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ORIGINAL EMPIRICAL RESEARCH

# Search modality effects: merely changing product search modality alters purchase intentions

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**Abstract**
Search modality is becoming increasingly important for Internet platforms and e-commerce businesses. Consumers can perform product searches on the Internet by typing their search queries (typed search modality) or by speaking them (voice search modality). Given the variation and the managerial ease of selecting different search modalities to adopt, we investigate the consequences of search modalities on consumers' mindsets and purchase intentions. Six studies, including an Implicit Association Test and an incentive-compatible field experiment, show that typed search modality (vs. voice search modality) led to higher purchase intentions and behavior. This results from learned responses where typing is nonconsciously associated with taking action, and vocalization is nonconsciously associated with information gathering and deliberation. Thus, consumers performing a typed search are more likely to be in an action-oriented mindset, whereas consumers performing a voice search are more likely to be in a deliberative mindset. Our research carries implications for digital technologies.

**Keywords** Voice search · Search modality · Mindset · Nonconscious · Digital technology

## Introduction

Search modality is becoming an increasingly important marketing decision for Internet search platforms such as Google, Bing, and Yahoo as well as e-commerce businesses such as Amazon and eBay. With the growing use of digital technologies and smartphones, these platforms and businesses now allow consumers to input their product search by typing their search queries or by speaking them. For example, when a consumer searches for a product on the Internet, he or she can type the search query on their device by entering characters on the keyboard ("typed search modality"). Alternatively, a consumer can speak the search query into the device by pressing the microphone icon and vocalizing the search query ("voice search modality;" see Appendix 1).

In the marketplace, there has been an increasing trend towards the adoption of voice search. For example, Google added the voice search icon next to the search bar, which now allows consumers to voice in their search queries. Similar trends have been observed for other e-commerce businesses. A news article on Fortune reported that companies are starting to invest millions of dollars in voice search technology and implement it (Dumaine, 2018). Additionally, managers are increasingly adopting voice searching because they believe it increases consumers' convenience as compared to typed searching (Kinsella, 2020). Given the options in search modalities (typed search vs. voice search) that can facilitate e-commerce, our research investigates the consequences of altering search modalities on purchase intentions.

As marketers make decisions on search modality across different platforms, we examine the consequence of these marketing decisions. We use the lens of Hebbian learning (Hebb, 1949) underpinned by Bidirectional Associative Memory (BAM) networks (Kosko, 1988; Sommer & Palm, 1998, 1999) to provide conceptual insights on the association between search modality and consumer's mindset. Hebbian

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learning is a mechanism in which two concepts (e.g., modality and mindset) become wired together when they co-occur repeatedly, which then facilitates the activation of an associated concept in the future. This learned relationship between modality and mindset should influence consumers' intention to purchase the product. Specifically, we propose that consumers who perform a typed search would be more likely to show higher purchase intentions due to a nonconsciously induced high action orientation mindset. In contrast, consumers who perform a voice search would be more likely to show lower purchase intentions due to a nonconsciously induced deliberation mindset. To the best of our knowledge, extant research has yet to examine the type of search modality as a factor that might influence consumer's mindset and purchase intentions (see Table 1). By addressing this gap, the current research offers three contributions.

Prior research on voice interface has studied the social role of voice assistance (e.g., as a "personal helper") and its social consequences, such as trust (Foehr & Germelmann, 2020; Pagani et al., 2019), engagement (Moriuchi, 2019), and loyalty (Moriuchi, 2019). These studies investigated voice interactions in smart home devices (e.g., Amazon Echo and Google Home) or voice assistance on smartphones (e.g., Apple Siri). In contrast, our research investigates how using one's voice during a search query alone (i.e., voice assistant interaction is not necessary) could influence purchase intentions. Given that consumers carry mobile devices (but not smart home devices) to most places and use them with greater frequency in everyday life (Melumad & Pham, 2020), the current work approaches voice interface in a consumer-relevant context that is most likely to benefit the marketer, and recognizes the multidimensional nature of the voice interface in the marketplace.

Recently, researchers demonstrated the negative effects of voice presentation in a voice commerce context. Munz and Morwitz (2019) found that a voice presentation is more difficult to cognitively process than the same information that is presented in writing, and hence consumers are less able to differentiate between the choice options, and tend to defer making a choice. Our research is different from their work because all participants in our research viewed options via textual presentation, whereas participants in their research viewed options either via textual versus audio presentation. Also, our research reveals mindset as the differentiating psychological process underlying the two types of search modality, rather than processing difficulty.

Another group of researchers studying expression modality documented their effect on the self-brand connection (Shen & Sengupta, 2018) and self-control (Klesse et al., 2015). More relevant to our research, Klesse et al. (2015) show that ordering products using voice causes more indulgent choice than ordering products by pressing a button because the act of pressing a button leads to more reflective thinking, and hence greater self-control. Our research differs from their work because we focus on the typing of product-related information on the Internet during the information search stage, rather than the pressing of a button on a vending machine during the purchase process stage. In other words, the typing or voicing in our study occurs before consumers have evaluated alternatives, whereas the pressing of a button in their study occurs after consumers have already evaluated alternatives.

Understanding how consumers behave differently as a function of whether the search query is generated vocally rather than textually is important for several reasons. First, given the variation in search modalities, managers should understand any unintended consequences that the search modality may exert on consumer purchases. Second, if voice searching is becoming an inevitable trend that consumers demand, we provide some guidance to managers on how to overcome the negative consequences of the voice search modality, such as by using narrow search framing and by action orientation priming (see General Discussion). Finally, managers can use our insights to come up with appropriate strategies for voice search on mobile devices, which is an understudied topic because the extant literature focuses on voice assistance. In sum, we examine how search modality might influence consumer mindset and purchase intentions.

## Theoretical background

### Effects of search modalities and action orientation mindset

How might voicing be related to deliberation and typing be related to action? In a cognitive system, the probabilistic activation of one concept versus another is a function of the frequency of associations between a precipitating stimulus and a mental state. This learning reflects the basic Hebbian learning principle: any two concepts that fire together, wire together (Hebb, 1949). The more frequently a precipitating stimulus (e.g., voicing/typing) is co-activated and associated with a mental state (e.g., deliberation/action orientation), the more likely it is that the stimulus will activate the associated mental state in the future. Subsequent research has shown that Hebbian learning generally results in Bidirectional activation (Kosko, 1988; Sommer & Palm 1998, 1999). Although there are exceptions, Bidirectional Associative Memory (BAM) networks are the norm because bidirectionality is a more efficient cognitive architecture.

The mindset literature dovetails with the literature on Hebbian learning and BAM in which repeated co-occurrences lead to the development of an association in the form of X→Y productions where X nonconsciously produces the Y outcome as a learned response after sufficient repetition

**Table 1** Literature review of modalities

| Modality | Context | Method | Key finding | Source |
|---|---|---|---|---|
| Voice and touch versus Touch only | Digital technology | Lab experiments | Using voice combined with touch (vs. touch only) to interact with a brand makes consumers feel less engaged and subsequently decreased trust. | Pagani et al. (2019) |
| Talking through voice assistant | Digital technology | Survey | Perceived ease of use and perceived usefulness of voice assistant technology increase consumer's engagement, and hence increase consumer's loyalty towards the voice assistant. | Moriuchi (2019) |
| Talking through voice assistant | Digital technology | Content analysis and interview | Consumers build trust with voice assistants through both anthropomorphism-based roles (i.e., "have humanlike personality", and "act as a partner") and non-anthropomorphism-based roles (i.e., "involve friends' and family's experience", and "familiarize with the technology ecosystem"). | Foehr and Germelmann (2020) |
| Talking through voice assistant | Online shopping | Online experiments | Using voice assistants to purchase products increases consumers' psychological power, thereby causing them to have higher willingness to purchase low (vs. high) involvement products. | Tassiello et al. (2021) |
| Audio presentation versus Written presentation | Online search | Online experiments and lab experiments | Presenting product choices in audio (vs. written) format increases consumers' cognitive difficulty in processing information, thereby delaying consumer choices. | Munz and Morwitz (2019) |
| Talking versus Button pressing/ Writing/ Taking notes | Product choice | Lab experiment and field experiment | Expressing preferences of food orally (vs. button pressing/writing/ taking notes) involves less motor movement, decreasing consumers' self-control, thereby causing them to order more vice (vs. virtue) products. | Klesse et al. (2015) |
| Talking versus Writing/Typing | Online reviews | Lab experiments | Expressing preferences orally (vs. in writing) makes consumers focus more on the social interaction with the communication recipient, and are more likely to express self-related thoughts, thereby increasing their self-brand connection. | Shen and Sengupta (2018) |
| Voice search versus Typed search | Online search | Online experiments, lab experiment, IAT, and field experiment | Voice search (vs. typed search) decreases action-orientation, thereby decreasing intentions to purchase one of the resulting products. | The present research |

(Wyer, 2018). In our research context where X refers to voicing/typing and Y refers to deliberation/action orientation, when people often speak out loud (X) during deliberation (Y), a subsequent exposure to vocalization (X) by itself will automatically elicit a deliberative mindset (Y), even without a conscious intention to deliberate. Furthermore, the likelihood that a concept or unit of knowledge is activated and applied in goal-directed activity is "a function of the similarity of its features to those of the situation in which the activity is performed, and the similarity of its features to those of other concepts that happen to be accessible in memory" (Wyer & Xu, 2010). When people have co-experienced vocalizations and deliberations together, and the features are similar ("vocal cord activation" and "moving one's lips" in both *speak out loud* and *voice product search*), the links are established because of synaptic sensitization (Hebb, 1949), causing subsequent vocalizations to automatically activate a deliberative mindset.

