

From Atoms to Bits and Back: A Research Curation on Digital Technology and Agenda for Future Research

BERND SCHMITT

Over the last 250 years, the Industrial Revolution and subsequent technology-driven economic transformations have radically changed how people live and work, and how consumers buy and use goods and services. We are now in the midst of another major technological transformation—the digital revolution. In *Being Digital*, Nicholas Negroponte, the visionary founder of the MIT Media Lab, used the metaphor of a shift “from atoms to bits” to characterize digitization (Negroponte 1995). Atoms, he wrote, have mass and materials and need to be transported. In contrast, bits are weightless and virtual and allow for instant global movement. He argued that the change from atoms to bits was irrevocable and unstoppable.

Consumer goods resulting from the Industrial Revolution, made in factories and sold in stores, have atoms. In contrast, consumer information products (e.g., websites, search engines), entertainment products (e.g., video games, digital photos and movies), interaction products (e.g., social media), and purchasing sites (e.g., ecommerce sites) can be made of bits. Past technological revolutions have created value for consumers largely by producing more and more “atomic” products as well as products of different physical kinds. In contrast, digital technologies add value to consumers by providing new forms of knowledge, entertainment, and interactions and new ways of buying products. Using the web, ecommerce, mobile devices, and social media, consumers can buy and

consume conveniently, and can easily interact and communicate with organizations and other consumers. In sum, digital technologies have profoundly changed the consumer experience.

Yet there is more to come. The digital revolution is entering a new phase, from bits back to atoms, by incorporating digital information into physical, solid products. Technologies such as the Internet of Things (IoT), augmented reality and virtual reality (AR/VR), artificial intelligence (AI), robots, smart cars, blockchain, 3D printing, and the like are on the verge of mass commercialization and likely to turn consumers’ lives upside down once more.

As a result of the digital revolution, new topics and themes have entered consumer research, and, as the digital revolution enters a new phase, additional new concepts and research questions will emerge. To illustrate the variety of themes on digital technology that consumer researchers have studied, I am presenting a collection of five articles that represent this active new research area. Moreover, I will look into the future and propose a research agenda to address key consumer behavior issues occurring during the next phase of the digital transformation.

RELATED CURATIONS

Two prior curated collections are closely related to the present curation: Wood’s (2016) curation of the psychology of innovation and Kozinets’ (forthcoming) curation of technocultures. The collection of articles on digital technology presented here complements these two prior curations. Together, the three curated collections will allow readers to explore research on consumer technologies and innovations and garner a deeper understanding of this research area.

Wood (2016) identified five major themes that evolved in consumer innovation research over the last four decades and featured one recent article within each theme. The

Bernd Schmitt (bhs1@columbia.edu) is the Robert D. Calkins Professor of International Business in the Marketing Division of Columbia Business School at Columbia University in New York City. The author thanks the editors for the opportunity to write this research curation.

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themes concerned understanding a generalized innovation process from a consumer's perspective, following the influential Rogers (1983) model; understanding the "mental work" of innovation adoption; understanding how cultural meaning shapes innovation adoption; capturing innovativeness as an individual trait; and, finally, studying the role of the internet and other social and technological networks in innovation. All five themes are of critical relevance for any research on innovation; and the last theme, the internet, clearly relates to this curation on digital technology. For the last theme, Wood featured a consumer culture theory (CCT) article by Dolbec and Fischer (2015) on connected consumers in the online fashion world.

Kozinets (forthcoming) defined technocultures as "the various identities, practices, values, rituals, hierarchies, and other sources and structures of meaning that are influenced, created by, or expressed through technology consumption." Technocultural consumption, then, is "the inflection of consumers' experiences by technologies as well as the injection of consumer desire and intent into technologies," including, for example, social media, ecommerce, online brand communities, smart devices, and apps, but also new emerging technologies such as AI and augmented and virtual reality. Kozinets featured four CCT articles and a conceptual article by Hoffman and Novak (2018) on IoT, using assemblage theory.

In the present collection on digital technologies, I will focus on empirical articles that employ mostly field and lab experiments, based on information processing or behavioral decision theory perspectives (MacInnis and Folkes 2010). All five articles featured in this curation have appeared in the *Journal of Consumer Research* over the past three years. They are timely and relevant, and address conceptually, empirically, and methodologically many of the facets and emerging themes related to consumer behavior vis-à-vis current digital technologies.

