How intelligent computer systems help us make not-so-good decisions

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Abstract

With the increasing practice of personalized, algorithm-based data in search engines and social media platforms' users are getting less exposure to conflicting viewpoints and are becoming insulated intellectually in their information-filtered bubbles. The objective of personalization is to provide the user with the most applicable information based on the user's special blend of needs and wants, tastes, concerns, and interests forecasted based upon customer demographics and online behavior. This also includes user search history, browsing choices, and web page interactions. Unfortunately, this kind of tailoring can also produce a warped reality. This is because this approach prioritizes and presents information based upon something individuals have already expressed interest in. In turn, this may create informational cocoons that significantly increase the likelihood of confirmation bias whereby information presented corresponds to individuals' previously held beliefs and ideas. Such errors can adversely impact decision-making. A multiple perspectives approach is offered to counter the limited search trap decision-makers often fall into.

Keywords: website personalization, filter bubbles, confirmation bias, and flawed decision-making

"For too many of us, it's become safer to retreat into our bubbles. ... And increasingly, we become so secure in our bubbles that we accept only information, whether true or not, that fits our opinions." – President Barack Obama (2017)

The early days of the Internet promised a mind-expanding ideal, where users could freely exchange new ideas and consider other viewpoints. However, as information on the Internet has expanded, users are facing growing problems of information overload in today's digitalized world (Bozdag, 2013). For example, Bulao (2021) and Petrov (2021) provide some stunning statistics:

- On average people created every day 2.5 quintillion bytes per day (there are 18 zeros in one quintillion);
- Internet growth statistics from Statista show that 4.66 billion people are using the Internet as of January 2021. That is close to 60% of the world population. There were only 2.6 billion internet users in 2013;
- According to the growth of internet statistics, 319 million new users joined the internet in 2020. As of 2021, the growth rate is 7%, translating to around 875,000 new users/day;
- Google is the number one search engine, with a 91% market share and will have about 2 trillion searches in 2021 which equates to 6 billion searches a day;
- Today it would take a person approximately 181 million years to download all the data from the Internet;
- In 2019, there were 2.3 billion active Facebook users, and they generated much data
- Twitter users send over half a million tweets every minute; and
- Data volumes have skyrocketed. More data was generated in the last two years (2019-2020) than in the entire human history before that.

Facebook and Google serve as key information intermediaries in addressing the massive amounts of data and "cognitive overstimulation" (Bozdag, 2013, p. 2011) generated by the internet. Facebook and Google have initiated personalization using sophisticated mathematical algorithms designed to tailor user experiences (including merchandise, online content, and other information) which keeps users engaged—and also generates profit—founded on what the firms expect will be appealing to users based upon users' beliefs, values, and knowledge (Gauch, Speretta, Chandramouli, & Micarelli, 2007). This data is obtained from multiple sources including demographics (e.g., name, age, country, education level) and personal interests or individual personal preferences as measured by click-throughs, online purchases, browsing history, previous queries, time spent reading information about a subject, IP address, cookies, etc. Google uses location, previous search keywords, and recent contacts in a user's social network to show users different results based on the same keyword search. Facebook registers the users' interactions with other users and so-called "social gestures" such as like, share, subscribe, and comment.

The goal of such personalization is to respond to a user's distinct goals, preferences, interests, desires, motivations, and needs, to increase the relevance of communication, to improve the quality of information access, infer the user's intentions, and assist the user with his or her online activity. Based on this, some internet sites vary per user so that two persons using the same search entry may retrieve different search results; for example, two persons entering the word "apple" into the search engine, the first person might receive information on fruit although the other user might obtain information regarding Apple, the California-based technology firm.

These websites have become trusted sources of information and arbiters of truth (Ekström, 2015), and many users tend to place blind faith in the quality of search results (Pan, Hembrooke, Joachims, Lorigo, Gay, & Granka, 2007).

For many people, particularly younger persons, communication and acquiring information and news transpire largely online. El-Bermawy (2016) reported that "61 percent of millennials use Facebook as their primary source for news about politics and government." Facebook's newsfeed acts like a news magazine, Google as a lexicon, and messengers like WhatsApp or Skype serve as forums for sharing information with friends, colleagues, and family. Many people now find practically everything they want to know on the Internet, and, in many ways, such digital networks govern individuals' online world and control and shape what they see and address.

While such a customized selection of information shown to specific users can be helpful, it has created an environment that constricts rather than expands access to all perspectives. This gatekeeping function may have a potential dark side since it tends to create a monoculture in which people are exposed to like-minded information. Individuals receiving the information they agree with reinforces their beliefs and behavior while potentially distorting that person's perception of reality. This narrows what users know and increases polarization which leads to loss of connection to other social groups in society, because users see mostly one perspective and not enough of other viewpoints (Bozdag & van den Hoven, 2015; Pariser, 2011; Sunstein, 2002, 2006, 2018). It is this concern that President Obama (2017) was referring to in our preface.

Removing data (or making some links less visited by reducing the websites' ranking) may be inconsistent with visitors' views, values, and ideas (Bozdag, 2013; van der Hof & Prins, 2008) leaves those seeking information with a restrained reality. This state will likely get worse as internet search engines increase knowledge of users' interests through increasingly high-level machine-learning models referred to as artificial intelligence (AI) protocols that subject users to congenial, opinion-reinforcing content while excluding diverse content that challenges opinion (Kitchens, Johnson, & Gray, 2020). This action leaves social media platforms and search engine users susceptible to confirmation bias which significant research has shown negatively impacts decision making (Nickerson, 1998).

Based on these factors this paper examines the increasing use of personalization or tailoring information presented to a user by many online platforms and how this tactic has generated information filter bubbles that tend to create confirmation biases that adversely impact individuals' decision-making. We first discuss online personalization and problems associated with this practice followed by an examination of filter bubbles and the confirmation biases they may create and the adverse effects they have on judgment and decision-making. We conclude with a summary.

Benefits of Personalization

Early search engines, like Google and AltaVista, found results based only on keywords. However, Google introduced personalized search in 2004 and it was implemented in 2005 to Google search. Google has personalized search implemented for all users, not only those with a Google account. Google founded personalized search, which has become much more complex to "understand exactly what you mean and give you exactly what you want" (Remerowski, 2012).

