Artificial Intelligence, Marketing, and the History of Technology: Kranzberg's Laws as a Conceptual Lens

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Abstract

Killer applications, or killer apps, are technology applications that profoundly change the way any society thinks, works, and functions. This paper explores Artificial Intelligence (AI) as a killer app, with specific application to marketing. Specifically, this paper employs the lens of technology history to explore the relationship between marketing and AI. Using Kranzberg's six laws of technology, this paper sheds light on all manner of innovations, how technologies have shaped and impacted society, and how marketers can respond to this. This inquiry offers two main contributions: First, it suggests a number of implications for marketing practice and scholars, derived from each of Kranzberg's laws. These suggestions are intended to guide marketing practice when implementing or using AI. In addition, this article offers a number of research directions that might be fruitful and important areas for investigation in future scholarly work regarding technology's impact among marketing scholars.

Artificial intelligence (AI): The killer app

The concept of "disruptive technologies," or innovations that *significantly alter the way that consumers, industries, or firms operate*, was promulgated by Christensen and his colleagues (Bower & Christensen, 1995; Christensen et al., 2015). These scholars question whether innovations such as Apple's iPhone (it is, they say), and the ride-sharing app Uber (it isn't, they say) are disruptive technologies. Similar to the prior conceptualization of disruptive technologies, Downes and Mui (1998) introduced the notion of killer applications or "killer apps" that change the way society itself thinks, works, and functions.

It is possible to say that the first "killer app," or technology that changed human destiny, appeared more than 3 million years ago (Cassidy, 2020). Until the 1960s, humans had been defined as different from other animals because of their ability to *make and use* tools. This conceptualization was shattered in 1960 when the young primatologist Jane Goodall observed a chimpanzee strip a twig of its leaves and use this dipping stick to extract termites from a mound (Goodall, 2021). Humans were then hastily redefined by scientists as unique because of their ability to *use tools to make tools*. The earliest recorded example of this is of a female *Australopithecus* (an early human ancestor) on the African savannah who walked upright. She used rocks to sharpen animal bones, and then used these bones to remove the skin from a scavenged animal carcass. From this skin, a rudimentary sling could be fashioned and used to carry an infant. This enabled the female to simultaneously carry the child, gather food, and protect herself from predators more easily than when she had to hold on to a clinging infant (Cassidy, 2020). This paved the way for early humans to become far more mobile, being able to move out of Africa and populate the world. Technology, even in the form of a primitive animal skin sling, shaped, and changed humans forever. It continues to do so. Countless killer apps followed the animal skin sling. Over time these have included, in rough chronological order, fire, bows, art, clothing, beer, surgery, horse riding, the wheel, and soap. These were over time followed by more technologies including typesetters, the saddle, the printing press, steam power, electricity, the internal combustion engine, the telephone, aircraft, television, transistors, computers, the internet, and more recently genetics and Artificial Intelligence (AI), to name but a random few in more or less chronological order.

More recently prominent, AI has seen increasing interest among social science scholars. Many scholars suggest that AI, defined as technology that allows computers to learn from experience and display human-like intelligence (Campbell et al., 2020; van Esch et al., 2021), will substantially transform organizations and society

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completely. What we intend to do in this paper is to explore AI as a killer app, with specific application to marketing. Specifically, we continue to look to a discipline outside of the field of business management, namely history of technology, as a useful lens to explore the relationship between marketing and AI. Using Kranzberg's six laws of technology, we discuss how technologies, and specifically AI, are shaping and impacting society, and how marketers can respond to this. This inquiry offers two main contributions: First, we suggest unique and hopefully useful perspectives on the implications of AI for marketing practice, derived from the conceptual lens of technology history. Second, we provide research directions that might be fruitful and important areas for investigation in future scholarly work.

Our paper is structured as follows: We begin by briefly defining and describing AI in order to narrow our focus on a particular type of Artificial Intelligence. Next, we review some marketing perspectives on technology. Then we introduce thinking from the discipline of technology history, specifically from the perspective of the historian Melvin Kranzberg, to further explore these perspectives and highlight considerations for managers, as well as suggesting avenues of research that marketing scholars who study AI in marketing might wish to pursue.

Marketing perspectives and artificial intelligence

Marketers in general, and marketing scholars in particular, have long shown a deep interest in technology. Indeed, one of the most cited papers in the academic marketing literature is Bass's (1969) seminal work on the introduction of new products, or new technologies. Much more recently, Lusch (2017) asks marketers challenging questions about what he terms a "long view" on technology. He asks what factors have led to humans creating tools; and, whether societies historically, and today, differ in their creation of tools. Most importantly, in our opinion, he asks what the consequences of technology are, and whether society overall is better or worse off as a result of technologies. This question is particularly interesting as we deliberate the extent to which AI might be a killer app that disrupts marketing (de Ruyter et al., 2018; van Esch et al., 2020).