**Voicing and deliberation** Supporting the idea that vocalizations facilitate deliberative cognition, research on oral discourse suggests that participants who use their voice to make a presentation showed vagueness (e.g., "things like that") and hedges (e.g., "roughly") in their speech (Redeker, 1984). Similarly, participants who discussed their views to others in vocal form generated phrases such as "I guess," "I feel," and "I think" frequently (Cayer & Sacks, 1979). Relatedly, participants who vocalized are found to engage in a self-reflexive process through hearing their own vocal cadence and pitch changes (Schroeder & Epley, 2015), thereby increasing thinking about something unrelated to the task, called "mind wandering" (Franklin et al., 2014). Furthermore, during anger management, people are encouraged to vocalize and talk to themselves in order to induce cognitive deliberation and *delay or prevent* the taking of action (Gross, 2013), and talking leads to calming neuroendocrine responses (Kim, 2008). In anger management, people are advised to talk to themselves to prevent rash action: "talk, so that you can think." Taken together, these findings suggest that the use of one's voice facilitates the deliberative mind.

**Typing and action** In contrast to "voicing facilitates thinking," people have repeatedly typed to execute actions. Research suggests that the motoric process of typing is a series of action sequences (Yamaguchi et al., 2013; Yamaguchi & Logan, 2016), which are typically activated to facilitate the taking of action (Logan & Crump, 2011; Snyder & Logan, 2014). For example, consumers type in the 16 digits of their credit card numbers when they are looking forward to placing an order, or type a shipping address when they are looking forward to obtaining a product. Relatedly, research suggests that typing activates an implementation of a series of decisions (Yang et al., 2009). Given such planning of action sequences, it suggests that typing induces action-related thoughts.

If we apply the structure of Hebbian learning to our product search context, consumers who are induced by marketers to perform a voice search should automatically become more deliberative. In contrast, when consumers are induced by marketers to perform a typed search, they would automatically become more action-oriented in the sense of higher readiness to make a purchase. Although there are exceptions to the relative dominance of voice-deliberation and typing-action associations over voice-action and typing-deliberation associations, these exceptions do not prevent the precipitating stimulus from generating the probabilistically associated outcome. For example, the concept "taxi cab" automatically activates the color yellow (Collins & Loftus, 1975), even though there are many exceptions, such as black taxi cabs. Similarly, although it is possible for people to use their voice to take action or to type to deliberate, we propose that it is the relative frequency of pairing that leads to probabilistic activation (Hebb, 1949; Wyer, 2018). Formally,

**H1** Typed searching activates a relatively action-oriented mindset, whereas voice searching activates a relatively deliberative mindset.

## Effects of search modalities on purchase intentions

We further predict that the mechanism that underpins the relationship between modality and purchase intentions is the consumer's mindset, induced by the wiring of links between each pair of modality and mindset. Supporting this view, research has shown that a mindset influences purchase intentions, even though consumers may not have had a purchase goal in the beginning (Schwarz & Wyer, 1985). Dhar et al. (2007) found that participants who had decided to buy a product in a first task reported a higher likelihood of buying a different product in a subsequent task, compared to participants who had refused to buy the product in the first task. Additionally, if consumers are stimulated to think about how to attain a goal (i.e., buying a product) without first considering whether they want to attain it, they would acquire an action-oriented mindset, that once activated, might generalize to situations they would encounter later on (Wyer & Xu, 2010). Conversely, when consumers deliberate, this leads to the increased processing of trade-offs, which then leads to action deferral on any specific option, and lowers their willingness to pay (Thompson et al., 2009). Relatedly, deliberation activates goals that are more about a general articulation of feasibility and comparison, and not about taking action (Soman & Zhao, 2011).

Integrating these findings to the current research, we predict that a consumers' mindset that is activated during a product search will carry over to the purchase decision

task. Specifically, we propose that consumers performing a typed search will be more likely to show higher purchase intentions because typing induces a higher action orientation. In contrast, we propose that consumers performing a voice search will be less likely to show high purchase intentions because voicing induces a deliberation mindset, and this reduces the level of action orientation. Formally,

**H2** Purchase intentions will be higher when consumers perform a typed search compared to when they perform a voice search.

**H3** The degree of action orientation will mediate the relationship between the type of search modality and purchase intentions.

## Study 1: IAT of modalities and mindsets

In Study 1, we administered an Implicit Association Test (IAT; Greenwald et al., 2003) to assess the degree to which a precipitating stimulus (e.g., voicing vs. typing) and a mental state concept (e.g., deliberation vs. action) are nonconsciously associated in consumers' memory networks. This technique has been used in consumer research to demonstrate automatic associations between meat and masculinity (Rozin et al., 2012) and greenness and femininity (Brough et al., 2016). The idea behind implicit associations is that a consumer can more rapidly sort stimuli when pairings between a concept and a target were associated in previous experience, than when the pairings were not associated (or relatively less associated) in previous experience. Thus, although readers can easily think of exceptions such as female meat lovers (Rozin et al., 2012), environmentally conscious males (Brough et al., 2016), or deliberative typists in the current research, the IAT tests the relative strength of association between two concepts, not whether the two concepts were ever paired in the participant's prior experience.

### Design, participants, and procedure

In a pre-registered study[1], 80 participants (44% females; $M_{age} = 39.73$ years, $SD = 11.83$) from MTurk were paid a small sum for completing the study. We used the IATGEN software to create an IAT (Carpenter et al., 2019). Participants completed seven blocks of stimuli sorting trials. In each trial, participants were presented with a stimulus on the center of the screen that represented either one of the concepts (*voicing vs. typing*) or targets (e.g., *deliberation vs. action*). Each participant then sorted the stimuli as quickly as possible, while the computer recorded each participant's response speed in milliseconds (ms). If one implicitly sees *voicing-related stimuli* as more deliberative than *typing-related stimuli*, then one should be able to sort more rapidly when one sees *voicing* and *deliberation* on the same side of the screen (compatible block). Conversely, one should be slower to sort when one sees *voicing* and *deliberation* on different sides of the screen (incompatible block). Across trials, participants completed both compatible and incompatible blocks, and response speeds were compared within participants (see Web Appendix 1).

**Stimuli** We created five words for the "voicing" concept (i.e., voice, speak, say, call, and talk) and another five words for the "typing" concept (i.e., type, text, typewritten, enter key, type characters). We also selected five words for deliberation (i.e., mull over, think, ponder, consider, and debate over) and another five words for action (i.e., move, execute, act, carry out, and perform). These stimuli were selected to be consistent with the definitions where *deliberation* is the process of deciding among two or more options, whereas *action* is carrying out a decision that has already been made (Gollwitzer & Bayer, 1999).

### Results and discussion

**Attention check** Thirteen participants failed the attention check, based on the guidelines as outlined in the preregistration, yielding 67 participants in the analysis.

To measure the existence and strength of each association, the IATGEN tool (Carpenter et al., 2019) calculated a standardized difference score (*D*-score) for each participant. A positive *D*-score would indicate that one was faster in the compatible block. Following the guidelines by Greenwald et al. (2003), the IATGEN tool dropped 24 participants from the analysis due to excessive speed (i.e., over 10% of trials are < 300ms.). Consistent with our predictions, a one sample *t*-test revealed that the *D*-score is positive ($M = .20$, $SD = .52$) and is significantly higher than zero ($t(42) = 2.47$, $p = .018$, $d = .377$). Thus, these results provide evidence that participants' memory networks naturally store nonconscious associations between voicing and deliberation concepts, as well as between typing and action concepts, supporting H1. This does not imply that participants have never used their voice to take an action, just that the relative co-activation of voice and deliberation is higher than that of voice and action. In the next study, we tested the impact of these associations on marketing outcomes.

[1] Study pre-registration available at: https://osf.io/f2uxq/?view_only=c0760a51792b4f4ea21dff796c988140

## Study 2: Search modalities and mindsets

In this study, we sought to provide evidence that voicing induces a deliberative mindset, whereas typing induces an action orientation mindset in an Internet product search context, as predicted in H1. We conducted a study where participants were experimentally manipulated into performing a product search using either one of the search modalities (voicing vs. typing) on a mobile device, and would then choose between two different types of search ads (ads with a deliberation headline vs. ads with an action headline). If our theorizing is correct, then participants performing a voice search will be more likely to prefer ads with deliberative headlines over ads with action headlines. We predicted the opposite pattern of results for participants performing a typed search.

In addition to measuring their preference for the ads, we also measured individual keywords that participants entered in the search. Consistent with our theorizing, voice-induced search terms should be more about the general articulation of the consumer's problem or needs, and less single-brand specific (e.g., "Should I buy headphones or not?" "Pros and cons of running," "Top 10 brands for shoes"). In contrast, typing-induced search terms should be more about taking action and more brand or product-specific (e.g., "Nike Air Max 270," "Keurig Single Cup Machine," "Buy Headphones"). We predicted that voicing-induced search terms should be more comparison-focused, whereas typing-induced search terms should be more action-focused and contain a specific brand name.

### Design, participants, and procedure

We recruited 252 participants (60% females; $M_{age} = 35.45$ years, $SD = 10.80$) from MTurk for a nominal compensation. Prior to random assignment, all potential participants were asked to answer two screening questions (i.e., "Have you ever purchased products online in the past 12 months?" and "Are you familiar with the following products: headphones, coffee makers, shoes, and clothes?"). We used these product categories based on what consumers commonly shop for when they go online (Kinsella, 2018). Participants who answered "no" to the questions were screened out at the beginning of the study and did not continue. The survey in this study as well as subsequent studies were programmed such that it automatically detected participants who did not use a mobile device to take the study.

At the beginning of the survey, participants were told that the study would be about product searches on Google using their smartphones. Participants were then randomly assigned to one of the two search modality conditions (voice search vs. typed search) and completed four product searches (i.e., headphones, coffee makers, shoes, and clothes; the order of the product presentation was counterbalanced).