Website personalization is the process of creating customized experiences for website visitors. Zanker, Rook, and Jannache (2019) indicate that "online personalization encompasses

all aspects of individualizing the interaction and information content a system exchanges with its user" (p. 160). Firms do this by collecting and analyzing users' information to generate tailored recommendations for each of them (Kaptein & Parvinen, 2015; Liang, Lai, & Ku, 2007; Liu, Mehandjiev, & Xu, 2013). At first, the information collected about Internet users was quite basic: age, gender, contacts added. But new web-based media have integrated several mechanisms that allow for websites to collect much more precise information. These include "share", "like", "subscribe" buttons, etc., which inform algorithms about peoples' online behavior. Facebook, for example, introduced its "like" button in 2009. A week later, 50,000 websites had integrated this button into their architecture (Olin, 2009). The presence of this button on countless websites allows Facebook to collect much information about its users.

Today, websites return results based on user's *characteristics or demographics* (e.g., gender, race, age, education, employment and income information, marriage status, interests (knowing this, for example, firms can show different promotional offers to single parents as opposed to retired couples), *actions or behavior* (click on a button, opening a link, pages viewed, searching for a topic, past transactions, navigation patterns, click-through rates [the proportion of presented items that received a click]), *intent* (make a purchase, check the status of an entity), *contextual data* (any relevant facts from the environment like device or browser that is used, geographic location, weather conditions, social media interactions, etc.), or *any other factor* that can be associated and identified with a person and thereby providing them with a custom-made experience (Movable Ink, 2016). For example, on Facebook, an individual with a strong interest in dogs as determined by increasingly sophisticated algorithms related to a person's online presence will be exposed to a large amount of dog-related information on their news feed.

Using a variety of artificial intelligence (AI) protocols, data are consolidated and merged from various channels where valuable insights are extracted, identifying actionable trends. These technologies customize and contextualize the human-technology interaction, allowing businesses to provide tailored language- and image-based information and services, with minimal or no human involvement. Global spending on AI is projected to double over the next several years, growing from $50.1 billion in 2020 to more than $110 billion in 2024. The International Data Corporation (2020) reports that spending on AI systems will continue to accelerate for the next several years as organizations employ artificial intelligence as one of their digital transformation efforts in remaining competitive in the digital economy. The compound annual growth rate for the 2019-2024 period is projected to be 20.1%.

Personalization aims to enhance the user experience by retrieving relevant resources and presenting them in a meaningful way (Raufi, Ismaili, Ajdari, & Zenuni, 2019). Rather than providing a single broad experience, website personalization presents users with unique experiences tailored to their needs and desires (Kaptein & Parvinen, 2015; Liang, Lai, & Ku, 2007; Liu, Mehandjiev, & Xu, 2013). With advances in personalization technologies, websites are increasingly able to customize web content and provide users with a unique experience.

Personalization algorithms are crucial to the functioning of these platforms, as they are the foundation of their business models. Thanks to these algorithm platforms, companies can better target product advertising. Advertising is the main source of revenue for digital social networks, and companies are indeed willing to invest significant amounts of money to ensure effective advertising targeting. Google and Facebook earn a large part of their revenue from personalized advertising. Facebook, for instance, generated $26.1 billion in Q1 of 2021 with ad revenues representing more than 95% of the company's total revenue (Ponciano, 2021).

Personalization provides obvious benefits to users, including disambiguation and retrieval of locally relevant results. For example, searching for "pizza" in New York and Boston may receive locally relevant restaurant results. Many individuals have grown accustomed to personalized experiences from their news feed, social network, and shopping recommendations. Expectations have risen so high that companies who want to improve their profits are changing their strategy to address this need directly. For example, with a seemingly limitless product database, finding what a person wants on Amazon can be quite difficult, but Amazon makes product searches easier through personalization. Right on the homepage, it is analyzing a person's previous behavior and offers products that it thinks the individual might want. With an incredible inventory of content, Netflix uses what a person has viewed in the past and how they have rated different shows to determine what to offer them and to make recommendations.

Furthermore, personalization may assist in overcoming cognitive impairment or an unhelpful experience referred to as choice overload (Johnson et al., 2012), or paradox of choice (Iyengar & Lepper, 2002). A paradox of choice occurs when an individual is presented with too many options and becomes dissatisfied and regretful about whatever choice they make (Chernev, Böckenholt, & Goodman, 2015). One method to address choice overload is to assist individuals in narrowing their option choices based upon their preferences. People like the idea of hundreds of options but only want to be presented with the best and most relevant to their needs when it comes to decision-making. Personalizing the content on a website can accomplish that consistently. Too many choices can also lead to behavioral paralysis—a situation where people are faced with so many choices that they cannot decide among them and make no choice at all. For example, Iyengar, Jiang, and Huberman (2004) offered 800,000 employees across 647 companies retirement packages that had either two options, or 59 options. When provided with two option choices, 75% of employees participated, but when 59 options were offered, employee participation fell to 60%. Personalization could reduce the options available to viewers and thus mitigate the problematic effects of too many choices or options.

Problems with Personalization

Despite these benefits, some have expressed concern about the potential for algorithmic filtering to reduce the diversity of information sources that individuals are exposed to, engage with, or consume (Van Alstyne & Brynjolfsson, 1996). They see the use of personalization as a form of control over individuals utilizing searches by only giving them certain information over highly discussed topics such as gun control, immigration, the origin of the COVID-19 virus, etc. A good example of a corporation controlling the information is Google. It not only provides individuals the information they want but they are at times using a person's personalized search to gear them towards their own companies or affiliates. Even if a person is not online, Google may personalize an individual's results because it keeps a 180-day record of what a particular web browser has searched for, linked to a cookie in that browser (Briggsby, 2013). Googlization is the term Vaidhyanathan (2011) uses when describing Google's influence beyond information search, over commerce, and pop culture. The concept of Googlization suggests the price of internet searching results in the relinquishment of control of opportunities and ideas to which users are exposed.

Personalization technology perceives personal preferences. When a user interacts with certain content, algorithmic filtering can restrict additional exposure to narrower and more closely aligned content (Pariser, 2011; Stroud, 2010). Unfortunately, receiving diverse sources of

information can often help persons understand the world better, foster strong opinions, and develop better decision making (Jehn, Northcraft, & Neale, 1999; Mutz & Martin, 2001; Van Alstyne & Brynjolfsson, 1996). Diverse information sources promote the value of information sources when derived from delivering alternative viewpoints and relevant information.

Individualized search results often function as hidden auto-propaganda, designed to indoctrinate individuals with ideas, causing them to become unaware of other views and perspectives. The process moves users from traditional search strategies used to identify trustworthy information toward a new approach primarily based on confirming provided information. Digital platforms do this to keep viewers connected because web designers know that internet search users prefer search results that reinforce their opinions over search results that challenge their opinions (Frey, 1986). Garrett (2009) discovered further support for this inclination in the results of an experiment composed of 727 online newsreaders, persons who expressed an interest in reading news stories online. The research results indicated the readers appeared to support opinions they already held while lacking interest in examining articles that challenge their opinions.