RESEARCH THEMES ON DIGITAL TECHNOLOGIES

The five articles in the current curation illustrate five emerging research themes.

Consumer Responses to Digital Versus Physical Products

The digital age has led to many new product innovations. These innovations raise the issues discussed and illustrated in Wood's curation: do consumers view these innovations as being part of the same innovation process? How do consumers mentally make sense of these innovations? Does cultural meaning shape them? However, a radical shift also calls for an examination of and focus on the

very nature of these new innovations. That is, generally speaking, how do consumers perceive and respond to digital products relative to physical products? Do they prefer bits over atoms?

The first article in this curated collection addresses this "big picture" issue, which is not easy to address rigorously because digitization has resulted in replacing, or at least vastly diminishing, physical products in many categories. That is, consumers do most of their banking online rather than interacting with a bank teller; they book flights online rather than going to a travel agent; and consumer researchers no longer communicate through letters with coauthors but instead use email or social media. Yet, in some categories, consumers still have comparable alternatives. Atasoy and Morewedge (2018) use books (both novels and college textbooks), photos, and movies, presented either in a digital or physical format, to demonstrate that *ceteris paribus* consumers value these digital goods less than the corresponding physical goods. Specifically, consumers anticipated less enjoyment from these digital goods; they showed lower purchase intention and willingness to pay; and, most importantly, in a field study at Old North Church in Boston including a consequential outcome, they were less likely to donate money for a digital than physical souvenir (a picture of themselves with a research assistant posing as Paul Revere). The theoretical explanation for this preference relates to one of the basic concepts of our field: psychological ownership. With physical goods, consumers feel a stronger sense of psychological ownership.

Many years ago, Belk (1988), in one of the seminal and foundational conceptual articles of our field, showed how important possessions are and how they are intricately linked to a consumer's self-identity. Indeed, Atasoy and Morewedge's (2018) research indicates that the effect is moderated by identity relevance: participants in their study that identified more strongly with a *Star Wars* movie exhibited a higher purchase intention for a physical copy than a digital one, whereas those who identified less did not care. It may be worthwhile to reflect on this article and its finding in light of Negroponte's (1995) prediction that, ultimately, what can be digital will be digital. It seems that from a consumer point of view, something valuable may get lost as this transition occurs. What gets lost seems to be something at the core of what it means to buy and consume—namely, to *possess something in its physical form*. Perhaps there is an evolutionary process at work. As part of our evolution we have learned to manipulate physical objects and therefore define ourselves, in part, through something from the physical environment that we call ours (similar to dogs who stake out a claim to a particular territory). This basic tendency may be the starting point of becoming a consumer. Accordingly, the finding that consumers value a physical product more

than a digital one relates closely to the very identity of being a consumer.

Sharing Digital Content

Digital technologies have enabled personalized, relevant experiences for consumers and have also resulted in new buying and consumption experiences (shopping based on recommendations and reviews from other customers, gaming, video chats, etc.). In general, experiences seem to make consumers happier than possessions, in part because of the greater enjoyment derived from sharing experiences (Gilovich, Kumar and Jampol 2015; Van Boven and Gilovich 2003). Importantly, consumers can use the internet to share their experiences instantly and conveniently with others anytime, anywhere. Digital photography and selfies are a case in point. Sharing photos of experiences and of oneself, taken on smartphones through social media, has become a widespread phenomenon. Every day hundreds of millions of photos are shared.

In the second article of this collection, Barasch, Zauberman, and Diehl (2017) explored some negative consequences of the intention to share an experience. Using field and lab studies, the authors show that in the context of photo-taking, the mere intention of sharing the photos undermines enjoyment of the momentary experience because anticipated sharing highlights self-presentational concerns that can produce anxiety. The effect does not occur when the photos are shared with close friends because friends are less likely to evaluate a person merely based on the photos. Companies pursuing an experiential marketing campaign may thus be well advised to get people to focus on the memory of the personal moment that photo-taking can provide rather than encouraging consumers to share. I guess, Kodak, a predigital company, had it right: focusing on moments and memories rather than sharing them can increase enjoyment.