To manipulate search modality, we varied the search interface where participants were told to imagine that they would like to buy headphones, and that their task was to use Google search to search for products (see Web Appendix 2). In the voice search modality condition, participants were shown a Google search page along with a blinking microphone icon, and participants then voiced in the search keywords. In contrast, in the typed search modality condition, participants were shown a Google search page along with a blinking cursor on the search bar, and participants then typed in the search keywords. We inserted a blank text box beneath the search bar so that participants could type in the assigned keywords. The microphone icon blinked while the participant voiced in the search terms (voice search), and the cursor blinked while the participant typed in the search terms (typed search).

After participants voiced or typed in their desired search phrase(s), we presented two ads (deliberative vs. action oriented) to participants. The two ads were modeled after Google search ads in which we varied the headline and part of the ad description (see Web Appendix 3 for stimuli). For example, the headline of the deliberative ad facilitates the deliberation and comparison of product options: "Best Entertainment Headphones | Compare Your Choices." In contrast, the headline of the action-oriented ad facilitates the taking of action: "Best Entertainment Headphones | Get Yours Today." A separate pretest confirmed that these ads varied on action orientation (see Web Appendix 3). Participants then responded to the following measure: "Between the two ads, which one would you be more likely to click on?" In total, participants were asked to search for four different products and the order of ad presentation was counterbalanced across the four product categories.

Our dependent measure was ad choice, where we coded "1" if participants selected an ad with an action headline, and coded "0" if participants selected an ad with a deliberation headline. At the end of the study, participants provided the keywords they had inputted during the four product searches, answered some demographic questions, and were thanked for their participation.

### Results and discussion

**Attention check** Results showed that 17 participants did not provide search keywords relevant to the assigned products (e.g., "cat," "search," or "A"), hence we removed them from the main analysis. We also removed two participants who were 3 standard deviations away from the mean study

completion duration, indicating that they had stepped away from the experiment for a significant amount of time before the experiment had concluded. Thus, the final sample was 235 participants (voice; $N = 109$ vs. type; $N = 126$).

**Action ads** To test our prediction that consumers would be more likely to prefer an ad that aligns with their activated mindset (action-oriented vs. deliberation-oriented), we ran a multilevel mixed-effects logistic regression using choice of the ad as dependent variable and search modality (between-subject; 1 = typed search, 0 = voice search), product type (within-subject), and their interaction as predictors. We used a random intercept to control for repeated measures. Analysis revealed the predicted main effect of search modality ($b = .80$, $SE = .33$, Wald $\chi^2 = 5.85$, $p = .016$, Exp($b$) = 2.22), indicating that the likelihood of choosing ads with action headlines increased when participants performed a typed search ($M = 1.88$, $SD = 1.19$) compared to voice search ($M = 1.37$, $SD = 1.17$). The main effect of product type ($b = .04$, $SE = .08$, Wald $\chi^2 = .23$, $p = .63$) and the interaction between the search modality and product type ($b = .09$, $SE = .11$, Wald $\chi^2 = .64$, $p = .42$) were both insignificant. These results support our theorizing of the connection between search modality and a deliberative versus an action-oriented mindset.

**Action keywords** We also predicted that participants in the typed search modality condition would be more likely to generate keywords that are more action oriented and brand specific in comparison to participants in the voice search modality condition. In testing this prediction, we coded the keywords that participants had inputted via voicing or typing during the product search. Two research assistants coded the searched keywords by assigning a value (1 = action keyword, 0 = deliberative keyword) for each of the four product categories. Any discrepancy between the two coders was discussed and resolved. Examples of deliberative keywords for headphones are "what are the best headphones," "highly rated headphones," "which are top-selling headphones," and "reviews for best quality headphones," whereas examples of action keywords are "Sony Bluetooth headphones," "Beats wireless headphones," and "buy headphones online." We then summed the keyword count across four products. A higher count refers to the use of more action-oriented keywords and a lower count refers to the use of more deliberative keywords. A Poisson regression using action-oriented keyword count as the dependent variable and search modality (1 = typed search, 0 = voice search) as the predictor showed a significant main effect of modality ($b = .35$, $SE = .10$, 95% CI [.16, .54]; $\chi^2$ (1) = 12.80, $p < .001$, Exp($b$) = 1.42), such that participants in the typed search condition ($M = 2.20$, $SD = 1.33$) used more action-oriented keywords compared to those in the voice search condition ($M = 1.55$, $SD = 1.44$).

Together, our results supported H1, such that typing induces action-oriented cognition, whereas voicing induces deliberative cognition. We provided evidence that supported the hypothesis using two types of measures: ad preferences and the open-ended inputting of keywords in the search queries. With regards to the keywords inputted during search queries, our results show that voice search participants became more deliberative by searching for reviews of products (e.g., "reviews for best quality headphones") or by soliciting suggestions for products (e.g., "What are the best headphones?"). This echoes intuition from practitioners in the industry report, in which consumers were said to search with more question-like keywords when using voice (Digital Marketing Institute, 2018). In the next study, we tested whether the type of search modality influences purchase intentions.

## Study 3: Search modalities and purchase intentions

Study 3 tested the effect of search modalities on purchase intentions (H2). To increase the generalizability of our results, we selected coffee makers as the product category because they are one of the most popular products purchased online (Kinsella, 2018).

### Design, participants, and procedure

We recruited 250 participants (60% females; $M_{age} = 34.80$ years, $SD = 10.13$) from MTurk and paid them a nominal compensation. After participants answered the screening questions (i.e., have made online purchases in 12 months and are familiar with the product category), they were randomly assigned to one of the two conditions (voice search vs. typed search). Next, participants were told that the study is about evaluating a new mobile website, where they would be browsing a mobile website and would then answer some questions. To increase realism, we created an ostensibly real mobile store called allaboutcoffee.com, where participants can either voice in or type in the keywords to accomplish the product search.

Similar to Study 2, we experimentally manipulated search modality (see Web Appendix 4). In the voice search condition, participants were shown a picture of a mobile website with a microphone icon, and were then told to tap the microphone icon and voice in the words "coffee makers." In the typed search condition, participants were shown a picture of a mobile website with a keyboard, and then were told to type in the words "coffee makers" by typing characters on

the displayed virtual keyboard. In contrast to the previous study, we controlled for the search keywords ("coffee makers") in this study in order to avoid eliciting any differences that could emerge between the two modality conditions.

After participants have voiced in or typed in the keywords, we presented coffee makers from different brands to participants. After participants had voiced in or typed in the search keyword, they saw three products. Participants were allowed to view or not to view any of the three resulting products in more detail. If participants decided to view the product(s), we presented the product on a separate page. To strengthen the search modality manipulation, we asked participants to perform the product search one more time using the same keyword. After the input of the search keyword, we presented another three products to the participants (see Web Appendix 5).

Following the product search session, participants completed several measures. Our key dependent measure was purchase intention. On a 9-point scale, participants rated "How likely is it that you would purchase the coffee maker(s) you searched for?" (1 = not at all, 9 = extremely). At the end of the study, participants completed an attention check by providing the keywords they had inputted during product search, gave their demographic information, and were thanked for their participation.

### Results and discussion

**Attention check** Results showed that 16 participants did not provide the correct search keywords ("coffee makers"), hence we removed them from the main analysis. Just like in Study 2, we also removed two participants who were 3 standard deviations away from the mean study completion duration, indicating that they had stepped away from the experiment for a significant amount of time before the experiment had concluded. Thus, the final sample was 232 participants (voice; $N = 113$ vs. type; $N = 119$).

**Purchase intentions** Results showed that participants viewed at least one product from each product search session. Next, an independent-samples $t$-test on the purchase intention scale revealed a significant effect ($t(230) = 2.07$, $p = .040$, $d = .269$). Consistent with H2, participants in the typed search condition ($M = 6.03$, $SD = 2.04$) indicated higher purchase intentions compared to those in the voice search condition ($M = 5.49$, $SD = 1.98$).

Thus, results of Study 3 provided evidence that typed searching leads to higher purchase intentions compared to voice searching. Nevertheless, participants may have chosen to inspect different coffee makers that could potentially have influenced their purchase intentions. In the next study, we controlled for the displayed information, such that participants in both conditions saw exactly the same information. We also measured action orientation to provide process insights.

## Study 4: Measuring action orientation

In this study, we had three goals. The first goal was to replicate results in Study 3 with an improved procedure. The second goal was to measure action orientation and test whether it mediates the effect of search modalities on purchase intentions (H3). The third goal was to rule out effort as an alternative explanation. Because voice searching is a relatively new technology as compared to typed searching, consumers may potentially find it more effortful to use voice search, and hence could be less willing to purchase the searched products.

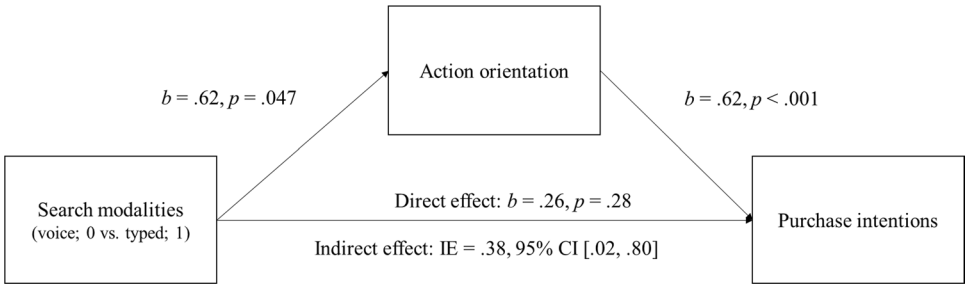
### Design, participants, and procedure

In a pre-registered study[2], 250 participants from MTurk were paid a small sum for completing the study. Ten participants did not complete the study and hence data was not recorded, yielding 240 participants in the analysis (50% females; $M_{age} = 37.54$ years, $SD = 9.31$). Participants answered the screening questions used in Study 3 and were randomly assigned to one of two search modality conditions (voice search vs. typed search). Participants were then told that the study was about evaluating a new mobile website called allaboutcoffee.com. In the voice search condition, participants read: "Please search for coffee makers by using your voice," and the instruction was presented along with a blinking microphone icon and a search bar (see Web Appendix 6). In the typed search condition, participants read: "Please search for coffee makers by using your fingers to type on the keyboard," and the instructions were presented along with a search interface showing a keyboard and a blinking cursor on the search bar (see Web Appendix 6). After participants have voiced in or typed in the keywords, we presented search results including 10 coffee makers in one page where the page displayed the product photo, product descriptions, and prices, controlling for star ratings (see Web Appendix 7). Unlike in Study 3, participants were not allowed to view any specific product information.