To summarize, for many people, communication and acquiring information happen exclusively online. Individuals now find almost everything they want to know digitally. Facebook's newsfeeds serve as a news magazine, Google as a lexicon, and messengers like WhatsApp or Skype serve as forums for sharing information with friends, colleagues, and family.

Filter Bubbles

As personalization becomes more prevalent and effective, users will become more enclosed in a filter bubble, the figurative sphere surrounding a user as they search the Internet. The word bubble, in this context, is a synonym for isolation; its context comes from a medical device called the *isolator*, a plastic bubble that was infamously used to sequester a young patient with immunodeficiencies in the 1970s. It is a person's own personal, unique universe of online information where personal viewpoints persist, unchallenged, and untested that strengthen an individual's beliefs, not adding and withdrawing from the communal pool. Pariser (2011) uses the filter bubble metaphor to point out that the personalization process often filters out important information, leaving those seeking information with an incomplete and slanted reality. Pariser (2011) contends that filter bubbles limit our "mental flexibility and openness" (p. 101) as they further shift from discovery-directed searching to a strategy of search and retrieval. Pariser considers filter bubbles a "unique universe of information for each of us" (Pariser, 2011, p. 9), "devoid of attitude-challenging content" (Bakshy, Messing, & Adamic, 2015, p. 1130), where "individuals only see posts that they agree with" (Lazer, 2015, p. 1090).

Although it may seem important to have a personalized, enhanced internet search experience, websites that track individuals' information and control the information that the user sees are what produces filter bubbles. Personalized information on the Internet can be harmful to Web users since they are no longer confronted with information that could broaden their interests, expose them to other viewpoints, or challenge their beliefs or opinions. "When you enter a filter bubble, you're letting the companies that construct it choose which options you're aware of. You may think you are the captain of your destiny, but personalization can lead you down a road to a kind of informational determinism in which what you have clicked on in the past determines what you see next—a Web history you're doomed to repeat. You can get stuck

in a static, ever-narrowing vision of yourself—an endless you-loop" (Pariser, 2011, p. 16). In other words, Internet users are finding themselves receiving information that bypasses any divergent information and impoverishes their curiosity. A filter bubble skews or limits the information an individual user sees on the Internet. Filter bubbles affect an individual's online advertisements, social media newsfeeds, and web searches, and essentially insulate individuals from outside influences and reinforce what the individual already thinks. The choices shown to Web users made by digital platforms' algorithms are not transparent. Previously, we used the Internet to connect with people who held different viewpoints, but since AI began to introduce data feeds, web professionals have shaped the Internet to shield individuals from different viewpoints.

Certainly, even before the arrival of the Internet, media outlets that offered very specialized information or held robust editorial lines already existed. But these outlets were upfront about it. Facebook, YouTube (which belongs to Google), and other similar platforms, on the other hand, do not present themselves as specialized media, or even as media, but simply as platforms that host content. In other words, the specialization and orientation of the information are displayed in part without the user's knowledge. Individuals may not even realize they are in a filter bubble because these algorithms do not ask users for their permission, reveal when they are active, or indicate to the user what they are keeping from them. Viewers do not get to decide what gets filtered and what gets removed, so they are unable to know what they are missing. Individuals online are shown a world where the Internet shows them what it guesses they want to see, and not necessarily what they need to see. Web analytics firm Hitwise contends that Google and Facebook have dominated the filtering market for years (O'Hear, 2010).

Algorithmic websites show users content that it believes users will interact with. Facebook and other social media companies need social media users to continue using social media. Instead of feeding *all* information, Facebook *selects* the information for each information feed. People will often assume the information presented to them is unbiased even when skewed in the direction of their beliefs. After a while of only seeing results they agree with, people begin to believe that they are *more correct* and then their views are strengthened and solidified. This means that when someone disagrees with them, both of their views are likely to be more polarized (Sîrbu, Pedreschi, Giannotti, & Kertész, 2019). This often results in people becoming less likely to come to an understanding with one other, or even converse with one another (Klein, 2020). The lack of news diversity and exposure to conflicting viewpoints in the long term increases the chance of accepting misleading information and accrediting unreliable sources (Mohseni & Ragan, 2018).

Filter bubbles can also produce an "echo chamber" effect (Cinelli, Morales, Galeazzi, Quattrociocchi, & Starnini, 2021) by promoting content favoring a user's existing mindset. Echo chambers describe a situation whereby individuals are only exposed to information from persons who think as they do and where homogeneous views are reinforced by communication inside closed groups. Such echo chambers have been previously studied concerning creating polarized opinions and shaping a false sense of credibility for users who frequent news sources through social media (Zajonc, 2001). This false sense of credibility holds users in a vulnerable position of accepting biased and fake news content.

While filter bubbles tend to be created *externally* by online platforms providing users with an abundance of attitudinal-consistent information, confirmation biases are generated *internally*, that is, within users' psyche. A highly curated stream of information facilitates the development of confirmation biases which develop when an individual or group of individuals

purposely look for information that will support their previously held beliefs (Nickerson, 1998). Confirmation bias is discussed in greater detail below.

Confirmation Bias

The biggest problem with decision-making is the decision-maker(s). This is because people approach decisions with their unique perspectives (Haynes, 2000). Their decision-making is often compromised due to their confirmation biases, a pervasive phenomenon where individuals seek and attach more credence to data that supports their previously held beliefs, hypothesis, and preconceptions while ignoring or minimizing information that could disprove their hypotheses and theories. Confirmation bias is gathering, remembering, or interpreting information in a manner that confirms one's opinions or beliefs (Tversky & Kahneman, 1974). Individuals also tend to accept at face value information that confirms their preconceived views, while they are skeptical of information that challenges them. As such, it can be thought of as a form of selection bias in collecting evidence where individuals tend to seek sources most likely to tell them what they want to hear, and they give too much weight to supporting data and too little contradictory information (Robbins & Judge, 2015).

Furthermore, recent empirical investigations emphasizing online contexts yielded a consensus that users of information favor attitude-consistent messages (e.g., review by Knobloch-Westerwick, 2015). In other words, people only search for information supporting their already existing opinions, viewpoints, beliefs, and preconceptions. Persons will often search for and decipher information in such a way as to validate their beliefs. It is the tendency to cherry-pick information that validates a person's existing beliefs or ideas. Consequently, partisan individuals—those holding ideological standings on issues—are drawn toward messages that corroborate, rather than refute, their positions.