The term "Artificial Intelligence" often raises concerns about computers and robots becoming self-aware and taking over the world; however, the type of AI discussed in this article is quite different from the previously mentioned concerns. We generally think of AI as a broad area of computer science that makes machines seem like they have natural, human intelligence. In other words, when computers exhibit cognitive functions and perform tasks that typically require human intelligence, we refer to them as having Artificial Intelligence (Cui et al., 2021; Paschen et al., 2019).

The most common applications, and the one that this paper focuses on, make use of *Narrow AI* (also referred to as Artificial Narrow Intelligence/ANI, or as Weak AI) to handle a singular, specific task. When compared to the natural intelligence of people, narrow AI focuses on a single subset of cognitive abilities. Examples range from speech recognition for virtual assistants (e.g. Siri and Alexa) and driving directions to performing complicated cancer diagnoses in the medical field—examples that show how popular, desirable and important narrow AI has already become in our lives. Narrow AI not only takes care of many well-structured and repetitive tasks to improve our overall productivity, efficiency, and quality of life, but also helps us accomplish tasks that were previously unthinkable (like riding in autonomous cars that use many ANI systems at once).

In contrast, *General AI*, also referred to as Artificial General Intelligence (AGI), and as Strong AI, relates to the notion of computers with general intelligence that can be applied to solve any problem, and even perform multiple tasks at once. AGI, still a theoretical construct that is predicted to become useful around 2040, will rely on a synthetic form of consciousness to become innovative, imaginative and creative. When it does, it will be indistinguishable from human intelligence in any given situation. For this to happen, though, machines need to be able to use a wide range of cognitive abilities, beyond replicating and simulating human intelligence for a single task.

Artificial Super Intelligence (ASI) refers to the type of computer world in which machines become self-aware and surpass the capacity of human intelligence and ability. While this is a massive step up from AGI, speculations about its arrival vary from "soon after AGI" to "not in the foreseeable future." ASI will define a world in which sentient computers will be able to train other computers. Under this scenario, we will approach a technological singularity where, as experts like Elon Musk, Ray Kurzweil and Stephen Hawking have debated, AI growth becomes uncontrollable and irreversible, resulting in unpredictable and possibly undesirable changes to human civilization (Figure 1).

Throughout the remainder of this article, references to AI relate to ANI. Moreover, our discussions also imply that AI uses the ability of systems to learn (through machine learning or deep learning) from the data provided to carry out specific tasks. An autonomous car, for instance, needs to be able to learn from its environment to make predictions or decisions without being explicitly programmed to do so for every imaginable traffic situation. As we will illustrate through the examples below, such input data can be structured (e.g. quantified data such as vehicle speed and velocity) or unstructured (e.g. qualitative data from people speaking), and AI can use various processes to generate useful outputs (e.g. text, video, audio, data for other machines) (Paschen, Pitt et al., 2020; van Esch et al., 2021b). In recent years, AI has received increased scholarly attention in the marketing discipline (Bakpayev et al., 2020; Balducci & Marinova, 2018; Berger et al., 2020; Campbell et al., 2020; Paschen et al., 2019; Syam & Sharma, 2018; van Esch & Cui, 2021; Xu et al., 2020). In the service literature, for instance, research has investigated service provisions enabled by AI technologies (see Black & van Esch, 2021; Huang & Rust, 2018). Other scholars have studied the antecedents and consequences of using AI for data analysis, for instance to analyze user-generated content on social media or review sites (see Pitt et al., 2018) or for marketing decision making including B2C marketing (see Kietzmann et al., 2018) and B2B marketing (see Syam & Sharma, 2018). Further, Campbell et al. (2020) discuss using AI in strategic marketing and identify how AI might be leveraged in each of the stages of a strategic marketing plan. Davenport et al. (2020) propose a framework by which to depict AI technologies based on the level of intelligence that AI technologies display and where in the virtuality/reality continuum they operate. The authors suggest that today's AI applications are rule-based, where their intelligence involves the imposition of logic. However, future AI applications, especially the above-mentioned ASI, may eventually display a form of intelligence where algorithms "learn how to learn" (Davenport et al., 2020, p. 27) and extend beyond their initial programming by humans.