Our dependent measure was purchase intention. We measured purchase intention using an item with a 9-point scale similar to that in Study 3: "How likely is it that you would purchase the coffee maker(s) you searched for?" (1 = not at all, 9 = extremely), and a second item that read:

[2] Study pre-registration available at: https://osf.io/kxjfq/?view_only=8f297ffb189a40dcb7d5f10bd2a442e4

**Fig. 1** Mediation in Study 4




"On the slider bar, indicate how ready you are to purchase the coffee maker(s) you searched for." (1 = not at all, 100 = extremely).

Our mediation measure was action orientation. We measured the degree of action orientation using two 9-point items (adapted from Brandstätter & Frank, 2002): "During the product search journey, I am already thinking about how to get a coffee maker that I like as quickly as possible." and "I was very sure which coffee maker I should buy." (1 = strongly disagree, 9 = strongly agree). To rule out effort, we measured perceived effort (Bosmans et al., 2010) using two 9-point items: "How much energy did you spend when searching on the mobile web?" and "How much effort did you spend when searching on the mobile web?" (1 = not at all, 9 = very much). At the end of the study, participants provided the keywords they had inputted during product search, answered demographic questions, and were thanked for their participation.

## Results and discussions

**Attention check** We removed 28 participants who failed our attention checks as outlined in the pre-registration. Thus, the final sample consisted of 212 participants (voice; $N = 88$ vs. type; $N = 124$).

**Purchase intentions** An independent-samples $t$-test on the 9-point purchase intention scale revealed a significant effect ($t(210) = 2.11$, $p = .037$, $d = .291$). Replicating results in Study 3, participants in the typed search condition ($M = 6.45$, $SD = 2.08$) indicated higher purchase intentions compared to those in the voice search condition ($M = 5.81$, $SD = 2.35$). Also, an independent-samples $t$-test on the 100-point purchase intention scale revealed a significant effect ($t(210) = 2.11$, $p = .036$, $d = .294$). Participants in the typed search condition ($M = 64.03$, $SD = 25.74$) indicated higher purchase intentions compared to those in the voice search condition ($M = 55.98$, $SD = 29.58$). Thus, H2 was supported.

**Mediation analysis** An independent-samples $t$-test on the averaged action orientation index ($r = .60$) revealed a significant effect ($t(210) = 2.00$, $p = .046$, $d = .283$). Participants in the typed search condition ($M = 5.90$, $SD = 2.15$) indicated higher action orientation compared to those in the voice search condition ($M = 5.27$, $SD = 2.34$). We also tested the mechanism of action orientation using a mediation analysis (Hayes, 2018). The analysis yielded a significant indirect effect (IE = .38, $SE = .20$, 95% CI [.02, .80]), supporting H3. As depicted in Fig. 1, participants who performed a typed search, coded 1 (relative to voice search, coded 0) indicated higher action orientation ($b = .62$, $SE = .31$, $t(210) = 2.00$, $p = .047$), which in turn increased intentions to purchase the searched products ($b = .62$, $SE = .05$, $t(209) = 11.61$, $p < .001$). Notably, the direct effect of search modality on purchase intentions when including action orientation became nonsignificant ($b = .26$, $SE = .24$, $t(210) = 1.08$, $p = .28$). In addition, we tested a similar indirect effect on the 100-point purchase intention scale. The analysis yielded a significant indirect effect (IE = 4.65, $SE = 2.44$, 95% CI [.07, 9.65]), supporting H3.

**Effort** Some readers may speculate that the low purchase intention for voice search could have resulted from participants' higher perceived effort in performing voice searches (vs. typed searches) due to the relative unfamiliarity with the technology. An independent-samples $t$-test on the two 9-point items measuring effort ($r = .72$) revealed a nonsignificant effect ($t(210) = .13$, $p = .90$). Participants in the typed search condition ($M = 4.55$, $SD = 2.32$) indicated a similar level of effort compared to those in the voice search condition ($M = 4.51$, $SD = 2.34$). This rules out the alternative explanation that participants in the typed search condition showed higher action orientation and purchase intentions because they were more familiar with the search modality, compared to those in the voice search condition.

In summary, this study replicates the search modality effect that was observed in Study 3. Also, the study provided evidence of the underpinning role of action orientation in mediating the causal relationship between search modality and purchase intentions, and ruled out alternative explanations related to perceived effort (by measuring perceived effort) and differences-in-task (by controlling for keywords across conditions). We also note that in our study, participants in the voice search condition engaged in minimal clicking responses; however, simple, one-button clicking is different from our construct of typed search, in which a

participant typed complete words and phrases (thus activating a motor representation of multiple action sequences; Yang et al., 2009) into a search box. In the next study, we tested our hypothesis in a more controlled setting (a laboratory) to further enhance internal validity. Additionally, we directly manipulated action orientation using a deliberation versus implementation mindset priming in order to test the idea that action orientation underlies the effect of search modalities on purchase intentions.

## Study 5: Manipulate action orientation

In Study 5, we experimentally manipulate the participant's mindset before the product search is performed. Recall that we hypothesized that voice search induces a deliberation mindset, which then lowers consumers' purchase intentions. We also hypothesized that a typed search induces an action-oriented mindset, which then increases consumers' purchase intentions. Given our hypotheses, if we increase the degree of action orientation among voice search consumers, we should observe an increase in purchase intentions. Similarly, if we decrease the degree of action orientation among typed search consumers, we should observe a decrease in purchase intentions. This approach of experimentally manipulating mindset enables stronger causal claims with regards to the role of action orientation in the difference between search modalities.

We experimentally manipulated a deliberation versus an implementation mindset using the mindset theory of action phases literature (Fujita et al., 2007; Gollwitzer & Kinney, 1989). A deliberation mindset entails being undecided about an issue, whereas an implementation mindset entails being decided about an issue, and preparing for action (Freitas et al., 2004). Implementation is thus synonymous with action orientation. We predicted that priming an implementation mindset among voice search participants will increase purchase intentions because the implementation mindset will increase action orientation, which will neutralize any decrease in action orientation that would normally have occurred for voice search participants. In contrast, we predicted that priming a deliberation mindset among typed search participants will decrease purchase intentions because such priming will decrease action orientation, which will neutralize any increase in action orientation that would normally have occurred for typed search participants. In addition, we included a control condition in which we did not manipulate mindset, and we predicted that purchase intentions will be higher in the typed search condition compared to those in the voice search condition, replicating results we observed in the previous Studies 3-4.

### Design, participants, and procedure

We recruited 200 university students (66% females; $M$ = 20.87 years, $SD$ = 2.59) to participate in the study in exchange for extra class credit. This was the total number of students who attended the experimental session, and no one was excluded. We selected the product categories of clothing, bags, and shoes because they are commonly searched for among the participant demographic. The study had a 3 (mindset: control vs. implementation vs. deliberation) x 2 (search modality: voice search vs. typed search), between-subjects design.

Upon arrival at the lab, participants answered screening questions as used in the previous studies and then were randomly assigned into one of the six conditions. Before participants searched for products (in what was ostensibly an unrelated task), we experimentally manipulated mindset (Fujita et al., 2007; Gollwitzer & Kinney, 1989). Participants in the deliberation mindset condition were asked to write about their decision-making processes in the form of "Should I do X or not?" and then listed consequences that could result from making the decision and from not making the decision, as well as difficulties that they expected to encounter when implementing the decision. In contrast, participants in the implementation mindset condition were asked to name an intended project that they plan to achieve within the next three months, and then listed five important steps to implement the project, as well as the details of the execution plan for each of the five steps (see Web Appendix 8). Participants in the control condition did not write about anything. Note that we asked all participants to write on a piece of paper in order to prevent participants from typing in all conditions.

Following the mindset manipulation, participants were presented with an ostensibly separate task on product search. Participants were asked to search for shoes, bags, or clothes on the Amazon app using the digital tablet device provided by a research assistant. Just like in previous studies, we experimentally manipulated search modality by asking participants to either voice in or type in their search keywords (see Web Appendix 9). In the voice search condition, participants were told to voice in the keywords by speaking into the tablet once the microphone icon appeared on the screen. In the typed search condition, participants were told to type in the keywords by entering characters using the keyboard. Following the product search task, participants responded to dependent and mediation measures. Finally, participants completed other measures as in the previous studies and provided demographic information.