Confirmation bias can be considered another way of explaining the inclination to perceive what the person desires and can further be explained as "believing is seeing" (Glick, 2017, p. 131). Unconsciously and consciously, people seek out opinions and information consistent with what they already believe. Moreover, Bakshy, Messing, and Adamic (2015) found that individuals tend to engage most with information that flatters their ideological preconceptions. In addition, individuals will often dodge, dismiss, or disregard new information inconsistent with previously held notions of what they currently believe (Parker, 2006). People are often more inclined to believe the information they agree with but scrutinize other information to a much greater extent. In some instances, confirmation bias may cause persons to develop inaccurate assumptions when information contradicts their views.

It appears that some people would prefer that the outside world with whom they interact match their thoughts, beliefs, opinions, and ideas. Whether information is factual or interpreted opposes the individual's preconceived views or notions produces cognitive dissonance which often results in mental discomfort. Human beings appear to be encoded to moderate, or whenever possible, eradicate this mental distress, which paves the way for confirmation bias to enter. The result is that individuals become locked into what we refer to as "inferential prisons" (Baron, 2012, p. 29) whereby any external information we find inconsistent with our current internal thinking will likely be ignored or dismissed as not being important and finally disregarded instead of changing their way of thinking. Individuals will typically avoid incompatible information that challenges or opposes beliefs they currently hold (e.g., Knobloch-Westerwick, Mothes, & Polavin, 2017) and are pulled toward information supporting their beliefs. In addition,

information that refutes those expectations may be ignored or dismissed as unimportant (Russo & Schoemaker, 2002). Research by Pearson and Knobloch-Westerwick (2019) and Knobloch-Westerwick et al. (2017) suggest that an online information format fosters greater confirmation bias than traditional media.

Web designers try to make browsing as enjoyable as possible and not create intellectual challenges. However, their vested interests reward viewers with what they like to see, and they are aware of this human tendency to attend more to messages that agree with their beliefs and partisanship and avoid ideologically discrepant messages personalize messages so that viewers see content that algorithms determine users will like and, in the process, often create filter bubbles that exacerbate user's confirmation bias. Personalization and filter bubbles often screen out material that does not conform to the individual's preferences, also leading to virtual cliques where viewers insulate themselves from opposite viewpoints, reinforcing their biases—particularly confirmation bias. These communities are referred to as echo chambers because the voice of each member essentially echoes that of every other member. Participating in an echo chamber reinforces individual existing views without encountering opposing views, facilitating unintended confirmation biases. Echo chambers may increase social and political polarization and extremism. Serving much like amplifiers and mirrors of an individuals' worldview, echo chambers appear to be fertile grounds for more likely decision-making error.

Decision-Making

Web personalization can often create filter bubbles and confirmation biases that can lead to a narrow search for solutions. This is because users are presented with the information they were previously comfortable with and therefore, do not feel the need for continuing to search for additional options. Settling on a single idea without truly exploring distinct alternatives that support one's prejudices may be considered preferential. However, the search for other options requires decision-makers to step forward into unknown territory and postpone making the decision, while waiting for additional possible solutions to surface, which can be discomforting and stressful. This error leads individuals to stop gathering information when the data validates their views or preferences they would like to be true and to ignore or reject evidence that casts doubt on it.

However, decisions cannot be fully informed if individuals are only focusing on evidence that supports their assumptions and beliefs. It can cause people to overlook pivotal information. This is problematic because practically all decision-making models and heuristics include a search for alternatives as a key step in the decision-making process (Albar & Jetter, 2009). Additionally, Nutt (2004) found decision-makers only seriously consider one idea in four of five of their decisions and only two out of three decisions are made with very little resources expended on the search for an alternative. Furthermore, many believe that swift, decisive action is often equated with competence (Barrett-Poindexter, 2019) leading decision-makers to act swiftly and rush to judgment. Reviewing only one option speeds up the decision-making process and limiting the collection of options increases the likelihood of failure (Nutt, 1999). Another drawback to driving decisions using a single idea is an absence of a well-defined expectation of anticipated outcomes. Often, decision-makers may be unclear or not willing to divulge their real intentions. The "answer" offered by only one option replaces the need to consider hoped-for results or allows the individual to conceal their intentions (Nutt, 2004). The emphasis is the idea itself the emphasis is not on the results of the idea.

Often, this failure to consider alternatives and to keep one's options open before selecting an action plan are overlooked leading researchers to call for multiple options for over a century (Dewey, 1910). Allison (1969, 1971), Steinbruner (1974), Churchman (1971), Checkland (1981), Gu and Zhao (1996), and Linstone (Linstone 1984, 1999; Mitroff & Linstone, 1993) offer many forms of multiple perspective theory. Considering diverse perspectives—values (what individuals think), beliefs (mental models of how the world works), and expectations (person's view about how the future will unfold)—enhances the decision-maker's ability to make better-informed choices (Hall & Davis, 2007).

The search for multiple strategies is often omitted is also supported by other research. For example, a person's confidence decreases when requested to provide an explanation that contradicts their responses, suggesting they fail to spontaneously search for alternatives (Koriat, Lichtenstein, & Fischhoff, 1980). Likewise, the subjects' belief that occurrences that happened were compelled to happen (referred to as hindsight bias)—does not decrease when individuals are told to simply reject their bias, but lessens when asked to defend why an opposite outcome occurred, indicating that individuals do not instinctively contemplate alternative approaches (Fischhoff, 1977). Similarly, the tendency to assess research supporting opposite positions with greater scrutiny (Lord, Ross, & Lepper, 1979) is not impacted when persons are instructed to be unbiased and objective but is eradicated when simply encouraged to "consider the opposite" of any decision soon to be made (Lord, Lepper, & Preston, 1984; Mussweiler, Strack, & Pfeiffer, 2000). When considered together, these research findings suggest that we are more prone to search instinctively for solutions in harmony with our biases than for conflicting evidence. The trap of a limited search appears to be an important procedure that underlies ineffective decision-making (Nutt, 2004) because when individuals are led to consider possibilities at odds with their beliefs and perceptions, they become better decision-makers. In addition, it appears that individuals are not cognizant of favoring evidence that is consistent with their existing beliefs and expectations and therefore must be encouraged to think about and consider alternative strategies.

A pluralistic approach expands knowledge and brings out the inadequacies of taking decisions based on any perspective. The pluralistic approach assumes any occurrence, system, organization, or problems that arise within the occurrence should be handled from a range of different perspectives, each perspective involving distinctive worldviews, where each challenges the others in a robust exchange of ideas and questions.

