influences now all interact online (Walther et al., 2010). This integration was foreshadowed by the concept of *cyberspace*, first manifested in Gibson's book *Neuromancer* (1984; coincidentally the year of both Orwell's book *1984* and the introduction of the Macintosh computer). Cyberspace is a total, multimedia, connected space, always on, unbounded by time or space, active and interactive (with content and with people), changing with users' actions, and inhabitable, providing shared structures but diverse and individually experienced content (Benedikt, 1991).

This essay frames these interrelationships among interpersonal, mass, and new media through the concept of *intermediality*. Intermediality refers to phenomena involving, or relationships between, at least two media (we include face-to-face). Intermediality takes two forms. The first is convergence, whereby the underlying digital nature of information allows the same content to be accessible through different media (separately or in combinations). The second is attributes, affordances, or applications that are conceptually distinct from any particular medium or channel, and thus may be available to greater or lesser extent in any medium (Helles, 2013; Rice et al., 2017). After a brief overview of the diffusion of innovations perspective, especially how media both influence the process of innovation diffusion as well as are the content (innovation) of diffusion, subsequent sections consider the implications of intermediality for process and content across major components of the diffusion process.

The diffusion of innovations perspective

Diffusion of innovations is the process through which an innovation (an idea, product, technology, process, or service) is adopted (usually in a S-curve form, from rejection through adoption, saturation, and reinvention), through a series of stages, influenced by interpersonal (such as an opinion leader or change agent), mass, and digital communication and networks, over time (at different rates), through a social system (from local to international), with a wide variety of consequences (positive and negative, intended and unintended, short-term, and long-term) (Rice, 2009; Rogers, 2003).

While this traditional diffusion of innovations model has been elaborated over 40 years, alternative approaches have also been developed. To name just two, Wirth, von Pape, and Karnowski's (2008) mobile phone appropriation model integrates a dozen theories (especially the theory of planned behavior) to explain how mobile adopters generate personalized mobile phone usage and meaning. And the unified theory of

acceptance and use of technology (UTAUT) integrates eight prior models of adoption, planned behavior, and technology acceptance (Venkatesh, Morris, Davis, & Davis, 2003).

Interpersonal, mass, and new media play a central role in providing diverse sources and types of information about an innovation, which shapes awareness of, and reduces uncertainty about, the attributes, meanings, uses, and consequences of an innovation, thus influencing adoption decisions. The basic idea of underscoring the interrelationships among interpersonal and mediated communication channels in the diffusion process is not new. Reardon and Rogers (1988) applied the innovation-decision stages to the case of an individual who was considering adopting a microcomputer, illustrating that each stage involves not only both mass and interpersonal communication, but also interactions between them (p. 287).

Interpersonal, mass, and new media play two distinct roles in the diffusion of innovations (Rice, 1987). The first is as part of the *process* of diffusion: They provide information about and meanings of the innovation. The second is as the *content*: They are the innovation being adopted. The next sections will consider just a few implications of intermediality, for a few core components of the diffusion process (sources, rates, and categories of adoption, attributes, networks, and consequences), with respect to new media as process and as content.

Implications of intermediality for diffusion of innovations research

Sources of innovation

Media as process

New media can enable many of the same kinds of access to new information that interpersonal and group communication can, but also some that it cannot (Baym, Zhang, & Lin, 2004; Rice, 1987). For example, some new media have been designed explicitly to foster *serendipitous social interaction*, such as office video (Fish, Kraut, Root, & Rice, 1993) and Chatroulette (Ozgun, 2015), increasing exposure to new and diverse sources and information and subsequent innovation (though less so in the case of Chatroulette). *Crowd-sourcing* through new media (Shirky, 2009) allows many more individuals to contribute to the value and creation of innovations, by reducing the constraints on interpersonal participation in collective activities. *Online recommendation systems* help expose unknown films, music, movies, and books; products and solutions; and performers, authors, bloggers, and critics, complementing or even replacing traditional rating services (Passoth, Sutter, & Wehner, 2014).

Media as content

Adopting new media enables users to produce and make available their own content, or adaptations of existing content, inspiring concepts such as *convergence culture*, *produsage*, *prosumers*, *remixes*, and *mash-ups* (Bruns, 2008; Jenkins, 2006). Movie fans use multiple media forms to edit and/or create alternative sound tracks for film trailers, and then post them to YouTube or fan sites, enhancing their interpersonal reputations as creative, ironic, critical, or satirical fans (Williams, 2012).