While AI, its applications and its effects on marketing and customers has garnered the attention of computer science-, management information systems-, strategy-, and marketing scholars, in this paper, we suggest that besides business management, history can also offer unique, interesting, and useful perspectives on this issue, as well as technology in general. More specifically, one of the seminal works, Laws of Technology (Kranzberg, 1986), regarding the history of technology can provide such standpoints. Therefore, we
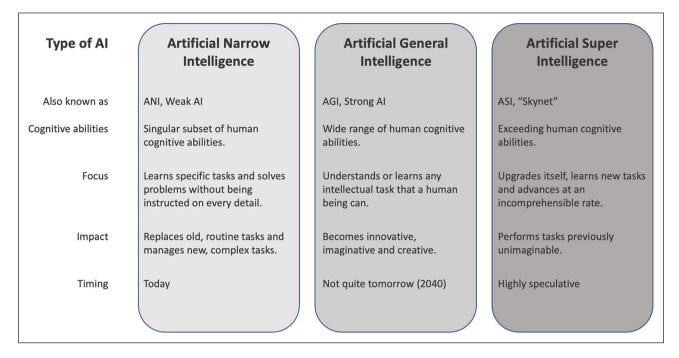
Figure 1. Three types of Artificial Intelligence.

deliberately use AI as a means to illustrate the unique perspective that Kranzberg's (1986, 1991) views on the history of technology can bring to marketing.

Kranzberg's laws of technology, and artificial intelligence

Melvin Kranzberg was a history professor who devoted his academic career to studying the history of technology. He is best known for his "Laws of Technology"; however, he emphasizes that, "These are not laws in the sense of commandments but rather a series of truisms deriving in a long-time immersion in the study of the development of technology and its interactions with sociocultural change." While this work has received considerable attention and is referred to in highly cited works in a very wide range of disciplines including MIS (e.g. Boyd & Crawford, 2012), network science (Axelsson & Easton, 2016), economics (Srnicek & Williams, 2015), medicine (Pressman, 2002), music (Holmes, 2012) and education (Zheng et al., 2016), it has received little or no attention from marketing scholars. In this section we restate each of Kranzberg's (1986) six laws of technology, consider specifically how they relate to AI, and raise interesting and important research topics that will help us understand the role of AI in marketing (see Table 1). We also suggest that these "laws" proffer interesting issues for marketers to consider in their general perspectives on technologies and innovations.

Kranzberg's first law: "Technology is neither good or bad; nor is it neutral"

Similar to Mick and Fournier's (1998) observation that the effects of technology are never only positive or negative, but paradoxical, Kranzberg states that technology is neither good nor bad. To which he adds, "nor is it neutral." He later (Kranzberg, 1991) explains this qualification by arguing that technology's interaction with society is such that its consequences for humans and society often go far beyond the intended purposes of the technology. Importantly, he notes that the effects of a particular technology can be very different depending on the contexts into which it is introduced, and that the valence of these effects can change over time. For example, the pesticide DDT is often credited as the single chemical compound that has saved more human lives than any other, in particular for its power in eradicating mosquito-borne malaria in many countries, as well as enhancing agricultural production (Kupferschmidt, 2016). However, in countries without malaria problems, such as the US and much of the developed world, DDT was banned for its harmful effects on the natural environment and the food chain. Thus, applied to AI, Kranzberg's first law would explain that its effects will be neither entirely positive nor entirely negative, but that they would also not be neutral and would depend on context and that it may change over time.

A marketing example might be the use of AI-powered robots to serve customers: The same robot might reduce costs and service waiting times but might also make the customer experience impersonal; this would depend on context, and might vary from one industry to another, and across customer groups as well (van Esch et al., 2021a). Similarly, facial recognition has been piloted and employed in some contexts, for instance, to simplify the check-in procedure at some airports. Instead of manually scanning boarding passes and checking passports, a camera at the gate scans passengers' faces and a screen signals permission to board. The process is relatively straight-forward: compare a passenger's face with all the faces recorded at the security check to assure that the right people are on the right planes. When a match cannot be verified, the gate agents can still go through the traditional process. It turns out, success depends on the demographics of the audience. A strong gender and skin-type bias suggest that facial detection identifies light-skinned men with a much higher rate of accuracy than dark-skinned women (Hardesty, 2018). This serious problem has even led to wrongful arrests based on bad face recognition matches. Systems that were trained on mainly Caucasian and male faces are good at identifying those (and useful for these audiences), but not very good at matching the nuances of others.

Table 1. Kranzberg's Laws and Research Implications for AI in Marketing.