The multiple perspectives method takes into consideration that each individual, group of individuals, systems, or organization, designs and frames the planet through a succession of psychological models, of which each individual is not complete. This approach forces individuals to consider in general terms and to examine problems from various viewpoints. As each viewpoint typically "reveals insights ... that are not obtainable in principle from others" (Mitroff & Linstone, 1993, p. 98). This approach is also helpful when attempting to comprehend other viewpoints, even when ultimately you disagree or employ another approach (Werhane, 2002).

Having a plurality of perspectives aligns with practices for innovation (Kelley & Littman, 2005), advancing knowledge (Committee on Facilitating Interdisciplinary Research, 2005; Galison, 1997), connecting research with practice (Turns, Adams, Martin, Cardella, Newman, & Atman, 2006), and fostering cross-disciplinary practice communities (Wenger, McDermott, & Snyder, 2002). Still, it can be disturbing for those used to a single perspective model. A plurality of perspectives includes coming into contact with different languages, communication methods,

value systems, and investigation procedures (Lattuca, 2001; Klein, 1996). In addition, it involves being willing to challenge personal perspectives to make way for transformative learning. Fundamental features of this method involve identifying the interrelationship and inseparability of viewpoints within a complicated analytical system (Churchman, 1971), thought-provoking explicit and implicit hypotheses, and dealing with the limits of a single model approach (Linstone et al., 1981). Moreover, research examining single-versus-shared decision-making implies that decision-making is enhanced when considering and choosing from among several options *at the same time* as opposed to rejecting or accepting choices *separately*. For instance, Bazerman, White, and Loewenstein (1995) found that people exhibit greater self-interest while considering one alternative at a time rather than when contemplating multiple options. Additionally, Bazerman et al. (1995) found that we display less willpower when considering alternatives separately.

Another reason why considering multiple perspectives can be beneficial for important and complex decisions is that it slows down the decision-making process and shifts it from instinctively forceful System 1 to the more thought-through System 2 thinking (Kahneman, 2011; Stanovich & West, 2000). System 1 represents our instinctive system, which is characteristically fast, involuntary, requires minimal cognitive effort, implicit, almost completely unconscious, and emotional. It requires little energy or attention, but it is often biased prone. System 1 is more influential and guides individuals' day-to-day decisions and judgments. The frenzied pace of our daily life is liable to cause persons to depend on using System 1 most often and cause us to make significant errors. By comparison, System 2 represents slower reasoning that is also conscious, involves substantial cognitive energy, is also logical and explicit, and is connected with creating and testing hypotheses (Wiswell, Tsao, Bellolio, Hess, & Cabrera, 2013). We use System 2 thinking when making rational decisions. It is this slower system that retrieves mental data and weighs the pros and cons for people.

To encourage a review of more alternatives we offer Linstone's Multiple Perspectives approach (Linstone, 1984, 1999; Mitroff & Linstone, 1993) also known as the TOP framework. It is a structured approach that requires decision-makers to consider at least three perspectives or lenses: T (technical), O (organizational), and P (personal).

- The T is the technical perspective and includes facts and economic realities using statistical comparisons and quantitative measures in addition to countable attributes. The emphasis is placed upon quality levels, profits, or projected savings, profits. This lens encourages people to think like an engineer. Additional measures will also include scientific and technical measures.
- The O perspective equates to "Organizational" or sociological perspective. Mitroff and Linstone found that (1993) "the O perspective reflects the culture and the myths that have helped to mold and bound the organization, group, or society together as a distinct entity in the eyes of its members" (p. 2). The sociological perspective incorporates project boundary issues, culture, power, dependencies, relationships, influence, conflict suppliers, group dynamics, and interconnectivity. Constructing the O perspective is essentially building a shared vision in which people are bound together around a common identity and sense of destiny whereby they excel and learn. This viewpoint examines the interactions linking organizations or segments of an organization (Mitroff & Linstone, 1993).
- The personal (P) perspective considers the decision from the perspective of those affected. The personal perspective is also considered a psychological perspective. This perspective is considered important as both the technical perspective and the organizational perspective can sometimes overwhelm personal concerns. Some examples of this include community groups,

regulatory agencies, major stakeholders, customers, chief executive officers, managers, computer users, hourly workers, etc. In addition, the personal perspective puts forth job security concerns, opportunities for demonstrating job competence, and advancement courses. The P perspective also considers individuals who view themselves as either victims or benefactors or as users or doers. This perspective also includes a person's feelings, beliefs, desires, needs, along loyalty to the team.

These three lenses connect to a previously selected group of decision-makers who can consider and evaluate the problem and offer various options. It is intended to simply encourage a holistic view by stimulating questions from within the decision-maker, and an expectation that the question will cultivate previously forgotten issues. Multiple perspectives can contribute to seeing various dimensions of a complex system as an integrated whole. Each perspective yields insights about the system not obtainable with others (Linstone, 1999).

Inherent features of this method include identifying the interrelationship and inability to separate the perspectives in a detailed search system (Churchman, 1971), testing both explicit and implicit assumptions, and in addition, dealing with the limitations of single pattern reductionist approaches (Linstone et al., 1981). The result of this method is a meta-inquiry system that prepares landscape maps of several means of knowing. This provides an opportunity for positive disagreement (Tompkins & Rogers, 2004) as distinctive means of inquiry intermingle to make transformative knowledge possible.

Conclusion

Sometimes people make decisions, sometimes cultures make them, and increasingly Internet algorithms are making them. Search engines and social media platforms increasingly shape the consumption of information by tailoring what individual users see which may foster the creation of information-limiting environments that can negatively impact decision-making because users become separated from data that differs from their viewpoints, effectively isolating them in their own cultural or ideological filter bubbles. Confirmation bias is the tendency to look for information that supports, rather than rejects, one's opinions and views by interpreting evidence that confirms their existing beliefs which thwart users from considering different viewpoints and conveying the impression that the user's self-interests are all that exist.

To address these problematic phenomena Linstone's multiple perspective TOP strategy was offered to address the limited search for alternatives trap that these issues foster. TOP strategy brings together various perspectives across distinctive thought paradigms to expand understanding into complicated systems and empower unrestrained systems reasoning and transformation across disciplines. Fundamental characteristics of this method comprise identifying the interrelation and the inseparability of viewpoints contained in a complex inquiry system, stimulating explicit and implicit assumptions, and dealing with the limits of reductionist approaches with only a single solution. Linstone's multiple perspectives method was offered to overwhelm filter bubbles and confirmation biases that can interfere with decision-making.