To measure purchase intentions, participants responded to the following scale on a paper questionnaire: "How likely is it that you would purchase the product(s) you searched for?" (1 = not at all, 9 = extremely). To measure participants'

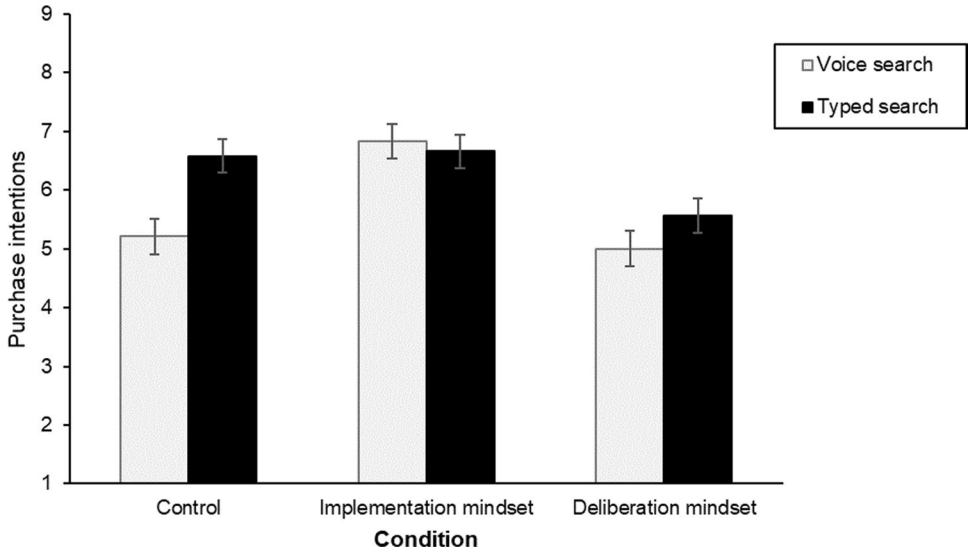



**Fig. 2** Interaction between search modalities and mindsets on purchase intentions in Study 5

action orientation, we improved our measure from Study 4 in order to achieve higher reliability using the following scales: "Right now, how ready/sure/confident do you feel to act on your decision?" (1 = not at all, 9 = very much; α = .88). To measure effort and energy spent, participants completed the same two 9-point items as in the previous studies ($r$ = .57).

## Results and discussion

**Manipulation check: priming** To ensure that our experimental manipulation of mindset induced the intended mindset, two independent research assistants reviewed the sentences that participants had written, following the procedure of Taylor and Gollwitzer (1995). All participants had chosen an appropriate topic and had completed the task appropriately.

**Purchase intentions** A two-way ANOVA revealed a significant main effect of search modality ($F$(1, 194) = 6.04, $p$ = .015, $\eta_p^2$ = .030) on purchase intentions, indicating that typed search participants are more likely to purchase one of the resulting products ($M_{typed}$ = 6.27, $SD$ = 1.69 vs. $M_{voice}$ = 5.66, $SD$ = 1.87). There was also a significant main effect of mindset ($F$(2, 194) = 12.03, $p$ < .001, $\eta_p^2$ = .110), indicating that an implementation mindset led to the highest purchase intentions ($M_{implementation}$ = 6.74, $SD$ = 1.58 vs. $M_{deliberation}$ = 5.31, $SD$ = 2.21 vs. $M_{control}$ = 5.89, $SD$ = 1.32). Most importantly, as predicted, these results were qualified by a significant interaction ($F$(2, 194) = 3.69, $p$ = .027, $\eta_p^2$ = .037; Fig. 2), indicating that the effect of search modalities varied as a function of the mindset manipulation. Next, we report means under each mindset condition. Under a control condition mindset, participants who performed a voice search showed lower purchase intentions ($M$ = 5.21, $SD$ = 1.19) than participants who performed a typed search ($M$ = 6.58, $SD$ = 1.08; $F$(1, 194) = 12.80, $p$ < .001, $\eta_p^2$ = .062), replicating the previous studies. Importantly, when we manipulated participants into an implementation mindset, voice search participants ($M$ = 6.83, $SD$ = 1.66) indicated similarly high purchase intentions as did typed search participants ($M$ = 6.66, $SD$ = 1.52; $F$ < 1). Likewise, when we manipulated participants into a deliberation mindset, the difference between voice search participants ($M$ = 5.00, $SD$ = 2.26) and typed search participants disappeared ($M$ = 5.56, $SD$ = 2.16; $F$(1, 194) = 1.73, $p$ = .19). In addition, a planned contrast between typed search participants under implementation mindset ($M$ = 6.66) and voice search participants under deliberative mindset ($M$ = 5.00) was significant ($t$(194) = 3.84, $p$ < .001).

**Action orientation** We performed a two-way ANOVA on the action orientation index. We observed a main effect of mindset on action orientation ($F$(2, 194) = 6.46, $p$ = .002, $\eta_p^2$ = .062), such that participants in the implementation mindset condition ($M$ = 5.70, $SD$ = 1.74) showed a higher action orientation than did those in the deliberation condition ($M$ = 4.58, $SD$ = 1.78) and those in the control condition ($M$ = 5.07, $SD$ = 1.66). More importantly, we also observed a significant interaction ($F$(2, 194) = 5.22, $p$ = .006, $\eta_p^2$ = .051) in the predicted direction, and these dovetailed with the pattern of purchase intentions. As depicted in Fig. 3, in the control condition, participants in the typed search condition ($M$ = 5.63, $SD$ = 1.77) showed higher action orientation than those in the voice search condition ($M$ = 4.52, $SD$ = 1.35; $F$(1, 194) = 8.27, $p$ = .004, $\eta_p^2$ = .041). However, the difference between typed search participants ($M$ = 5.61, $SD$ = 1.69) and voice search participants ($M$ = 5.79, $SD$ = 1.83) was not significant in the implementation mindset ($F$ < 1). Similarly, the difference between typed search participants ($M$ = 4.27, $SD$ = 1.93) and voice search participants ($M$ = 4.95, $SD$ = 1.53) was not significant in the deliberation

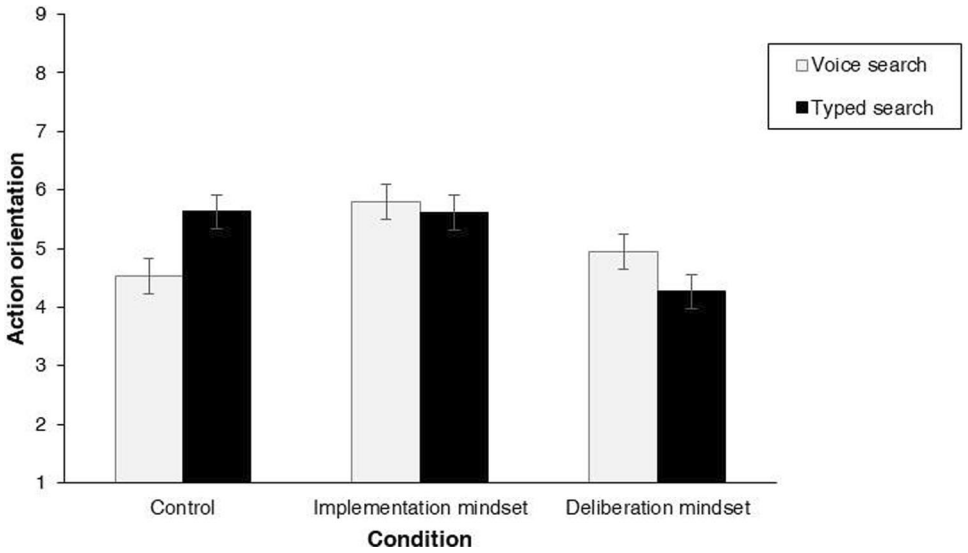



**Fig. 3** Interaction between search modalities and mindsets on action orientation in Study 5

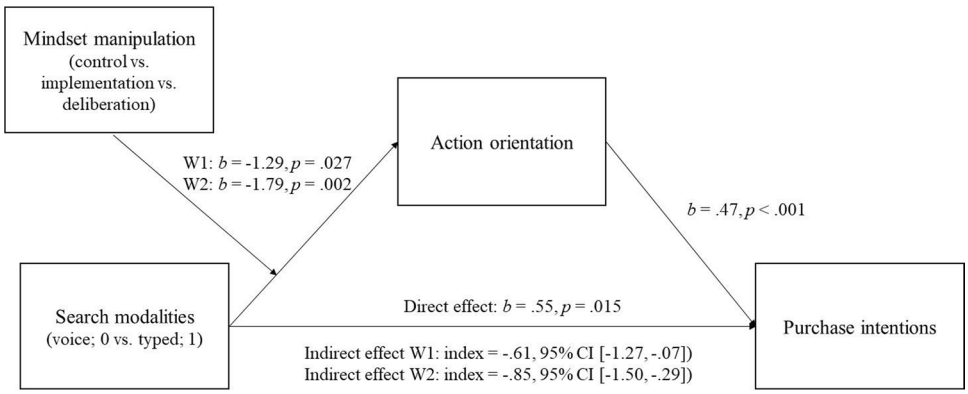



**Fig. 4** Moderated mediation in Study 5. *Note*. We created two dummy variables. W1 compared implementation (coded 1) and control condition (coded 0). W2 compared deliberation (coded 1) and control condition (coded 0)

mindset ($F(1, 194) = 2.47$, $p = .12$). In contrast, a two-way ANOVA on the effort index was not significant ($F(2, 194) = 1.13$, $p = .33$). Participants in the typed search condition ($M = 4.80$, $SD = 1.98$) perceived a similar level of effort as did participants in the voice search condition ($M = 5.15$, $SD = 1.98$). Thus, we ruled out effort as an alternative explanation.