Rate and categories of adoption

Media as process

New media, through digital networks, both speed up and extend over time the diffusion of information about a new event, idea, or product. Individuals can exchange, share, and discuss personal experiences (Flickr, YouTube, YikYak) through photos, videos, audio, and comments. Users or algorithms can tag this content (such as words or categories, metadata, color, location, time, and semantic content), creating a collective store of innovative material from individual contributions. Media settings can alert appropriate users, or people can search for relevant content or follow feeds and valued communicators. Thus some information can go “viral,” diffusing quickly across millions of viewers, from music videos to real-time coverage of political protests in other countries (Lotan, Graeff, Ananny, Gaffney, & Pearce, 2011).

New media can also extend the adoption process across many more users, innovations, and time. Anderson (2006) applied the concept of “the long tail” to potential adoption of both popular as well as extremely niche content. The costs of storage, access, and distribution of digital content is nearly zero, and each user (from around the world) provides some kind of identification and evaluation of the content (either intentionally, by tagging, liking, rating, or recommending, or unintentionally, by frequency of searching and associations with other searches (e.g., Amazon, Google). These factors make a wide range of infrequently adopted and obscure content accessible (e.g., eBay) to many different kinds of individual potential adopters who would otherwise not know about or be able obtain to obtain these diverse materials through interpersonal or mass channels, or physical stores.

Media as content

What constitutes *personal* or *new media* depends on what has recently diffused. Early personal electronic media included fax machines, videocassette recorders, and personal computers (Ganley, 1991), as well as transistor radios, the Sony Walkman, and pagers. In 2008 they included mobile phones, e-mail, instant messenger, blogs, and photo-sharing services (Lüders, 2008). Now they include social media, social robots, the Internet of things, virtual reality, ubiquitous computing, and wearable/embedded media, among others. By the early 1990s, *virtual reality* was an intriguing interpersonal medium, due to its “multichannel, multisensory and real-time interactive capabilities” (Palmer, 1995, p. 293). Research provides evidence of the similarity between face-to-face and *virtual reality* interaction: Social relationships established by classical psychological and social psychology experiments are replicated in *virtual environments* (Kozlov & Johansen, 2010; McCall & Blascovich, 2009). A recent example integrating interpersonal and mediated environments is Pokémon-Go (Serino, Cordrey, McLaughlin, & Milanaik, 2016). This game is a mediated and physical experience using *augmented reality* and *geo-location data*, with the goal of finding and capturing virtual creatures located around the world. Pokémon-Go diffused much more successfully than its predecessors because it combined existing massive crowd-sourced geocaching data (Schlatter & Hurd, 2005), global positioning

service (GPS) location tools, and the pre-existing nonaugmented reality version of Pokémon.

Attributes of innovations

Media as process

The traditional diffusion model identifies five attributes of an innovation that influence adoption: relative advantage, compatibility, complexity, trialability, and communicability/observability. Traditional conceptualizations of media (such as those discussed by Reardon & Rogers, 1988) tended to associate specific attributes with specific media. However, as noted above, the convergence of digital content and the growing diversity of new media platforms and applications are expanding the repertoire of attributes, as well as decoupling associations between any particular medium and any particular attribute (Helles, 2013). The need to understand and assess such communication channel attributes has been analyzed many different ways (see Nass & Mason, 1990; Steuer, 1992). Central approaches to characterizing and comparing new media have included *social presence* (Short, Williams, & Christie, 1976; Rice, 1993), *media richness* (Daft & Lengel, 1986), and *presence* (Lessiter, Freeman, Keogh, & Davidoff, 2001). For example, Rice (1987) argued that it is more useful to consider interpersonal, mass, and new media as associated with more or less overlapping sets of underlying, continuous attributes.

Such approaches also showed that characteristics typically associated only with interpersonal communication might also apply to new media. For example, Rice and Love (1987) found moderate expression of socioemotional content in an online bulletin board discussion, when most research and the popular press still emphasized the impersonal aspects of new media. Flanagin and Metzger (2001) (among earlier others) applied *uses and gratifications* theory to the new media domain, showing, for example, that a cluster of needs labeled “social bonding” included face-to-face as the most frequently used channel, but also e-mail and Internet due to their support of conversation.

The concept of *affordances* (Gibson, 1979; Norman, 1988) has been increasingly applied to explaining adoption, uses, and effects of media. *Media affordances* are relationships among action possibilities to which agents perceive they could apply a medium, within its potential features, capabilities, or constraints, relative to the agent’s needs or purposes, within a given context (Rice et al., 2017). As an example, Baym et al. (2004) concluded that affordances such as accessibility, message visibility, nonverbal cues, and intrusiveness are relevant in people’s decisions to use media for social sharing, in what contexts and with whom. New media also exhibit affordances unavailable through face-to-face communication, such as searchability through vast databases or repositories, or system-generated awareness of news and unknown others’ activities. *Polymedia* theory explicitly considers how users focus on a “communicative environment of affordances” instead of specific, discrete technologies (Madianou & Miller, 2013).