Humanizing Technology

Another research theme examines the tension between digital technology and the concept of humanness. Anthropomorphism has been defined as “perceiving human-like traits in nonhuman agents” (Epley 2018, 591). Consumers anthropomorphize all sort of objects including products and brands (Touré-Tillery and McGill 2015); conversely, handwritten typefaces can introduce an element of humanness (Schroll, Schnurr, and Grewal 2018). Physical appearance suggesting a face or a body, as well as the expressive display of emotions, seems to be the critical factor to creating believable and lifelike virtual characters. Appearance increases a “human schema,” whereas certain behaviors seem to lead to attributions of a “human-like mind” (Aggarwal and McGill 2007; Epley, Waytz, and Cacioppo 2007).

The third article included here, by Kim, Chen, and Zhang (2016), studies consumer responses to digital assistants with humanlike features in a gaming environment. Digital games have become one of the most popular forms of entertainment in the US, and especially in Asia, and earn more revenues than the movie and music industries combined. Examining the effect of anthropomorphic representations of computerized helpers on game enjoyment, the authors find that consumers enjoyed a game less when they received assistance from a computerized helper with humanlike features than from a helper construed as a mindless entity, because the humanlike appearance of the digital helper undermines a gamer’s sense of autonomy. As I will discuss later, anthropomorphism and autonomy are likely to become focal constructs in the new phase of digitization where technology increasingly will take on a humanlike form.

Resisting Digitization

For decades, researchers have studied resistance to new technology. Neglecting statistical models, even when these models outperform human judgment, has been a major research topic since the 1950s (Dawes 1979; Meehl 1954). Regarding digital technology, research has focused on AI, consisting of algorithms that interpret data, learn from it, and use those learnings to solve problems, make decisions, and perform various tasks. Researchers have identified a decision bias referred to as “algorithm aversion”—preferring humans over algorithms in a variety of decision tasks (Dietvorst, Simmons, and Massey 2015). How can one overcome this aversion, especially when the technology is in the interest of consumers and provides important benefits for them? It seems to me that, in general, consumer researchers can make important contributions to consumer welfare by understanding reluctance to technology and designing interventions to overcome it.

Consider healthcare. In the fourth article of this collection, Longoni, Bonezzi, and Morewedge (forthcoming) argue that medical AI is likely to become a \$10 billion industry in the US by 2025 and replace 80% of the work that doctors currently do. AI can result in significant cost savings for equal or greater accuracy. For example, IBM Watson already diagnoses heart diseases, and can outperform human healthcare providers in diagnosing certain cancers. Similarly, skin care apps diagnose skin cancer with expert accuracy. AI is thus revolutionizing healthcare, but consumers seem to be reluctant to utilize healthcare provided by AI. The authors show that “uniqueness neglect”—a concern that artificial intelligence cannot as easily account for patients’ unique characteristics and circumstances—explains consumer resistance to medical AI. As a result, the negative effect can be eliminated when AI is personalized and when the technology is framed as

supporting rather than replacing the decision of a human healthcare provider.

New Methodologies

The rise of digital technology requires new methodologies for analyzing digital content. One such methodology is “sentiment analysis,” which refers to the use of text mining, computational linguistics including natural language processing, and biometrics to extract consumer attitudes and affective states from digital content. The rise of social media and consumer reviews has fueled great interest in sentiment analysis. From a consumer research point of view, the question arises of how to best code consumer data to reveal insights about their sentiments.

In the fifth article of this curated collection, Ordenes et al. (2017) apply Searle’s (1969) speech act theory to code data and then study the effect of various speech acts on sentiment strength. They distinguish explicit sentiment expressions (e.g., “I hate this”) and implicit sentiment expressions such as directive speech acts (e.g., “You should stay here”), commissive speech acts (e.g., “You should never buy another book from this author”) and assertive speech acts (e.g., “We got a discount”). In addition, they consider discourse patterns such as incoherence (different speech patterns within a discourse). They formulate hypotheses about the relation of speech acts to sentiment strength and test their hypotheses by scraping data from Amazon, TripAdvisor, Twitter, and Facebook. Results indicate that the identified speech act characteristics relate to sentiment strength, and sentiment strength influences changes in sales ranks. The article is an example of the type of methodologies and big data analyses that will increasingly add consumer insight.

PROPOSING A FUTURE RESEARCH AGENDA

As we have seen, consumer researchers have begun to examine the many facets of the digital transformation. Researchers should continue to conduct empirical studies on the differences between digital and physical products, the nature of digital content, the tension between digital technology and humanness, and resistance to digital technology, and also continue to create new methodologies. Moreover, new themes will emerge—for example, how consumers will manage their lives with interconnected devices (e.g., IoT devices in their smart homes or integrated apps that feature messaging, social media, entertainment, payment, and other services).