Nevertheless, Linstone's model does not specify the optimum number of alternatives that should be generated. Indeed, too many alternatives (for example beyond seven) from a time and resources perspective can be dysfunctional because they may generate much more complexity than decision-makers are prepared to integrate, particularly when time is of the essence. Another difficulty is that in a group decision-making format consensus can become more difficult to achieve when a broader number of perspectives are considered. Janis, (1972) considered

groupthink another complication. He describes (Janis, 1972), groupthink is a psychological occurrence that can occur within a group when the desire for accord and cohesiveness within a group or team results in specious decision-making because its members consciously or unconsciously agree at all costs, causing the group to minimize conflict and reach a consensus decision without critical evaluation. Finally, individuals should be cautious of confining themselves to acting upon the assertions put forward by prominent stakeholders. Claims such as this frequently reduce the range of alternative searching in detrimental ways or point it in the direction of controversial or low-priority concerns, while missing key concerns of important stakeholders.

Although the research cited herein address personalization, it should be noted that other non-transparent website factors such as colors, images, page design, and site design impact website visitors' behavior (Drèze & Zufryden, 1997; Mandel & Johnson, 2002; Murphy, Hofacker, & Bennett, 2001). Particularly important is website link placement. In a review of studies, Murphy, Hofacker, and Mizerski (2006) found that links at the top (and sometimes the bottom) of a list on a website received the most clicks; that is, users are biased towards clicking on higher-ranked results (Joachims, Granka, Pan, Hembrooke, Radlinski, & Gay, 2007). Web designers and managers are aware of this serial position effect and can influence a user's search activity by placing their most desirable links toward the top or bottom of a web page and their least desirable links in the middle. Further research could examine the combined effects of personalization and the serial position effect on user behavior.

Engle (2021) raises these questions. Is diversity of thought, perspectives, and information important to you? Do you prefer to spend time with people who think as you do? Or instead, do you attempt to meet persons with different viewpoints, opinions, and experiences? Are you friends with anyone with different political views than yours? Are you okay with having your beliefs challenged? Or, do you prefer having your beliefs confirmed and supported?

Finally, we believe that it is improper to ask whether to have personalization or not, but how to design more appropriate personalization. Having a huge amount of information with no way of separating the pertinent from the irrelevant is not feasible because users must have access to some protocols that sift through large quantities of information and knowledge provided to whittle down into a manageable and comprehensible scope. However, helping remind people to remove their cognitive blinders and consider multiple perspectives will help them make better decisions in a world of distorted information.

REFERENCES

Albar, F. M., & Jetter, A. J. (2009). Heuristics in decision-making. In *Proceedings of PICMET 2009: Technology Management in the Age of Fundamental Change* (pp. 578-584), Portland, OR.

Allison, G. T. (1969). Conceptual models and the Cuban Missile Crisis. *American Political Science Review, 63*(3), 689-718

Allison, G. T. (1971). *Essence of decision: Explaining the Cuban Missile Crisis*. Boston: Little, Brown.

Bakshy, E., Messing, S., & Adamic, L. A. (2015). Exposure to ideologically diverse news and opinion on Facebook. *Science, 348*(6239), 1130-1132.

Baron, R. A. (2012). *Entrepreneurship: An evidence-based guide*. Northampton, MA: Edward Elgar Publishing, Inc.

Barrett-Poindexter, J. (2019). *Why the Best Leaders Act Swiftly and Decisively.* Retrieved from https://www.glassdoor.com/employers/blog/act-swiftly-and-decisively/

Bazerman, M. H., White, S. B., & Loewenstein, G. F. (1995). Perceptions of fairness in interpersonal and individual choice situations. *Current Directions in Psychological Science, 4*(2), 39-43.

Bozdag, E. (2013). Bias in algorithmic filtering and personalization. *Ethics and Information Technology, 15*, 209- 227.

Bozdag, E., & van den Hoven, J. (2015). Breaking the filter bubble: Democracy and design. *Ethics and Information Technology, 17*(4), 249-265.

Briggsby, J. (2013). *A Better Understanding of Personalized Search*. Retrieved from https://www.briggsby.com/better-understanding-personalized-search

Bulao, J. (2021). *How Much Data Is Created Every Day in 2021?* Retrieved from https://techjury.net/blog/how-much-data-is-created-every-day/#gref

Checkland, P. (1981). *Systems thinking, systems practice*. New York: John Wily & Son.

Chernev, A., Böckenholt, U., & Goodman, J. K. (2015). Choice overload: A conceptual review and meta-analysis. *Journal of Consumer Psychology, 25*(2), 333-358.

Churchman, C. W. (1971). *The design of inquiring systems*. New York, NY: Basic Books.

Cinelli, M., Morales, G. D. F., Galeazzi, A., Quattrociocchi, W., & Starnini, M. (2021). The echo chamber effect on social media. *Proceedings of the National Academy of Sciences of the United States of America*. Retrieved from https://www.pnas.org/content/118/9/e2023301118
Committee on Facilitating Interdisciplinary Research. (2005). *Facilitating interdisciplinary research*. Washington, DC: National Academies Press.

Dewey, J. (1910). *How we think*. New York: Heath.

Drèze, X., & Zufryden, F. (1997). Testing website design and promotional content. *Journal of Advertising Research*, *37*(2), 77-91.

Ekström, A. (2015). *The moral bias behind your search results*. Retrieved from
"
https://www.ted.com/talks/andreas_ekstrom_the_moral_bias_behind_your_search_results?referrer=playlist-how_to_pop_our_filter_bubbles#t-795

El-Bermawy, M. M. (2016). *Your Filter Bubble Is Destroying Democracy*. Retrieved from https://www. wired.com/2016/11/filter-bubble-destroying-democracy/

Engle, J. (2021, May). Do you think you live in a political bubble? *The New York Times*, Retrieved 07/22/2021 from https://www.nytimes.com/2021/05/07/learning/do-you-think-you-live-in-a-political-bubble.html

Fischhoff, B. (1977). Perceived informativeness of facts. *Journal of Experimental Psychology: Human Perception and Performance, 3*(2), 349-358.

Frey, D. (1986). Recent research on selective exposure to information. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology* (Vol. *19*, pp. 41-80). Cambridge, MA: Academic Press.

Galison, P. (1997). *Image and logic*. Chicago, IL: The University of Chicago Press.

Garrett, R. K. (2009). Echo chambers online? Politically motivated selective exposure among Internet news users. *Journal of Computer-Mediated Communication, 14*(2), 265-285.

Gauch, S., Speretta, M., Chandramouli, A., & Micarelli, A. (2007). User profiles for personalized *information access. The adaptive web*. Berlin Heidelberg: Springer.

Glick, M. (2017). Believing is seeing: Confirmation bias. *Journal of the American Dental Association, 148*(3), 131-132.