Kranzberg's laws of technology	Marketing research implications	Future research directions
i. Technology is neither good or bad; nor is it neutral	Marketers should study AI within its contextual and temporal setting	1. How do specific AI applications (e.g. chatbots) positively or negatively affect particular business sectors (e.g. customer experience in banking)? 2. What are the unexpected or unintended outcomes from using AI technology in certain fields?
ii. Invention is the Mother of Necessity	Marketers should focus on technological and power imbalances introduced by AI.	3. What technological or power imbalances does AI create in marketing? 4. How can marketing practitioners use such imbalances as an opportunity to obtain a competitive advantage?
iii. Technology comes in packages, big and small	Marketers should study systems rather than their AI parts.	5. How should marketers and stakeholders collaborate and which innovations should they employ to create better functioning AI systems in particular marketing sectors? 6. What is the effect of implicit biases on the performance of AI, and how can companies address such biases?
iv. Although technology might be a prime element in many public issues, nontechnical factors take precedence in technology-policy decisions	Marketers should prioritize non-technical factors in AI studies.	7. How can marketers increase the explainability of AI to individuals in order to address stakeholder concerns with the implementation of this emerging technology? 8. How can companies that use AI systems eliminate ethical issues that can arise via the usage of this revolutionary technology?
v. All history is relevant, but the history of technology is the most relevant	Marketers should investigate the impact AI has on social and human evolution.	9. How does AI influence individuals' social and human evolution? How can marketing practitioners enhance individuals' attitudes toward AI and AI acceptance? 10. How should companies take positions regarding short term and long term impacts of AI to particular business sectors?
vi. Technology is a very human activity—and so is the history of technology	Marketers should study the role of humans in developing and controlling AI.	11. How do AI and human intelligence co-create value for individuals? 12. During the value co-creation, what is the role of humans and which tasks are completely dependent on human intelligence and creativity?

This raises two important points for researchers interested in the intersection of marketing and AI. First, *AI context matters*, and weight needs to be given to the particular setting of an AI study. The same AI technology can be deployed for very different purposes, with very different outcomes. Smart robots might speed up service in a fast-food restaurant, for example, but would lack warmth and the personal touch in a fine dining environment. Second, *AI timing matters*, and the temporal aspect of an AI implementation, adoption and diffusion needs to be considered in studies of AI (Guha et al., 2021; van Esch et al., 2019). Many of the unanticipated and unintended consequences will emerge as the technology is rolled out on a wider scale. For marketing scholars, focusing on the changing expectations and impact of technology should be a key focus of AI studies. While innovations like smart mirrors, the integration of shopping bots, and conversational user experience by means of digital assistants are becoming more important in fashion retail in the short-term, in the long run, they might actually reduce a stores' ability to differentiate. In summary, it is important to recognize that AI technologies are not good or bad, helpful or unhelpful, but that their impact can change over time. The consequences of AI innovations, intentional and unintentional, are usually not dichotomous, but simultaneously have both bright and dark sides. In any case, they are never neutral, and always depend on context.

Kranzberg's second law: "Invention is the mother of necessity"

Kranzberg's (1986) second law refers to the additional technological advances necessary to successfully implement the original technical innovation. New technical innovations are rarely ready to use by themselves and often need supplementary technical inventions in order for their full effects and benefits to be realized. Kranzberg provides the example of Kay's "flying shuttle," in the 18th century

textile industry. The flying shuttle allowed wider fabrics to be woven and for the process to be partly automated. However, because the flying shuttle was so much faster, it disturbed the balance in a factory of a ratio of four spinners to one weaver. Further innovations were developed to arrive at automatic machine looms that could realize the full impact of Kay's flying shuttle, and to redress the spinner/weaver ratio problem. In other words, an improvement in one technology disturbs the balance of a system that must be corrected through a new innovation, or even a series of new innovations. More recently in the 1990s, as the newly prominent World Wide Web began to take off, technological pessimists predicted its downfall because the "world would run out of bandwidth." It may well have run out were it not for the developments in faster networking, buffering technologies, cloud computing and advances in data storage technology (Gilder, 2000). It is important to note that many of the subsequent developments would have not been necessary had it not been for the impetus from the original invention.

A more detailed recent example of Kranzberg's second law in action concerns Walmart retrofitting a store location into an "AI Lab" so that they can experiment with the different capabilities AI has to offer before rolling it out to other stores (Moody, 2019). One use-case is based on footage from cameras pointing at product shelves, which AI then analyses to detect which products need restocking (Perez, 2019). To implement this, sufficient cameras had to be installed in the store, facing every shelf, to collect data on all the products. Each camera produces 6 to 9 megabytes of data per second. However, once the cameras were installed, a technological imbalance was created: The problem was finding a solution to process this amount of data in as close to real time as possible. To achieve this, a data center was built within the store in order to process the large amounts of data, and to provide instant updates to store associates on which items needed to be restocked (Moody, 2019). Prior to the AI-driven restocking solution, these problems did not exist, and there

was no need for an in-store data-center. In simple terms, a plethora of cameras facilitated data collection, but also created a mountain of data that needed to be processed rapidly and efficiently. In summary, additional technological advances are necessary to make AI work effectively and efficiently.