**Moderated mediation analysis** We tested the full model of moderated mediation using a bootstrapping technique with 5,000 iterations (Hayes, 2018). Since our moderator is a multicategorical variable, we created two dummy variables (W1: implementation coded 1; W2: deliberation coded 1) with a control condition (coded 0) as a comparison group. As depicted in Fig. 4, search modality and mindset had a significant interaction on action orientation for W1 ($b = -1.29$, $SE = .58$, $t(194) = -2.23$, $p = .027$) and W2 ($b = -1.79$, $SE = .58$, $t(194) = -3.09$, $p = .002$). The first stage of the mediation model was moderated (search modalities ➔ action orientation). When we controlled for the interaction between the search modalities and the mindset factor, action orientation had a significant effect on purchase intentions (action orientation ➔ purchase intentions; $b = .47$, $SE = .06$, $t(197) = 7.49$, $p < .001$). When we controlled for action orientation, the direct effect was significant ($b = .55$, $SE = .22$, $t(197) = 2.45$, $p = .015$). Finally, consistent with our predictions, the analysis revealed a significant index of moderated mediation for W1 (index = -.61, SE = .31, 95% CI [-1.27, -.07]) and for W2 (index = -.85, SE = .31, 95% CI [-1.50, -.29]). More specifically, the indirect effect of search modalities on purchase intentions through action orientation was significant only when mindset was control condition ($b = .53$, $SE = .20$, 95% CI [.16 .97]), but not when mindset was implementation ($b = -.08$, $SE = .21$, 95% CI [-.53, .30]) or deliberation ($b = -.32$, $SE = .21$, 95% CI [-.76, .09]).

We acknowledge that the moderated mediation is partial and provide an explanation for this, given the full moderated mediation tested and observed in the previous Study 4. Together, Studies 4 and 5 provide support that mindset underlies the effect of search modalities on purchase intentions. In the next and final study, we tested our proposed effect by measuring purchase behavior, using an incentive-compatible study design.

## Study 6: Incentive compatible purchase behavior and immediacy of purchase

Study 6 measured real product purchase behavior. We predicted that typed search consumers (vs. voice search consumers), when navigating an ostensibly real online store, are more likely to actually purchase the product. In addition, we measured desire for immediacy of product purchase. Given that action orientation should expedite rather than delay when consumers desire to obtain the product, we predicted that typed search consumers (vs. voice search consumers) are more likely to express a higher desire for an expedited timeline to purchase the product.

Although Studies 4-5 demonstrate that search modality affects action orientation mindset, we conducted a pretest to provide further evidence of the causal relationship. Eighty-five participants on MTurk (49.4% females; $M_{age}$ = 39.27 years, $SD$ = 11.76) were randomly assigned to list at least one reason behind their use of either voice modality or type modality during an online product search. The total number of thoughts generated was 192 (voice; $N$ = 118 vs. type; $N$ = 74). Next, two independent judges ($r$ = .90) reviewed each thought and suggested four categorizations: (1) convenience (e.g., "more convenient," "easier"), (2) physical ability or inability to perform the search (e.g., "hands are not free to type," "I had no keyboard"), (3) accuracy of searching (e.g., "I don't know how to spell," "to narrow down my search"), and (4) others (e.g., "I want to hear Siri"). Participants in both conditions (voice; 49% vs. type; 50%) listed major reasons pertaining to convenience, and none of the thoughts were related to a deliberation/action orientation mindset (see Web Appendix 10). Thus, consumers were not choosing a corresponding search mode because they were already in that mindset (or wish to enter that mindset), and this means that real-world manipulations of search modality should impact mindset, and subsequently alter purchase intentions and behavior.

### Design, participants, and procedure

In a pre-registered study[3], 123 participants including students, staff, and visitors on a university campus (64% females; $M_{age}$ = 33.47 years, $SD$ = 10.25) were invited to participate in an online opportunity to purchase a real product (i.e., fruity jelly). These consumers were offered an opportunity to purchase the product at a realistic and attractive price. In measuring purchase behavior, we adopted the procedure from the literature (Lee et al., 2017) by endowing a nominal amount of money to participants that they can use to either purchase or not to purchase a real product.

Following the screening questions, participants were led to believe that the test was implemented by a real E-commerce company, and each participant received 25 cents to spend on a product purchase (or not spend it at all). Participants were then handed a mobile phone by a research assistant and were randomly assigned to one of the two search modality conditions (see Web Appendix 11). In the voice search condition, participants read: "Use your voice to say the phrase "Fruity Jelly." Tap the record button to start voicing and tap the same button to stop recording. Then, tap the submit button to continue to the next screen." The voice modality instructions were presented along with a microphone icon where participants had to speak the search keyword. In the typed search condition, participants read: "Use your mobile keyboard to type the phrase "Fruity Jelly" in the search bar. Then, tap the submit button to continue to the next screen." The type modality instructions were presented along with an empty text box where participants had to type the search keyword. Following the input of the search keyword, we presented the results to participants, which we modeled after the actual results on the E-commerce website. In the results page, participants saw pictures of fruity jelly from one brand in different flavors along with the product size information. A separate pretest from the same pool of participants confirmed that the resulting product search results as well as the price were realistic ("looks real"), and were attractive (see Web Appendix 12 for stimuli and pretest results).

Following the viewing of the results page, participants completed several measures. For the dependent measure, participants read: "The fruity jelly product you saw is 50 cents (per bag). How interested would you be to purchase one of the resulting fruity jelly?" Participants subsequently made their purchase using a binary scale (1 = Yes, I want to buy) or did not (0 = No, I don't want to buy). To simulate the real world in which consumers must part with some of their own real money, we set the actual price of the product higher than the endowment. If participants would like to purchase the product, they can use the endowed money plus their own money to buy the product. On the other hand, if participants did not want to buy, they can keep the endowed money. In addition, we measured when participants would like to receive the product using an ordinal scale: "When would you like to receive the product?" (1 = right now, 2 = tomorrow, 3 = this week, 4 = next week, 5 = this month, 6 = next three months, 7 = next six months, 8 = this year, 9 = have not decided yet). Next, participants completed the mediation measure using the same three 9-point scales from Study 5 (α = .92), effort and energy spent using the same two 9-point scales from Studies 4-5 ($r$ = .82),

[3] Study pre-registration available at: https://osf.io/z8qax/?view_only=6ab346c563e4449082031715e5e94b59

and demographic information. Finally, participants were thanked for their participation.

### Results and discussion

**Attention check** We excluded seven participants who indicated that they purchased the product but did not pay any money upon the completion of the survey. Thus, the final sample consisted of 116 participants (voice; $N = 55$ vs. type; $N = 61$). Note that our results remained significant without excluding any data.

**Product purchases** We performed a binary logistic regression with search modality (typed search coded 1; voice search coded 0) as a predictor and product purchase (1 = purchased, 0 = did not purchase) as the dependent variable. In line with H2, 63.9% of participants in the typed search condition (vs. 41.8% in the voice search condition) decided to purchase the product ($b = .90$, $SE = .38$, Wald $\chi^2 = 5.59$, $p = .018$, Exp($b$) = 2.47). Next, we used ordinal logistic regression to analyze our outcome of *desire for immediate purchase* because the outcome was categorical and ordered from now to farther in the future (e.g., "right now" coded 1, "tomorrow" coded 2, "this week" coded 3, …, "this year" coded 8, "have not decided yet" coded 9). An ordinal logistic regression revealed a significant effect of search modality on the desire for immediate purchase ($b = -.78$, $SE = .35$, Wald $\chi^2 = 4.88$, $p = .027$, Exp($b$) = 2.18), with participants who performed typed search indicating a significantly stronger desire to obtain the product immediately.

**Mediation analysis** As anticipated, participants in the typed search condition ($M = 6.36$, $SD = 2.73$) indicated higher action orientation than participants in the voice search condition ($M = 4.68$, $SD = 2.95$; $t(114) = 3.19$, $p = .002$, $d = .592$). Next, we tested an indirect effect of search modality (typed search, coded 1; voice search, coded 0) on product purchases via action orientation using a bootstrap technique with 5,000 iterations (Hayes, 2018). Supporting H3, the indirect effect was significant (IE: = .83, $SE = .33$, 95% CI [.30, 1.60]). Participants who performed a typed search (relative to voice search) indicated a higher action orientation ($b = 1.68$, $SE = .53$, $t(114) = 3.19$, $p = .002$), which in turn increased product purchases ($b = .50$, $SE = .09$, $z = 5.26$, $p < .001$). Notably, the direct effect of search modality on product purchases when including action orientation became nonsignificant ($b = .37$, $SE = .47$, $z = .79$, $p = .43$). In addition, we tested an indirect effect of search modality on desire for immediate purchase via action orientation using Baron and Kenny's approach (1986) as this enabled the use of ordinal logistic regression to obtain regression coefficients for a Sobel test. First, a linear regression revealed a significant pathway between search modality (typed search, coded 1; voice search, coded 0) and action orientation ($b = 1.68$, $SE = .53$, $t = 3.19$, $p = .002$). Second, an ordinal regression revealed a significant pathway between action orientation and desire for immediate purchase ($b = -.63$, $SE = .10$, Wald $\chi^2 = 42.75$, $p < .001$; Exp($b$) = .54). Finally, the effect of search modality on desire for immediate purchase, controlling for action orientation, was not significant ($b = -.16$, $SE = .41$, Wald $\chi^2 = .15$, $p = .69$). Accordingly, action orientation mediated the effect of search modality on the desire for immediate purchase (Sobel test: $z = -3.01$, $p = .003$). Finally, we did not observe any differences in effort between participants in the typed search condition ($M = 2.48$, $SD = 2.33$) and participants in the voice search condition ($M = 2.15$, $SD = 2.02$; $t(114) = .81$, $p = .42$).

In a field study with an incentive-compatible measurement of purchase behavior and a measure of consumer's desire for immediacy of product purchase, we found that a typed search modality made consumers become more action-oriented and hence made an actual purchase of a real product, and also showed a higher desire to receive the product sooner rather than consumers in the voice search modality. These results are consistent with findings observed in previous studies, and suggest that our findings are likely to be observed in the real world.