As digitization enters its next phase from bits back to atoms by incorporating digital information into physical products, the future consumer research agenda on digital technology also needs to include new developments that may affect consumer behavior more radically. The bulk of

past research, and the five articles featured in this collection, has examined technologies that are outside the human body and do not directly change the body or mind. Yet some new technologies are getting closer and closer to people’s bodies and may even directly affect their minds.

For example, AR/VR will provide consumers with unique experiences to supplement their real-life experiences. AR does so by creating an add-on and interactive experience of a real-world environment (for example, on a smartphone). VR simulates the environment entirely and thus immerses consumers in a virtual world. AR/VR technology is likely to provide relevant new information as well as imagination before, during, and after purchase. These technologies are likely to revolutionize product trials, imaginations of product usage, and the consumption experience. Moreover, other technologies, such as transcranial direct-current stimulation (tDCS), as well as genetic engineering techniques like CRISPR and brain-computer interfaces, directly enhance consumers’ physical and mental capacities. These developments have sparked a debate on “transhumanism,” focusing on the essence of human nature (Haslam 2006). Whereas some enthusiastically support transhumanism as a positive vision that can help people live better lives (Bostrom 2005), others view it as the greatest threat to the welfare of humanity because transhumanism destroys the natural order of human nature (Fukuyama 2004).

While humans enhance themselves with technology in various ways, technology itself is increasingly being humanized. For example, chatbots with voice, based on natural language processing, behave like human conversational partners. They do not just provide information but interact using casual language and jokes, and can display emotions through voice. Moreover, the design of many robots increasingly includes human features (a face and facial features, a body with arms and legs), and some humanoid robots look strikingly similar to humans and can engage in humanlike conversations. The market for these “consumer robots,” which (or who?) will interact with consumers in stores or hotels and service them, is growing fast. For their homes consumers will be able to purchase robots with a human appearance that can serve as conversational partners, companions, and assistants. In sum, AI in both its general and its embodied form (as robots) offers potentially great functional and social benefits.

Given these two parallel developments (humans incorporating more and more technology into their bodies and mind, and technology becoming increasingly humanized), the distinction and relationship between human and machine will play an increasingly central role in future research. In fact, we may approach a point in the future where the capabilities and the “mind” of a human and a machine may become rather indistinguishable, and where a system may pass the Turing test, not only in its original textual form but also on voice, appearance, and movement.

A key question for researchers, then, is how consumers perceive and respond to products and services along the human-machine spectrum—that is, how consumers perceive and respond to products that enhance their bodies and minds to various degrees, and, conversely, how they perceive and respond to the technologies in stores, online, and in homes that are becoming humanized.

KEY CONSTRUCTS ALONG THE HUMAN-MACHINE SPECTRUM

Several constructs and theories seem particularly relevant for studying consumer perceptions and responses along the human-machine spectrum.

Anthropomorphism

Anthropomorphism will be a key construct in explaining consumer reactions along the human-machine spectrum. Consumers are likely to react differently to technology products (e.g., robots), depending on how human they look and behave and thus how easily they can be anthropomorphized. According to Mori's (1970) well-known "uncanny valley" hypothesis, the humanlikeness of a robot is the key factor for predicting affinity toward it. Interestingly, more humanlikeness is not always better. As we have seen already, digital helpers were liked less when anthropomorphized, and Mori (1970) predicted that highly humanlike robots may produce a feeling of eeriness.

Research in the future should move beyond the study of anthropomorphism *features* (e.g., humanlike facial features; Aggarwal and McGill 2007) toward anthropomorphism *dimensions*. That is, for the perception of a machine it may make a difference along which dimension the machine is being anthropomorphized. For example, according to Fiske, Amy, and Glick (2007), warmth and competence are the two basic human judgment dimensions in human interactions that account almost entirely for how people characterize other people. Competence—associated with traits such as capable, competent, and skilled—seems to be related to technology. Thus, it seems that we could use this judgment dimension to judge digital technology performance, and higher competence will be judged positively. However, it seems odd to apply the warmth dimension—associated with traits such as caring, nice, and sociable—to a technology product, and increasing the warmth of a robot may lead to less positive responses (Kim, Schmitt, and Thalmann 2019). Technology and humanness thus seem to be at odds to some degree. This conflicting relation also seems to manifest itself when consumers use cognitive enhancement products: they are "mechanistically dehumanized" (likened to a robot) when the technology expands their mental capabilities beyond normal levels (Castelo, Schmitt, and Sarvary 2019).