This example of Kranzberg's second law in Walmart's AI Lab also emphasizes two important points for AI research in marketing. First, *AI technological imbalances matter*. Technologies interact with and are dependent on one another, and when one changes, others need to follow suit. Second, *AI power imbalances matter*. Kozinets and Gretzel (2021) describe several hurdles marketers face when implementing AI technologies that relate to Kranzberg's second law. One challenge they discuss is "vulnerability" in which an increasing adoption of AI technologies will create a power imbalance, between firms and suppliers, and firms and their customers. In the AI context, this includes developers, users, vendors, etc., all of which add interesting and important elements to a study of AI in marketing. Thus, a worthwhile avenue of research would be to consider the adoption of AI technology and the vulnerabilities it could create for marketers and customers as they become beholden to the changes in technology. Similarly, new AI technologies create both practical and research opportunities as practitioners and scholars alike explore how new technologies can address the imbalances occasioned by new AI technologies.

Kranzberg's third law: "Technology comes in packages, big and small"

Kranzberg's (1986) third law is an extension of his second law. The difference between the two, while appearing small, is of significant importance. The previous law talked about technological and power imbalances, whereas this law extends this perspective by emphasizing that technology comes in packages of different sizes and that these are interconnected. More importantly, it points toward the importance of "systems of systems," all with their own contextual and temporal settings (points 1 & 2 above). Much like the previous law, where further technologies must be invented to make an innovation function, this law refers to the different technologies and stakeholders that must work together to create a functioning information system, and to create value. As an illustration, and as discussed above, a number of innovations were developed to make the World Wide Web work effectively. It also required for standards to be set by governing bodies, laws and regulations to be adapted, organizational practices to be changed, etc. While Tim Berners-Lee may have invented the three fundamental technologies (HTML, URL, and HTTP) that remain the foundation of today's web, the final system is composed of many interrelated elements, all of which were, and still are, required to make it work, and which are connected to other systems too. In summary, technology always comes in a system, and this system is inter-connected with other systems.

Related to AI specifically, the Walmart case also serves as an illustration of Kranzberg's third law. Walmart's AI Lab is an illustration of the technological structures interacting in "packages" as Kranzberg refers to them (more commonly now called systems). For example, the images that are collected by the cameras are sent to the data center to be processed and an alert is sent to a store associate to restock a certain product if needed (Moody, 2019). Each package, regardless of its "size" is important, needed and itself based on individual, social, and organizational elements.

For AI in marketing research, Kranzberg's third law points out that *systems matter more than their AI parts*. One avenue of research for marketing scholars to explore concerns the overall success of

the system as a whole when it is comprised of many interdependent packages. If an AI technology and subsequent algorithms are used in a retail firm to help with several different functions, such as product ordering and stocking shelves and a more stakeholder-facing function such as hiring, or targeting customers, it is important to be aware of implicit biases that might be replicated in the algorithms. It would be worth exploring how implicit biases from the individuals responsible for creating the algorithms would impact the overall success of the AI system. This so-called developer bias is different from the training-bias mentioned above. The consequences of deploying an AI system targeted at identifying good hires or reaching attractive market segments that unknowingly prejudiced particular ethnic groups or particular genders, could create significant corporate social responsibility issues for firms. Marketing scholars might want to be involved in studying how these errors can be eliminated in the first place, through pre-, in-, and post-processing safeguards, and in recommending strategies for achieving a "fairer AI" and dealing with the public relations fallout should such events occur (Feast, 2020).

Kranzberg's fourth law: "Although technology might be a prime element in many public issues, nontechnical factors take precedence in technology-policy decisions"

According to Kranzberg, technological developments often have societal, environmental, and human implications that go far beyond the original intentions (and intended benefits) of the technology. This recognition is frequently over-emphasized to the extent that the non-technical considerations outweigh the technical ones when evaluating a technology. The evaluation of any technology, according to Kranzberg, is largely influenced by the public's *perception* of risk, rather than the risk itself. Stated differently, the likelihood of potential unintended consequences or the impact of these consequences or both, are over-estimated by the public, and as a result, political, societal, or environmental considerations often take precedence over technical ones when evaluating a technology.

A good recent example of this concerns what is arguably the single most significant technological advance of the 21st century to date, CRISPR ("clusters of regularly interspaced short palindromic repeats") (see Doudna & Charpentier, 2014; Jinek et al., 2012). CRISPR is the technology that enabled the development of mRNA vaccines (e.g. Pfizer-BioNTech and Moderna) to provide immunity against the COVID-19 virus in the pandemic that began in 2020. Whereas most vaccines have taken years to develop, CRISPR technology enabled the development of an effective virus in less than twelve months (see Isaacson (2021) for an excellent lay description of this process). Despite their effectiveness, public response to the vaccines has not been entirely positive. Some people fear that the vaccines might have hidden side effects that might damage their health in the long term. So-called "anti-vaxxers" have spread significant misinformation about the effects of the vaccines to an extent that in many parts of the world large numbers of people have chosen not to be vaccinated. As a result, without the majority of a population vaccinated, the COVID-19 problem may not be solved entirely (Berman, 2020).