Media as content

Indeed, what we identify as a specific “medium”—as well as what we consider “natural” about and how we perceive and use both traditional and new media—are shaped by a wide variety of factors, ranging from physical material, technological infrastructure, means of access, social conventions, media habits, preferences of communication partners, and institutional structures. With continued use and integration into and shaping of society, the *medium* becomes idealized, naturalized, and metaphorized. As the material aspects of the medium become confounded with its content and attributes, media are socially constructed into artifacts (Rice, 1999). Helles (2013) especially highlights the switch from media tied to specific locations to the more individual and portable modes of personal digital media, whereby “the user becomes a mobile terminus for mediated communicative interaction across the various contexts of daily life” (p. 14). Further, the diffusion of apps, especially on smartphones, allows users to select or combine one or more media based on their affordances and/or embedded networks, rather than as an artifact of location and infrastructure (Helles, 2013; Rice, 1999). Another aspect of interrelationships among media attributes as they are adopted is *remediation* (Bolter & Grusin, 2000), as new media reflect, extend, and incorporate as well as rival, extend, and transcend those media.

Communication networks*Media as process*

The process of diffusion of an innovation involves *communication networks*, both interpersonal and mediated. Communication from, and attitudes and behavior (such as adoption) of, one’s network members influence a potential adopter’s decision. Wellman (1999) has forcefully argued that in the new media age we must reconceptualize communities as grounded in social networks, which can not only be supported by, but also extended in space, time, and type of relationships through, digital media. New media are influencing the conceptualization, creation, processes, nature, and fates of social networks and communities, both online and offline (Katz, Rice, Acord, Dasgupta, & David, 2004). This is most clearly reflected in the rise of social networking systems (SNSs), which by definition integrate social networks with digital/online media. For example, Hilbert et al.’s (2017) analysis of network patterns of over 150,000 tweets from nine environmental social movement protests in Chile identified four network roles: voices (organizations or individuals dedicated to the issue), media outlets, amplifiers (performing some of the activities of opinion leaders or change agents), and individual participants. They concluded that such online network environments reshape traditional diffusion roles (see also Cappella, 2017).

With constant decreases in size and increases in power and networking, all manner of digital devices are being interconnected into the *Internet of things* (Yan, Zhang, Yang, & Ning, 2008). By 2020, there may be as many as 50 billion devices connected to the Internet and thus networked with each other, ranging from household appliances

and smartwatches to package trackers and wearable technology, and as well as quantified self resources (Swan, 2012). Applying the social media model to the *Internet of things* creates the *social Internet of things*, which explicitly provides ways of navigating the massive network of digital devices and their users (Atzori, Iera, Morabito, & Nitti, 2012).

Media as content

Network relations affect adoption and use of new media in a variety of ways. For example, those who communicated more with each other face-to-face and held similarly favorable attitudes toward a forthcoming implementation of e-mail were more likely to adopt the system a year later (Rice, Grant, Schmitz, & Torobin, 1990). Kim, Kim, Park, and Rice (2007) found that face-to-face and mobile phone communication constituted one hierarchical media cluster, while instant messaging, e-mail, and SMS communication constituted a second media cluster, based on patterns of shared social relationships. Use of mediated social networks can also foster *social capital*, the set of potential resources (instrumental and emotional support, information about jobs, access to power) embedded in social networks beneficial to the individual or the relevant social group (Kikuchi & Coleman, 2012; Putnam, 2000). Adoption of mediated communication can build and maintain some kinds of social capital, depending on the medium and use (Ellison, Steinfield, & Lampe, 2007; Sheer & Rice, 2017; Vergeer & Pelzer, 2009).

Some new media are designed to specifically affect personal activity and interpersonal networks as well as to expand those networks to include mediated entities. For example, *digital health games* (e.g., *Just Dance*) provide opportunities for mediated play with friends while engaging in physical activity. Others teach users how to interact better with others, to understand oneself better, and to take on other identities to experience how those are treated by others, as well as to diffuse better health behaviors (Lieberman, 2012). *Social robots* constitute a growing arena for software and hardware design, modeling factors influencing social relationships, and seeking successful communication between humans and machines (De Graaf, Allouch, & Klamer, 2015; Zhao, 2006). Breazeal, Takanishi, and Kobayashi (2008) summarize concepts and research about social robotic multimodal communication (including paralinguistic, group, and collaborative communication), expressive emotion-based interaction, and sociocognitive skills (including mental perspective-taking).