Gu, J., & Zhao, L. (1996). An overview of evaluation theory and practice. *IEEE International Conference on Systems, Man, and Cybernetics. 3*, 2407-2411.

Hall, D. J., & Davis, R. A. (2007). Engaging multiple perspectives: A value-based decision-making model. *Decision Support Systems, 43*(4), 1588-1604.

Haynes, J. D. (2000). *Perspectival thinking*. Palmerston North, New Zealand: ThisOne and Company.

International Data Corporation (IDC). (2020). *Worldwide Spending on Artificial Intelligence Is Expected to Double in Four Years, Reaching $110 Billion in 2024, According to New IDC Spending Guide*. Retrieved from https://www.idc.com/getdoc.jsp?containerId=prUS46794720

Iyengar, S., Jiang, W., & Huberman, G. (2004). How much choice is too much? Contributions to 401(k) retirement plans. In O. Mitchell & S. P. Utkus (Eds.) *Pension design and structure: Lessons from behavioral finance* (pp. 83-95). Oxford, UK: Oxford University Press.

Iyengar, S. S., & Lepper, M. R. (2002). Choice and its consequences: On the costs and benefits of self-determination. In A. Tesser, D. A. Stapel, & J. V. Wood (Eds.), *Self and motivation: Emerging psychological perspectives* (pp. 71-96). Washington, D.C.: American Psychological Association.

Janis, I. L. (1972). *Victims of groupthink: A psychological study of foreign-policy decisions and fiascoes*. Boston: Houghton Mifflin.

Jehn, K. A., Northcraft, G. B., & Neale, M. A. (1999). Why differences make a difference: A field study of diversity, conflict, and performance in workgroups. *Administrative Science Quarterly, 44*(4), 741-763.

Joachims, T., Granka, L., Pan, B., Hembrooke, H., Radlinski, F., & Gay, G. (2007). Evaluating the accuracy of implicit feedback from clicks and query reformulations in web search. *ACM Transactions on Information Systems, 25*(2), Article 7, 1-26.

Johnson, E. J., Shu, S. B., Dellaert, B. G., Fox, C. R., Goldstein, D. G., Häubl, G., Larrick, R. P., Payne, J. W., Peters, E., Schkade, D., Wansink, B., & Weber, E. U. (2012). Beyond nudges: Tools of choice architecture. *Marketing Letters, 23,* 487-504.

Kahneman, D. (2011). *Thinking fast and slow*. New York: Farrar, Straus, and Giroux.

Kaptein, M., & Parvinen, P. (2015). Advancing e-commerce personalization: Process framework and case study. *International Journal of Electronic Commerce, 19*(3), 7-33.

Kelley, T., & Littman, J. (2005). *The ten faces of innovation: IDEO's strategies for beating the devil's advocate and driving creativity throughout your organization*. New York, NY: Doubleday.

Kitchens, B., Johnson, S. L., & Gray, P. (2020). Understanding echo chambers and filter bubbles: The impact of social media on diversification and partisan shifts in new consumption. *MIS Quarterly, 44*(4), 1619-1649.

Klein, E. (2020). *Why we're polarized*. London: Profile Books.

Klein, J. T. (1996). *Crossing boundaries: Knowledge, disciplinarities, and interdisciplinarities*. Charlottesville, VA: University Press of Virginia.

Knobloch-Westerwick, S. (2015). The selective exposure self- and affect-management (SESAM) model: Applications in the realms of race, politics, and health. *Communication Research, 42*, 959-985.

Knobloch-Westerwick, S., Mothes, C., & Polavin, N. (2017). Confirmation bias, ingroup bias, and negativity bias in selective exposure to political information. *Communication Research, 47*(1), 104-124.

Koriat, A., Lichtenstein, S., & Fischhoff, B. (1980). Reasons for confidence. *Journal of Experimental Psychology: Human Learning and Memory, 6*(2), 107-118.

Lattuca, L. (2001). *Creating interdisciplinarity: Interdisciplinary research and teaching among college and university faculty*. Nashville, TN: Vanderbilt University Press.

Lazer, D. (2015). The rise of the social algorithm. *Science, 348*(6239), 1090-1091.

Liang, T. P., Lai, H. J., & Ku, Y. C. (2007). Personalized content recommendation and user satisfaction: Theoretical synthesis and empirical findings. *Journal of Management Information Systems, 23*(3), 45-70.

Linstone, H. A. (1984). *Multiple perspectives for decision making: Bridging the gap between analysis and action*. New York: North Holland.

Linstone, H. A. (1999). *Decision-making for executives: Using multiple perspectives to improve performance*. Boston: Artech House.

Linstone, H. A., Meltsner, A. J., Adelson, M., Mysior, A., Umbdenstock, L., Clary, B., … Shuman, J. (1981). The multiple perspective concept with applications to technology assessment and other decision areas. *Technological Forecasting and Social Change, 20*(4), 275-325.

Liu, L., Mehandjiev, N., & Xu, D. L. (2013). Context similarity metric for multidimensional service recommendation. *International Journal of Electronic Commerce, 18*(1), 73-104.

Lord, C. G., Lepper, M. R., & Preston, E. (1984). Considering the opposite: A corrective strategy for social judgment. *Journal of Personality and Social Psychology, 47*(6), 1231-1243.

Lord, C. G., Ross, L., & Lepper, M. R. (1979). Biased assimilation and attitude polarization: The effects of prior theories on subsequently considered evidence. *Journal of Personality and Social Psychology, 37*(11), 2098-2109.

Mandel, N., & Johnson, E. J. (2002). When web pages influence choice: Effects of visual primes on experts and novices. *Journal of Consumer Research*, *29*(2), 235-245.

Matzke, D., Love, J., Wiecki, T. V., Brown, S. D., Logan, G. D., & Wagenmaker, E.-J. (2013, December 10). Release the BEESTS: Bayesian Estimation of Ex-Gaussian STop-Signal reaction time distributions. *Frontiers in Psychology*. Retrieved from https://www.frontiersin.org/articles/10.3389/fpsyg.2013.00918/full

Mitroff, I. I., & Linstone, H. A. (1993). *The unbounded mind: Breaking the chains of traditional business thinking*. New York: Oxford University Press.

Mohseni, S., & Ragan, E. D. (2018). Combating fake news with interpretable news feed algorithms. A survey of evaluation methods and measures for interpretable machine learning. *arXarXiv: 1811.12349v2*.

Movable Ink. (2016). *Everything You Need to Know About Contextual Marketing*. Retrieved from https://movableink.com/blog/ebook-everything-you-need-to-know-about-contextual-marketing/

Murphy, J., Hofacker, C. F., & Bennett, M. (2001). Website generated market-research data: Tracing the tracks left behind by visitors. *Cornell Hotel and Restaurant Administration Quarterly*, *42*(1), 82- 91.