Applied to AI, we have witnessed the public outcry in 2018 when Facebook permitted the unauthorized access of millions of its user accounts by Cambridge Analytica to be mined by AI algorithms for political purposes. Although other tech giants, including Google and Amazon, have been criticized for violating user privacy through their handling of recordings from devices powered by their AI assistants, consumer reactions have been much less vocal. In summary, Kranzberg's fourth law posits that a number of political and societal

issues affect the development and efficacy evaluation of AI and that these issues may undermine technological considerations.

A number of future research avenues in marketing emerge from Kranzberg's fourth law, based on the tenet that *non-technical AI factors matter more than technical AI factors*. First, future scholarly work might investigate the extent to which the privacy and data security questions raised by AI impact marketing exchanges between customers and organizations (Puntoni et al., 2021). For example, how do customers balance privacy and anonymity considerations with their goals to receive customized and personalized communications and offers, knowing that there is more than just rudimentary database recommendation software behind the targeting that is occurring?

Second, future research might explore issues of ethics and fairness when using AI in marketing. Here again, the issue of bias is often raised, specifically, how to avoid biases in conclusions provided by AI algorithms that are trained on historical data in which the bias may have been present.

A third important avenue for future research is the issue of explainability of AI, or better, the lack thereof. There is much that the average person in society does not understand about AI, and this could hinder its successful implementation both in organizations and for the societal good. For example, the reluctance of many people to trust an AI-based diagnosis of a health problem (such as using smartphone-based image diagnosis of a cancerous skin mole) is as much a marketing issue as it is a medical problem. Berman (2020) notes "people change their own minds, we can't do it for them" and that enabling them to search for and use credible sources of information is vital for their informed decision-making. He suggests and offers strategies, tools, and scientific information to effectively challenge some of the misconceptions that people hold concerning vaccinations. Marketers could follow similar approaches in getting people to understand and accept AI applications more readily when these can add value. How AI arrives at a conclusion or comes up with a recommendation is often opaque to humans, and future work can investigate the implications of 'unexplainable' AI for trustworthy and fair marketing exchanges. In summary, when investigating AI's implications for marketing, both technological and other, non-technology considerations, such as societal or human issues need to be taken into account.

Kranzberg's fifth law: "All history is relevant, but the history of technology is the most relevant"

In his fifth law, Kranzberg suggests that technological elements are often overlooked in the history of human development. As an example, it was improvements in agricultural production resulting from technological developments that enabled many people, particularly children, to take part in formal schooling. Previously these individuals would have had to remain on the farm and work to produce sufficient food for a family's survival. Digitization and digitalization have had a significant impact on the accessibility of information and knowledge and has impacted society's education and progress. Technology has always, and will continue to have, a significant influence on people's daily lives. Any history that ignores the technological factor in societal development does not allow mankind to comprehend how our world came into being.

When applying Kranzberg's fifth law to AI, key societal advancements should consider the role that AI may have played, and will play in bringing these advancements forward, such as the application of AI in the medical field, including diagnosis, treatment protocol development, drug development, personalized medicine, and patient monitoring and care.

Kranzberg's fifth law brings about an important point for marketing scholars: *AI evolution will drive social and even human evolution*. Amara's Law reminds us that we tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run. "We shape the tools and thereafter they shape us." (Culkin, 1967). These notions open up two more important avenues for future research at the intersection of marketing and AI. Researchers should develop an understanding of the long-term societal and organizational implications of using AI in marketing, in addition to exploring how these implications define existing marketing concepts and theories. Simultaneously, marketing scholars may wish to consider the long-term implications of AI in marketing-related disciplines, and collaborate with researchers from fields such as psychology, organizational design, and education, among others.

How will AI mold work in these disciplines, and what will the knock-on effects be for marketing? Berthon et al. (1999) (see also Siguaw et al., 2006) have pointed out that marketers tend to view products instrumentally, and as solutions to customer problems developed in response to discovering customer needs. They refer to this as "following" and contend that following frequently ignores the fact that innovations and technologies frequently "shape" customers, and in so doing create markets that weren't previously there. These customers and customer needs would not have been found by means of traditional marketing research. In his biography of Apple's Steve Jobs, Isaacson (2013) notes that when Jobs was asked whether the firm should do some market research to see what customers wanted, he replied, "No, because customers don't know what they want until we show it to them" (p. 311). The first Apple Mac shaped customers who realized that the mouse was the best way of interacting with a personal computer, and the first iPhone shaped new mobile phone users who realized that a mobile phone didn't need a physical keypad. Marketing researchers can contribute significantly by studying and speculating on how AI will shape, and in a very real sense, create markets and customers.