Consequences of adoption and diffusion

Media as process

Smaller, more flexible, and wearable media provide opportunities for diffusing new services and practices. For example, media are taking on aspects of fashion as *wearable technology* and even integrated into fabrics (Campbell, 2008; Fortunati, Katz, & Riccini, 2010). (Wearable communication technology is not technically new; Seymour & Beloff, 2008, noted the popularity of cameras hidden in clothes in the 1870s.) Smart watches communicate with one's smartphone and computer, and indicate and provide

messages; Bluetooth transmission allows one to wear a wireless earpiece for music or phone communication; and Snap camera glasses provide digital capabilities such as photography. Garments may be infused with sensors, media, and networking capabilities, integrating clothing, technology, body, and self (Ryan, 2009). The smartphone provided the foundation for the *quantified self* or *self-tracking* movement(s) to diffuse (Lupton, 2016) through the integration of capabilities such as global positioning, physiological monitoring, data networking, analysis, and visualization. The adoption of separate, wearable, and embeddable devices (e.g., Fitbit) allows users to measure, monitor, store, analyze, and transfer a wide range of data about their health, physical processes, mood, and sleep. Users can communicate with and about one's self, and with others such as one's physician or other quantified self-participants, thus creating adoption networks and critical masses of other adopters, making measurement comparisons more interpersonal and informed, and fostering social or group exercising. Related devices or adaptations of the Fitbit can format and broadcast selected monitored bodily data from the wearer to intended interaction partners, displaying, for example, emotional states (Ashford, 2014).

Media as content

Adoption and use of new media involves a wide variety of positive, negative, and paradoxical consequences (Rice, 1999). Historically, mediated communication throughout history has initiated, shaped, or prevented face-to-face meetings and relationships (Clayton, 2003). The early stages of media diffusion has often generated widespread dystopian or utopian reactions about the interrelationships between interpersonal and mediated communication (Jensen, 1990; Marvin, 1990; Katz & Rice, 2002). Turkle's (2011) extensive analysis of interviews with youth about their use of new media identified many paradoxes, such as frequently using and strongly valuing their new media, but also being quite aware of the negative implications of the constant focus and use, such as wasting time, fear of missing something, growing dependence on mobile apps and tools, and distraction from or interruption of an unmediated interpersonal or group interaction. Social control of and through social media, for example, involves balancing the needs and concerns of the self with those of one's multiple groups, and also blurs boundaries between public and private spaces and lives (Rice & Hagen, 2010). Even the use of Pokémon Go is associated with positive and negative real, physical, interpersonal, and social consequences, such as Pokémon dates, team competitions, exercise, and interacting with other players, but also injury, accidents, trespassing, and abduction.

Seymour and Beloff (2008) suggest that human bodies will become a media interface through a variety of devices, whether held, worn, or embedded. Of course, potential adopters vary in their preferences for the extent to which media such as *health-related RFID* (radio frequency identification) devices are worn on or embedded in their bodies (Katz & Rice, 2009). The initial concept of the *cyborg* combined an organism (typically human) with biomechanical components and feedback mechanisms (i.e., a *cybernetic organism*) (Balsamo, 1996). Such components can

include pacemakers, prosthetic devices, and, depending on the perspective, hearing aids, glasses, vaccines, and pharmaceuticals. Haraway (1991) and others developed a much more philosophical conceptualization of the cyborg. This approach rejects traditional binaries in Western civilization; emphasizes paradoxes and freedom from hegemonic labels and language; highlights the emergence of relational, network, and social communication theories beyond individualist perspectives; and shifts from individual communication intentions to contexts and the constitutive nature of communication (Gunkel, 2000).

Conclusion

This article ends by suggesting one general question for each combination of new media as *process* and as *content* in the diffusion process, with the *five components of the diffusion of innovations perspective*, emphasizing interrelationships among interpersonal, mass, and new media.

Sources

What are the relative strengths and weaknesses of interpersonal, mass, and media sources in generating exposure to and adoption of innovations? What combinations of interpersonal, mass, and new media communication are used in creating innovative content?

Rate and categories of adoption

What patterns or types of multistep flows involving interpersonal, mass, and new media communication are most influential in different stages of the diffusion curve? Content: Do different types of adopters value different combinations of interpersonal, mass, and new media components of innovations?

Attributes

What attributes of interpersonal and mediated communication are most influential in the different stages of the diffusion process? To what extent are attributes of new media shaped through interpersonal and mediated communication after adoption of the new medium?

Communication networks

How do interpersonal and mediated communication networks differentially, similarly, or jointly affect different aspects of the diffusion process? How do people integrate new media and into their existing social networks?

Consequences

How does interpersonal and mediated sharing and discussing of information from new media influence the use of other health-related innovations and services? How can research help identify and resolve paradoxes of positive and negative consequences of new media adoption and diffusion?

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