Murphy, J., Hofacker, C. F., & Mizerski, R. (2006). Primacy and recency effects on clicking behavior. *Journal of Computer-Mediated Communication, 11*(2), 522-535.

Mussweiler, T., Strack, F., & Pfeiffer, T. (2000). Overcoming the inevitable anchoring effect: Considering the opposite compensates for selective accessibility. *Personality and Social Psychology Bulletin, 26*(9), 1142-1150.

Mutz, D. C., & Martin, P. S. (2001). Facilitating communication across lines of political difference: The role of mass media. *American Political Science Review, 95*(1), 97-114.

Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of General Psychology,2*(2), 175-220.

Nutt, P. C. (1999). Surprising but true: Half of the organizational decisions fail. *The Academy of Management Executive, 13*(4), 75-90.

Nutt, P. C. (2004). Expanding the search for alternatives during strategic decision-making. *Academy of Management Executive, 18*(4), 13-28.

Obama, B. (January 10, 2017). *President Obama's Farewell Address*. Retrieved from https://obamawhitehouse.archives.gov/farewell

O'Hear, S. (2010). *Social networks overtake search engines in the UK – should Google be worried?* Retrieved from https://techcrunch.com/2010/06/08/report-social-networks-overtake-search-engines-in-uk-should-google-be-worried/

Olin, K. (2009). *Facebook advertising guide* (Kindle Edition). Retrieved from " https://www.amazon.com/Facebook-Advertising-Guide-Kris-econ-ebook/dp/B0036OSBZI/ref=s r_ 1_1?dchild=1&keywords=9780980648478&linkCode=qs&qid=1625686731&s=books&sr=1-1

Pan, B., Hembrooke, H., Joachims, T., Lorigo, L., Gay, G., & Granka, L. (2007). In Google, we trust: Users' decisions on rank, position, and relevance. *Journal of Computer-Mediated Communication, 12*(3), 801-823.

Pariser, E. (2011). *The filter bubble: What the Internet is hiding from you*. London: Penguin Books Limited.

Parker, S. C. (2006). Learning about the unknown: How fast do entrepreneurs adjust their beliefs? *Journal of Business Venturing, 21*(1), 1-26.

Pearson, G. D. H., & Knobloch-Westerwick, S. (2019). Is the confirmation bias bubble larger online? Pre-election confirmation bias in selective exposure to online versus print political information. *Mass Communication & Society*, *22*(4), 466-486.

Petrov, C. (2021). *25+ Impressive Big Data Statistics for 2021*. Retrieved from https://techjury.net/blog/big-data-statistics/#gref

Ponciano, J. (2021). *Facebook Posts $26 Billion In Revenue, Shattering Wall Street Expectations As Income Nearly Doubles.* Retrieved from https://www.forbes.com/sites/jonathanponciano/2021/04/28/facebook-earnings-first-quarter/?sh=4e31d9ff68a5

Raufi, B., Ismaili, F., Ajdari, J., & Zenuni, X. (2019). Web personalization issues in big data and Semantic Web: Challenges and opportunities. *Turkish Journal of Electrical Engineering and Computer Sciences*, *27*, 2379-2394.

Remerowski, T. (2012). *Inside Google* (film). Retrieved from https://letterboxd.com/film/inside-google/

Robbins, S. P., & Judge, T. A. (2015). *Organizational behavior* (16th ed.). Boston. Pearson.

Russo, J. E., & Schoemaker, P. J. H. (2002). *Winning decisions: How to make the right decision the first time*. London: Piatkus.

Sîrbu, A., Pedreschi, D., Giannotti, F., & Kertész, J. (2019) Algorithmic bias amplifies opinion fragmentation and polarization: A bounded confidence model. *PLoS ONE, 14*(3), e0213246.

Stanovich, K. E., & West, R. F. (2000). Individual differences in reasoning: Implications for the rationality debate. *Behavioral & Brain Sciences, 23*(5), 645-665.

Steinbruner, J. D. (1974). *The cybernetic theory of decision*. Princeton, NJ: Princeton University Press.

Stroud, N. J. (2010). Polarization and partisan selective exposure. *Journal of Communication*, *60*(3), 556-576.

Sunstein, C. R. (2002). *Republic.com*. Princeton, NJ: Princeton University Press.

Sunstein, C. R. (2006). Preferences, paternalism, and liberty. *Royal Institute of Philosophy Supplements, 59*, 233-264.

Sunstein, C. R. (2018). *Republic: Divided democracy in the age of social media*. Princeton, NJ: Princeton University Press.
Tompkins, T. C., & Rogers, K. S. (2004). Using conflict to your advantage. *Graziadio Business Review*, *7*(1), 1-7.

Tran, T., & Yerbury, H. (2015). New perspectives on personalized search results: Expertise and institutionalization. *Australian Academic & Research Libraries, 46*(4), 275-288.

Turns, J., Adams, R. S., Martin, J., Cardella, M., Newman, J., & Atman, C. J. (2006). Tackling the research-to-practice challenge in engineering design education: Making the invisible visible. *International Journal of Engineering Education, 22*(3), 598-608.

Tversky A., & Kahneman D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, *185*, 1124-1131.

Vaidhyanathan, S. (2011). *The Googlization of everything (and why we should worry).* Berkeley: University of California Press.

Van Alstyne, M., & Brynjolfsson, E. (1996). Could the Internet Balkanize Science? *Science*, *274*(5292), 1479-1480.

Van der Hof, S., & Prins, C. (2008). *Personalization and its influence on identities, behavior, and social values. Profiling the European citizen: Cross-disciplinary perspectives* (pp. 111-127). Netherlands: Springer.

Wenger, E., McDermott, R., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge*. Cambridge, MA: Harvard Business School Press.

Werhane, P. H. (2002). Moral imagination and systems thinking. *Journal of Business Ethics, 38*(1-2), 33-42.

Wiswell, J., Tsao, K., Bellolio, M. F., Hess, E. P., & Cabrera, D. (2013). "Sick" or "not-sick": Accuracy of System 1 diagnostic reasoning for the prediction of disposition and acuity in patients presenting to an academic ED. *American Journal of Emergency Medicine, 31*(10), 1448-1452.

Zajonc, R. B. (2001). Mere exposure: A gateway to the subliminal. *Current Directions in Psychological Science, 10*(6), 224-228.

Zanker, M., Rook, L., & Jannache, D. (2019). Measuring the impact of online personalization: Past, present, and future. *International Journal of Human-Computer Studies, 131*, 160-168.