## General discussion

Search modalities on the Internet vary in terms of search interface (voice search vs. typed search). Due to the growth of digital technologies as well as the use of smartphones, managers of Internet search platforms and e-commerce businesses are increasingly adopting voice search (Dumaine, 2018). However, the results of our studies suggest that the voice search modality may elicit unintended consequences with regards to lowering consumers' intentions to purchase one of the resulting products that is generated by the search process (see Appendix 2 for summary of results). Our findings are thus important to companies that migrate consumers from typed search modality to voice search modality, and digital technology startups who are deciding on which search modality to build their consumer interface around.

### Theoretical contributions

The results of this research contribute to the literature on voice interface effects by studying the effect of using one's voice during a product search (i.e., saying a keyword for product search on Google search, Amazon app, or any online retailers). Most of the work in this stream investigates how consumers interact with a voice assistant (i.e., interacting with Alexa or Siri), and the trust

that consumers have for these assistants (Foehr & Germelmann, 2020; Moriuchi, 2019; Pagani et al., 2019). Our research sets a broader context that covers consumer behavior beyond interactions with anthropomorphic figures by examining the nonspecific impact of voicing in the search requests (vs. typing them). As a result, our findings can help our field understand the effects of voice technology on consumer behavior more broadly and fundamentally, and can be generalized to the use of voice technologies that only take voice input but does not anthropomorphically or vocally interact with the user. Building on this broader understanding of voice technology, future research can begin to explore the effect of voice technology in broader contexts, even the ones that voice assistants do not normally access (e.g., websites with more images, such as Pinterest).

We also add to the literature on the negative effects of voice-facilitated commerce on consumer decision making and marketing outcomes by examining a new dependent variable of purchase intention and a new psychological process of mindset. Research shows that presenting information to consumers in oral form (as opposed to written form) increases the cognitive difficulty of processing the presented information, which then delays consumer choice (Munz & Morwitz, 2019). The results of our research add to this literature by demonstrating a negative effect of voice search, such that the mere invocation of a consumer's voice can trigger a deliberation mindset, and this leads to lower purchase intentions. Building on this relationship, future research can begin to explore variables that could disconnect these links and eliminate this negative effect, such as adjusting the algorithms generating the search terms or vocal expression dimensions.

Finally, our findings contribute to the literature related to communication modalities. Research in this stream shows that communication modalities influence consumer behavior. For example, Klesse et al. (2015) show that expressing preferences of food orally involves less motor movement and hence lowers consumers' self-control by causing them to order more hedonic food. We demonstrate a counterintuitive effect by showing that oral expression versus typing expression during the product search process (even when holding information constant) can negatively influence purchase intentions (Study 4) and product purchase behavior (Study 6). Hence, our findings suggest that under certain conditions, the mindsets that are activated by the product search modalities can overcome the changes in self-control that would otherwise have been activated by the preference expression modalities. Building on this finding, future research can begin to examine the boundary conditions that make neural mechanisms (Klesse et al., 2015) versus our mindset-based mechanisms more potent in shifting consumer behavior, perhaps as a function of the nature of the task, such as the exposure to affectively rewarding products (King & Janiszewski, 2011).

## Managerial implications

From a marketing practitioner's standpoint, this research has important implications for online businesses and Internet search platforms. First, managers can strategically present messages that match the activated mindset of consumers who search by typing, which is likely to result in higher purchase intentions and purchase behavior. For example, search engine marketers may present search results with action-oriented headlines in the form of text ads (i.e., "Get yours today", "Fast shipping to your location", or "Express checkout & shipping"; see Study 2 stimuli). Alternatively, marketers of a mobile app or shopping website can come up with features or options that allow consumers to "check out" their product faster and more conveniently.

Counterintuitively, because there is a recent trend towards voice searching, this trend could benefit specific types of search ads on search engines. For example, our findings reveal the insight that search engine marketers who present a search ad with deliberative headlines would actually perform *better* than a search ad with action-oriented headlines among consumers who perform a voice search on Google, because deliberative headlines would be more attractive to consumers who vocalize. If this is true, then it increases the chances of consumers clicking on their ad, and their digital marketing metrics will improve as more users flock to their site. Firms should assess whether clicking on the ad is an important metric for digital companies that more than compensates for the negative consequences of lowered purchase intentions.

Our results suggest that companies or products with specific consumer interfaces that have already migrated to voice search should increase action orientation. Marketers using voice search technology could increase consumers' intentions to purchase a product by priming an implementation mindset (Study 5). In addition, marketers of a clothing company can design ads that prime consumers toward a higher action orientation mindset before consumers start a product search. For example, marketers can induce more action orientation among voice search consumers by designing an action-oriented ad such as a finger pointing at the product (Villarroel Ordenes et al., 2019), or by presenting an ad with a motion picture or dynamic word (Farace et al., 2020).

With regards to implications on consumer well-being, it is possible that some of the device-related addiction befalling consumers today (e.g., nonstop gaming, pornography) may be exacerbated by "feedback loops" triggered by the contiguous nature of typed product searches → consumption → further product searches that perpetuate consumption. Our findings suggest that a typed modality induces an

action orientation mindset, which may intensify the dopaminergic surge that fuels an incipient addiction. An action-oriented mindset, after all, induces consumers to continue searching for new online gaming rewards (or pornographic rewards), rather than stop consumption. In contrast to the typed modality, the voice modality activates oxytocinergic rather than dopaminergic pathways (Panksepp, 1998), so the government may regulate that these "vice" marketers (e.g., computer gaming, online gambling) provide a voice interface in order to reduce the intensification of the addiction feedback loop.

## Limitations and directions for future research

There are two limitations of this research that need to be acknowledged. First, the current research focuses on voice search performed via a search bar on smartphones (Studies 2, 3, 4, 6) and tablets (Study 5). However, consumers can also perform voice search for information online via voice assistants on smartphones (e.g., Apple Siri), on smart home devices (e.g., Google Home or Amazon Echo), or on other devices (e.g., Microsoft's assistant Cortana on a PC). Given that our scope for voice search covers consumer interfaces without an anthropomorphic figure, future research may study whether the negative effects of voice search could be mitigated by programming the voice assistant to adopt a narrow framing, or by using another intervention.

Second, our experimental manipulation of the voice search modality is, understandably, not entirely voice navigated. However, it is consistent with our theorizing of mere voicing and its consequence on mindset and purchase intentions (and behavior). We suspect that our search modality effect would be even stronger if participants were to use voice navigation throughout the study. Future research could replicate our findings by programming the studies with an "all voice" navigation in which the participant does not have to click at any point of the experiment. Nevertheless, the design of our experiments accurately reflects the real marketing ecology: online stores currently do not have an "all voice" navigation that extends all the way to the purchase process, because current voice technology is not accurate enough to capture credit card numbers with 100% accuracy, and because of privacy concerns with capturing voice information. Thus, our studies mirror the consumer experience in existing online stores, with a product search that can be performed either by voice or by typing, and with the final checkout process consummated by clicking.

Our findings suggest fruitful avenues for future research that could further help researchers as well as marketers understand and exploit the potential of voice technology (see Table 2). First, future research could focus on testing new variables that increase action orientation among voice search consumers. One intervention could be to test whether inducing voice searches with more narrowly framed keywords would increase action orientation, and hence lead to more purchases. Digital marketers can induce a "narrow framing" effect by providing autocompleted narrow search terms such as "a hotel with a nice beach view in a specific city" rather than broad search terms such as "search for any hotels" (Lambrecht & Tucker, 2013). Our research suggests that combining narrow (rather than broad) framing with a typing interface may result in faster purchase decisions in contexts where the consumer has a moderate or high readiness to buy a product.

Future research could also focus on examining different dimensions of vocal expression that marketers could control to see how that would affect consumers' purchase intentions. For example, researchers could test whether marketers could increase action orientation among voice search consumers by priming vocal pitch (high rather than low) just before the consumer performs the voice search. The literature suggests that a high vocal pitch indicates a higher readiness for action (Chen et al., 2013; Locke, 2017), whereas vocal stutters or vocal staccato patterns may indicate that the consumer only wishes to deliberate (Sares et al., 2020), and is not remotely interested in purchasing at this time. Researchers and digital marketers can prime high vocal pitch by endowing a higher vocal pitch to voice assistants when consumers search for products. This higher vocal pitch may stimulate consumers' mirror neurons and activate consumer mimicry (Chartrand & Lakin, 2013), which could then activate action orientation that leads to a higher likelihood to purchase products.

Another angle via which researchers could expand our finding is to explore different types of websites and test how the type of website interacts with modality in affecting revenues. The current research studied E-commerce websites; hence, a voice interface appears to have a *negative* influence on a marketer's revenue. However, not all websites rely on purchases to generate revenues. The revenue from some websites comes from selling advertising slots (and other indirect commission fees) from third parties based on their viewership and importantly, the amount of time that each consumer spends viewing product options on the site. This type of website may not be *negatively* impacted by a voice interface. Future research could test whether the type of website (E-commerce vs. Curation) may interact with cognitive mindsets and influence the marketer's revenues in surprising ways. For example, Pinterest is a curation website that is arguably most well-suited for facilitating deliberation (e.g., "Pin" or save favorites to compare different furniture options), whereas Amazon is an E-commerce website that facilitates the taking of action (e.g., make product purchase). Because Pinterest is a digital corkboard whose value is a function of how well it facilitates deliberation, a managerial decision by Pinterest to introduce navigating the site via voice inputs may attract more users to the platform and