Speciesism

Consumer researchers should further investigate to what degree fears and technophobia, and even speciesism, may play a role in consumer reactions to these technologies. Once AI is indistinguishable from human intelligence, and robots have taken on a humanoid body, there should be no reason to treat AI (and perhaps even robots) differently from humans. However, this new phase of technology may raise fears (about jobs and even human uniqueness), result in biases, and perhaps even prompt a prejudice against technology that may be characterized as "speciesism." Speciesism has been defined as "the assignment of different moral worth based on species membership" and studied in the context of human-animal relations as a kind of prejudice analogous to racism and sexism (Caviola, Everett, and Faber, 2019). Consumer researchers should examine whether speciesism may also be at play as a bias or prejudice toward these new technology products, which may disadvantage digital decision and recommendation systems, chatbots, and robots in retail and service settings, and thus be a barrier to their adoption.

Autonomy

Finally, consumer researchers should investigate how perceived autonomy of the technology affects human-machine interactions. Autonomy has been defined as "the extent to which a system can carry out its own processes and operations without external control" (Beer, Fiske, and Rogers 2014). Autonomy requires the ability to sense an environment, plan, and act on that environment with the objective of reaching a task-specific goal without external control. The perceived autonomy of a system is inversely related to the consumers' perceived control over the system. This raises important research questions. As the next wave of the digital age unfolds, how much autonomy do consumers find desirable and, conversely, how much control are they willing to give up to receive benefits? Moreover, which tasks should—and which should not—be fully automated?

Ultimately, the decision of which tasks to automate also has an ethical dimension (just think about autonomous cars). In fact, in addition to the conceptual issues discussed above, ethical, regulatory, and consumer privacy and protection issues need to be a significant part of the research agenda on future digital technologies. As we have seen, the digital transformation also calls for new methodologies, and perhaps even new paradigms. Will the information processing and decision perspectives taken from psychology, which have dominated consumer research for decades, suffice to describe and explain the behavior of technologically enhanced consumers interacting with smart, autonomous machines? Or will it be necessary to open up the field of consumer behavior (CB) to concepts from science

and engineering? No matter which topics, methodologies, and paradigms consumer researchers will pursue in the future, some of the issues that may appear at present as “Sci-Fi CB” may soon be the new research reality.

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ARTICLES IN CURATION

Digital Goods Are Valued Less than Physical Goods
(Vol. 44, Issue 6)

Ozgun Atasoy
Carey K. Morewedge

Digital goods are, in many cases, substantive innovations relative to their physical counterparts. Yet, in five experiments, people ascribed less value to digital than to physical versions of the same good. Research participants paid more for, were willing to pay more for, and were more likely to purchase physical goods than equivalent digital goods, including souvenir photographs, books (fiction and nonfiction), and films. Participants valued physical goods more than digital goods whether their value was elicited in an incentive compatible pay-what-you-want paradigm, with willingness to pay, or with purchase intention. Greater capacity for physical than digital goods to garner an association with the self (i.e., psychological ownership) underlies the greater value ascribed to physical goods. Differences in psychological ownership for physical and digital goods mediated the difference in their value. Experimentally manipulating antecedents and consequents of psychological ownership (i.e., expected ownership, identity relevance, perceived control) bounded this effect, and moderated the mediating role of psychological ownership. The findings show how features of objects influence their capacity to garner psychological ownership before they are acquired, and provide theoretical and practical insights for the marketing, psychology, and economics of digital and physical goods.