Kranzberg's sixth law: "Technology is a very human activity—and so is the history of technology"

In his sixth and final law, Kranzberg posits that humans and technology are inextricably linked. For example, a computer without the human knowledge, skills, and expertise to operate it, is just a technological artifact that does not provide value; on the other hand, the most sophisticated computer knowledge and expertise held by a person is useless without a computer to apply this knowledge to. Thus, Kranzberg posits that humans become an integral part of technology and vice versa, technology becomes an integral part of humans without one (e.g. technology) dominating the other (e.g. humans).

To provide an illustration of Kranzberg's sixth law and AI, developing a marketing strategy encompasses the three strategic elements of segmentation, targeting, and positioning. AI can sift through vast volumes of data, and segment a market based on a virtually unlimited number of variables, in addition to making recommendations for the target market(s). A human could do this by trying and testing a seemingly endless number of possible permutations. In complex situations, this could take weeks and months, if not years, for a human to discover (Huang & Rust, 2021). Without the help of powerful AI algorithms, using only human efforts in data analysis and modeling may be less effective and efficient (van Esch & Black, 2019). However, positioning and targeting also require creativity and sensitivity toward how a target segment would like to see and feel about an offering, and AI technology, at least Artificial Narrow Intelligence, is not yet mature enough to master this task. Thus, both

humans and technology are required to develop a marketing strategy, ideally with neither dominating the other.

One important research direction emerging from Kranzberg's sixth law is: *humans are essential in developing and controlling AI (for now)*. This is very important for all facets of human life, including the interactions between marketers and AI (Paschen, Paschen, et al., 2020; Paschen, Wilson, et al., 2020). This may include exploring the best approaches to human-AI collaboration in marketing for various types of tasks, including those that are predominantly analytical (such as market segmentation), creative (such as positioning) and those that require a high degree of empathy (such as responding to customer objections and complaints). In conclusion, an investigation of how AI and marketers add value, and their respective limitations is an important area for future scholarly work.

Observations, caveats, Kranzberg's laws and AI as a killer app

Kranzberg's laws should spark interesting questions in the minds of thinking marketing practitioners, for innovations in general, and for AI applications in particular. The first law, that technology is neither good or bad, but also not neutral, and also depends on context, suggests that marketing strategists should always consider both the positive and negative aspects of any innovation. This is true whether it is their own innovation, that of a competitor, or within another market altogether. When an innovation has significant positive effects, such as a significant reduction in costs, obvious questions would be whether there would be downsides, such as lower levels of customer service. Also, while an innovation might have positive effects in one arena, might it have negative consequences in another context? To answer this question, future research should explore how can specific AI applications (e.g. chatbots) positively or negatively affect business sectors (e.g. customer experience in banking)?

The second law, that invention is the mother of necessity, suggests that alert entrepreneurs will see opportunities wherever technological imbalances exist much in the same way that Dickson's (1992) theory of competitive rationality implies that wherever customers are not availed of choice, marketers can exploit opportunities by providing other options. So, as an improvement in one aspect of an AI technology, for example, upsets a previous balance, this will necessitate a new innovation to redress the balance, and this could in turn be a profitable opportunity. Following this, we encourage marketing scholars to investigate the current imbalances created by the improvement of AI and how practitioners can use it as an opportunity to obtain a competitive advantage. In parallel with the previous law, the third law, that technology comes in packages, big and small, suggests that entrepreneurial innovators will recognize that for a "big" technology such as AI to work effectively in a given setting, an entire ecosystem of hardware and software will need to be in place for this to happen. The multitude of components of this ecosystem will need to be produced and marketed by someone and even relatively small packages can be a significant prospect for a new firm or an incumbent. As Mark Twain observed, "During the gold rush, it's a good time to be in the pick and shovel business." On the other hand, the success of AI technology depends on its components. For instance, many companies use AI in various settings, such as hiring or market segmentation, and algorithms are playing a vital role in the performance of AI. However, such algorithms can have implicit biases because they were created by a developer (human). Implicit biases in AI can cause serious threats to the company because the system can be discriminative against a particular race, gender, or religion. Therefore, future research should explore how much effect implicit bias has on the performance of AI and how companies can eliminate such biases.