**Table 2** Suggested directions for future research

| Variable | Future research question | Prediction | Managerial implications |
|---|---|---|---|
| Search term (narrow vs. broad) | Does inducing voice searches with more narrowly framed terms increase action orientation and purchases? | Since narrow (vs. broad) search term is more brand/product specific (Lambrecht & Tucker, 2013), we predict that adopting a narrow search term could increase action orientation and purchase intentions. | Digital marketers aiming to increase sales should encourage consumers to use narrow search terms by providing more specific searches via autocompletion (e.g., search for a hotel with a nice beach view in Hawaii). |
| Vocal pitch (high vs. low) | Does higher vocal tone increase action orientation and purchase intention? | High vocal pitch indicates a higher readiness for action (Chen et al., 2013; Locke, 2017), whereas low vocal pitch (e.g., fragmented and staccato vocalization) signals deliberation (Sares et al., 2020). We predict that priming high vocal pitch during search queries should increase action orientation and purchase intentions. | Digital marketers can prime a high vocal pitch by adjusting voice assistant's pitch when consumers search for products. This would induce consumers to mirror the high pitch, thus increasing action orientation in the context of product purchase. |
| Type of website (e-commerce vs. curation) | Does the type of website moderate the effect of search modalities on attractiveness of website (number of site visitors)? | Compared to e-commerce websites, curation websites (e.g., Pinterest) focus on deliberation rather than purchase. We predict that adding a voice interface will make curation websites more attractive, because of the match between the consumer's mindset and modality. | Curation websites that integrate voice navigation will attract more visitors to their websites or mobile app (i.e., increase the number of daily active users, increase the number of minutes participants spend on the website or mobile app) |
| Degree of deliberativeness (extreme vs. moderate) | Does the degree of deliberativeness moderate the effect of search modalities on action orientation and choice? | When consumers are under extreme deliberation (e.g., use voice search for movies on Netflix), we predict that providing authoritative consumer reviews would increase action orientation and speed up choice. | Digital marketers should identify the degree of deliberativeness and then provide relevant information to help the consumer decide (e.g., Roger and Ebert movie reviews) in order to increase action orientation and choice selection. |
| Self-control (vice vs. virtue) | Do search modalities influence self-control? | Inducing consumers to vocalize improves self-control through deliberation. Hence, consumers performing a voice search should be more likely to choose virtue over vice products. | Regulators of "vice" products may require voice, rather than typed, product searches for products that are addictive (e.g., online gambling, cigarettes, alcohol), akin to installing "mirrors" to prevent shoplifting. |

increase the amount of time that each consumer spends on the platform deliberating amongst options.

As the Internet of Things (IoT) expands into more homes (Hoffman & Novak, 2018), many consumers now own smart televisions, and they can either voice in or type on the remote control when searching for shows. For example, the Fire TV stick encourages movie searches using voice commands throughout the search process, which could lead to an intensifying degree of deliberation (vs. moderate if voice commands are only used to search for the movie). Voice searches may lead to more indecision regarding which pay-per-view product to purchase, implying that marketers (e.g., Netflix, Roku) may want to integrate decisive, authoritative reviews into the user interface to help the consumer decide (e.g., Roger and Ebert movie reviews that clearly recommend a particular movie with 5 stars). Future research could test whether the insertion of reviews and "star ratings" after a voice interaction with product options could ameliorate the indecision that arise from voice-induced deliberation.

Finally, future research could test whether voice search consumers would be more likely to purchase virtue over vice products. Since voice searches lead to more cognitive deliberation, it is plausible that consumers could avoid choosing harmful products if vocalization is induced. At the public policy level, the government may also consider requiring the online sales of vice products (e.g., online gambling, cigarettes, alcohol) to have a voice interface, because the voice interface would increase cognitive deliberation that may limit the consumption of products that would be harmful. This marketing intervention could have a similar effect as installing mirrors in department stores to prevent shoplifting via an increase in consumer self-awareness and deliberation. Hearing one's own voice could be the auditory equivalent of seeing one's own reflection in the mirror in increasing the salience of the self, hence promoting virtuous behavior. Together, our research shows that search modality influences consumers' mindsets, which impact purchase intentions and actual behavior, and stimulates further research on this understudied yet increasingly relevant topic of voice technology.

## Appendix 1

Figure 5

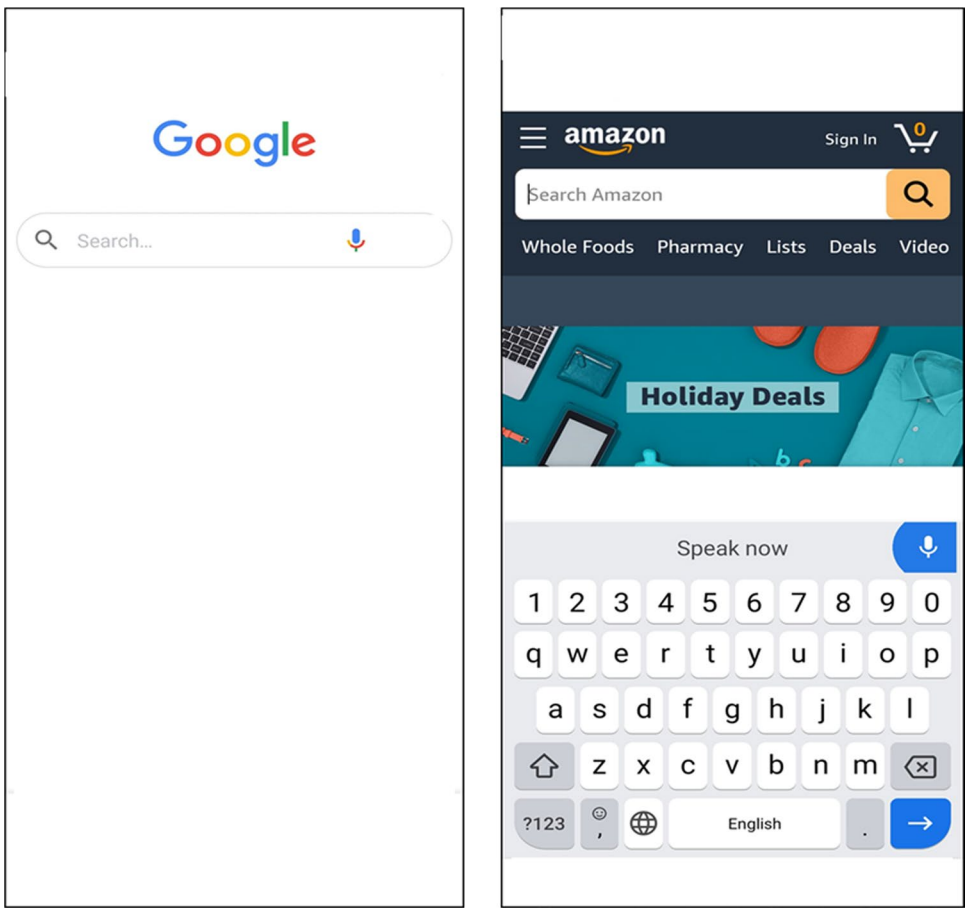



**Fig. 5** Examples of search modalities in the marketplace. *Note*. When browsing on a Google website, a consumer can perform a search either by entering characters on the search bar using keyboards (typed search modality) or by speaking into the device using a microphone feature (voice search modality). Similarly, a consumer can perform either a typed search or a voice search on the Amazon website

## Appendix 2

Table 3

**Table 3** Summary of results

| Study | Type of study | Data source | Sample size | Measured MED and DV | Main finding | |
|---|---|---|---|---|---|---|
| | | | | | Voice search | Typed search |
| Study 2 | Online experiment | MTurk | 235 (out of 252 initial) voice; $N = 109$ vs. type; $N = 126$ | Action ads (choice) | 1.37 (1.17) | 1.88 (1.19) |
| | | | | Action keywords (count) | 1.55 (1.44) | 2.20 (1.33) |
| Study 3 | Online experiment | MTurk | 232 (out of 250 initial) voice; $N = 113$ vs. type; $N = 119$ | Purchase intention | 5.49 (1.98) | 6.03 (2.04) |
| Study 4 | Online experiment | MTurk | 212 (out of 250 initial) voice; $N = 88$ vs. type; $N = 124$ | Action orientation | 5.27 (2.34) | 5.90 (2.15) |
| | | | | Purchase intention (9-pt) | 5.81 (2.35) | 6.45 (2.08) |
| | | | | Purchase intention (100-pt) | 55.98 (29.58) | 64.03 (25.74) |
| Study 5 | Lab experiment | Students | 76 under control mindset voice; $N = 38$ vs. type; $N = 38$ | Action orientation | 4.52 (1.35) | 5.63 (1.77) |
| | | | | Purchase intention | 5.21 (1.19) | 6.58 (1.08) |
| | | | 62 under implementation mindset voice; $N = 30$ vs. type; $N = 32$ | Action orientation | 5.79 (1.83) | 5.61 (1.69) |
| | | | | Purchase intention | 6.83 (1.66) | 6.66 (1.52) |
| | | | 62 under deliberative mindset voice; $N = 28$ vs. type; $N = 34$ | Action orientation | 4.95 (1.53) | 4.27 (1.93) |
| | | | | Purchase intention | 5.00 (2.26) | 5.56 (2.16) |
| Study 6 | Incentive-compatible field experiment | Students staff visitors | 116 (out of 123 initial) voice; $N = 55$ vs. type; $N = 61$ | Action orientation | 4.68 (2.95) | 6.36 (2.73) |
| | | | | Product purchase (choice) | 41.80% | 63.90% |
| | | | | Desire for immediate purchase | 36.11% | 63.89% |

Means are reported in the table and standard deviations are reported in parentheses. Items are measured on a 9-point scale except where a different scale is mentioned. In Study 6, we performed an ordinal logistic regression, and the search modality conditions were coded as follows: 0 = voice search, 1 = typed search. The desire for immediate purchase dependent variable was coded from 1 = right now to 9 = have not yet decided. Percentages indicate option shares for the "right now" desire to receive the product within each search modality condition. Differences in sample sizes across studies stem from (1) randomization and (2) slight variations in the number of participants we filtered out due to their failing vital attention and manipulation checks. Cleaning processes were consistent across all studies and were decided in advance

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