How the Intention to Share Can Undermine Enjoyment:
Photo-Taking Goals and Evaluation of Experiences
(Vol. 44, Issue 6)

Alixandra Barasch
Gal Zauberaman
Kristin Diehl

People often share their experiences with others who were not originally present, which provides them with both personal and interpersonal benefits. However, most prior work on this form of sharing has examined the decision to share one's experience only after the experience is over. We investigate a distinct, unexplored aspect of the sharing process: when the decision to share is already salient during an experience and hence can impact the experience itself. We examine this research question within the context of photo-taking, an increasingly ubiquitous and integral part of people's experiences. Across two field and three laboratory studies, we find that relative to taking pictures for oneself (e.g., to preserve one's memories), taking pictures

with the intention to share them with others (e.g., to post on social media) reduces enjoyment of experiences. This effect occurs because taking photos with the intention to share increases self-presentational concern during the experience, which can reduce enjoyment directly, as well as indirectly by lowering engagement with the experience. We identify several factors that moderate the effect of photo-taking goals on enjoyment, such as individual differences in the extent to which individuals care about how others perceive them and the closeness of the intended audience.

Anthropomorphized Helpers Undermine Autonomy and
Enjoyment in Computer Games
(Vol. 43, Issue 2)

Sara Kim
Rocky Peng Chen
Ke Zhang

Although digital assistants with humanlike features have become prevalent in computer games, few marketing studies have demonstrated the psychological mechanisms underlying consumers' reactions to digital assistants and their subsequent influence on consumers' game enjoyment. To fill this gap, the current study examined the effect of anthropomorphic representations of computerized helpers in computer games on game enjoyment. In the current research, consumers enjoyed a computer game less when they received assistance from a computerized helper imbued with humanlike features than from a helper construed as a mindless entity. We offer a novel mechanism that the presence of an anthropomorphized helper can undermine individuals' perceived autonomy during a computer game. Across six experiments, we show that the presence of an anthropomorphized helper reduced game enjoyment across three different games. By measuring participants' perceived autonomy (study 1) and employing moderators such as importance of autonomy (studies 2, 3, and 4), we also provide evidence that the reduced feeling of autonomy serves as the mechanism underlying the backfiring effect. Finally, we demonstrate that the effect of anthropomorphism on game enjoyment can be extended to other game-related outcomes, such as individuals' motivation to persist in the game (studies 4 and 5).

Resistance to Medical Artificial Intelligence
Forthcoming (Vol. 46, Issue 4)

Chiara Longoni
Andrea Bonezzi
Carey K. Morewedge

Artificial intelligence (AI) is revolutionizing healthcare, but little is known about consumer receptivity to AI in

medicine. Consumers are reluctant to utilize healthcare provided by AI in real and hypothetical choices, separate and joint evaluations. Consumers are less likely to utilize healthcare (study 1), exhibit lower reservation prices for healthcare (study 2), are less sensitive to differences in provider performance (studies 3A–3C), and derive negative utility if a provider is automated rather than human (study 4). *Uniqueness neglect*, a concern that AI providers are less able than human providers to account for consumers' unique characteristics and circumstances, drives consumer resistance to medical AI. Indeed, resistance to medical AI is stronger for consumers who perceive themselves to be more unique (study 5). Uniqueness neglect mediates resistance to medical AI (study 6), and is eliminated when AI provides care (a) that is framed as personalized (study 7), (b) to consumers other than the self (study 8), or (c) that only supports, rather than replaces, a decision made by a human healthcare provider (study 9). These findings make contributions to the psychology of automation and medical decision making, and suggest interventions to increase consumer acceptance of AI in medicine.

Unveiling What Is Written in the Stars: Analyzing Explicit, Implicit, and Discourse Patterns of Sentiment in Social Media
(Vol. 43, Issue 6)

Francisco Villarroel Ordenes
Stephan Ludwig
Ko de Ruyter
Dhruv Grewal
Martin Wetzels

Deciphering consumers' sentiment expressions from big data (e.g., online reviews) has become a managerial priority to monitor product and service evaluations. However, sentiment analysis, the process of automatically distilling sentiment from text, provides little insight regarding the language granularities beyond the use of positive and negative words. Drawing on speech act theory, this study provides a fine-grained analysis of the implicit and explicit language used by consumers to express sentiment in text. An empirical text-mining study using more than 45,000 consumer reviews demonstrates the differential impacts of activation levels (e.g., tentative language), implicit sentiment expressions (e.g., commissive language), and discourse patterns (e.g., incoherence) on overall consumer sentiment (i.e., star ratings). In two follow-up studies, we demonstrate that these speech act features also influence the readers' behavior and are generalizable to other social media contexts, such as Twitter and Facebook. We contribute to research on consumer sentiment analysis by offering a more nuanced understanding of consumer sentiments and their implications.