The fourth law, namely that while technology might be a prime element in many public issues, nontechnical factors take precedence in technology-policy decisions important for marketing executives and policy-makers alike. While both, AI technologists and marketers, might see significant advantages in AI technologies for both firms and customers, less tech-savvy politicians and policy-makers might view things differently. This means that the most effective AI technologies will not always win out, and that technologically optimal AI solutions will not always be met with political and social approval. Where marketers and AI technologists might see opportunities for improvement and advancement, politicians and the public might often see only risk, even where real risk might not even exist. On this basis, a possible future research area can be the explainability of AI to people and how to eliminate ethical problems that can arise via the usage of this revolutionary technology in the marketing world to address the concerns of various stakeholders, including the general public and policy-makers.

According to Kranzberg (1986), any human history that ignores the role of technology in how society evolves prohibits us from understanding how our world came into being, and from understanding our world as it is. To reiterate, his fifth law states, "All history is relevant, but the history of technology is the most relevant." Effective marketers will not only understand the immediate potential and implications of AI in their own business and markets; they will also have a broad appreciation of the history and evolution of AI, and its application not only in their own environment, but in a broader global relevance. Also, we suggest marketing scholars to investigate the impact of AI on social and human evolution. For instance, how does AI affect consumers' attitudes and behaviors? How should companies take positions regarding its long- and short-term impacts on different business sectors? These questions can lead scholars to novel future research opportunities.

Lastly, marketers concerned with the application of AI will appreciate Kranzberg's sixth law, namely that technology is a very human activity, and so is the history of technology. This means that humans become an integral part of technology, and that without one the other cannot be. Kranzberg (1986) relates the story of the great violinist Fritz Kreisler, who when someone mentioned that he obviously had a really great instrument, held up his violin and said, "I don't hear any music coming from it." Like most technologies (automobiles, home appliances, cellular phones), AI might end up ruling our lives, but, as Kranzberg (1986) argues, this does not mean that technology will necessarily direct all our thoughts and actions. AI might permit information technology to go beyond rapid data processing and calculation to problem anticipation and solving, and even acts of creation, but it is unlikely that it will ever think, in the sense that humans "think." Reflecting on his defeat by IBM's AI suite Watson in the game show *Jeopardy*, the show's greatest winner of all time, Ken Jennings, noted that the one thing that computers weren't really good at, and probably never would be, was determining exactly when and where a known fact would be valuable (Kietzmann & Pitt, 2020). Context matters, and wisdom, rather than knowledge or intelligence, is what is required to respond to context. While AI might be more artificially intelligent than even the smartest marketer, it is unlikely that AI will be wiser. In addition, there are several future research opportunities that arise from Kranzberg's sixth law. For instance, marketing scholars can explore how AI and human joint power co-creates value for individuals? Another example is, during the value co-creation, what is the role of humans and which tasks are completely dependent on human intelligence and creativity?

Our discussion warrants a number of caveats, and also permits a number of further observations. First, as previously noted, Kranzberg had emphasized that his "laws" were more a series of maxims or truisms, rather than legal commandments that brook no censure, or mathematical laws like the law of commutative addition, or Newton's law of universal gravitation in physics. As such, it would be pointless for researchers in technology or marketing, and in the application of AI in marketing, in particular, to attempt to prove or disprove or even test Kranzberg's laws. Rather, they should serve as brief, succinct expressions of truth that should guide thinking about marketing and technology in general, and more specifically in the context of this paper, as guidelines to marketing scholars and practitioners in thinking about AI. While we have briefly considered and suggested avenues of research that marketing scholars might wish to pursue in this regard, Kranzberg's laws in and of themselves should stimulate intellectual curiosity among marketing scholars with regard to the impact on- and effects of, AI in marketing.

Second, whether a technology is a killer app or not is context-dependent. Some technologies are not recognized as killer apps until much later, while others are forecast to be killer apps and then turn out to have an insignificant impact in the long run. For example, while most people would hardly regard the humble stirrup as a killer app (or as a disruptive innovation for that matter), Downes and Mui (1998) use the stirrup as an example to illustrate the fact that killer apps don't just change the way something is done but change history and change the world. The stirrup was first used successfully in Europe in combat by the army of Charles Martell, leader of the Franks against a Umayyad invasion of Aquitaine at the Battle of Tours. The stirrup enabled stability, mobility and speed, and permitted a soldier to hold and fight with a sword and shield while on horseback. Martell's grandson was Charlemagne, the first Holy Roman Emperor and unifier of Western Europe, who, it can be argued, changed the course of world history. The questions are of course, first, did eighth century Europeans recognize the stirrup as a killer app, and, second, why don't we still think of it as such today?

As Kranzberg's first law recognizes, and as he later emphasized (Kranzberg, 1991), technologies are always context dependent. Is AI a killer app? Will it be recognized as such a hundred years hence? Might it be a killer app in domains such as engineering and medicine but be largely innocuous in marketing in years to come? Or does it have the potential to change marketing as we know it forever? These are intriguing questions for marketers and marketing scholars to consider.

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