Curvy Digital Marketing Designs: Virtual Elements with Rounded Shapes Enhance Online Click-Through Rates

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Forthcoming, *Journal of Consumer Research*

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ABSTRACT

With the growing prevalence of digital platforms for online shopping, advertising, and marketing activities in general, it is imperative to better understand how designs of virtual elements on digital interfaces influence click behavior. Websites and online advertisements contain virtual elements such as call-to-action buttons, images, and logos. This research examines how curved versus sharp angled shapes of virtual elements in online ads and on websites influence click-through rate (CTR) outcomes. The findings of a series of studies, including three field experiments and an eye tracking study, show that website and online ad elements in curved (vs. sharp angled) shapes generate higher CTR. Process evidence suggests that curved (vs. sharp angled) digital elements enhance visual appeal, leading to approach motivation and greater CTR. In terms of practical implications, the findings of this research have strong relevance for designing online ads and website interfaces and for digital marketing strategies. Specifically, digital marketers desiring higher click rates would benefit from having more curved (than sharp angled) virtual elements on websites and in online ads.

Keywords: digital marketing, call-to-action (CTA) buttons, click-through rates (CTR), virtual element shapes, online ads, designs

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Over the last couple of decades, marketing practices have undergone fundamental paradigm shifts, especially with consumers moving a significant portion of their spending to digital channels and online shopping (Baluch 2023; Lamberton and Stephen 2016; Swaminathan et al. 2020). Along with the growth in e-commerce, there has been a phenomenal growth in online advertising, such as through search engine marketing (e.g., Google Ads), social media advertising (e.g., on Facebook), and video ads (e.g., on YouTube) (Graham 2023). Current estimates value the global digital advertising spending in 2023 at over $625 billion, which is about 67% of the total expenditure on media ads; forecast models are predicting that by 2026, digital ad spending will be over $835 billion, which will be more than 72% of all media ad spending (Oberlo 2023; Statista 2023). In light of these statistics, it is especially important and relevant to examine how different design elements in online settings (in ads and on websites) might influence consumer click behavior.

One major difference between physical and digital settings is that physical stores can manipulate a wide range of sensory cues. In contrast, the options are more limited for digital environments. Future technologies might allow the availability of olfactory and haptic cues for online environments (McNulty 2022). However, currently, the primary utilizable sensory cues are visual in nature. Moreover, even when other sensory modalities are made available, the visual mode plays a critical role, especially since visual cues tend to dominate and influence other sensory cues (Hoegg and Alba 2007).

This research focuses on the design aspects of websites and online ad design elements like buttons and images. More specifically, we examine the impact of different shapes of virtual elements, including clickable images, non-clickable images, and call-to-action (CTA) buttons, on

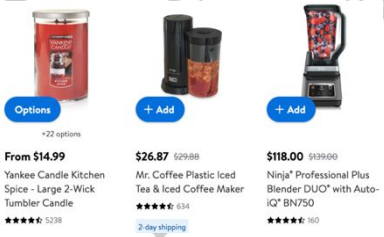
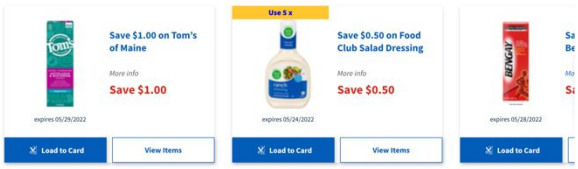
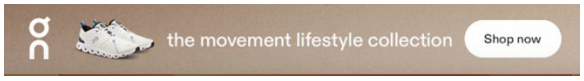
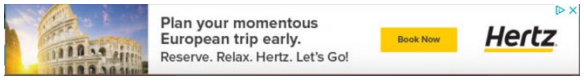
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consumer click behavior. The CTA usually invites or encourages an action, such as "shop now," "add," "view items" or "book now"; see web appendices A-B and table 1 for examples.

On some websites, CTA elements are part of the text. However, as illustrated in web appendices A and B (and in table 1), in most cases, CTA elements can be seen in the shape of a button (Leaning 2019). In online stores and on landing pages, CTA buttons enable the consumer to make a selection and go to the next step in the purchase journey. In the context of digital ads, the entire ad is usually clickable such that a click anywhere on the ad would redirect the user to the landing page. In sum, we investigate how the shapes of virtual elements for online ads and websites might influence click-through rate (CTR) outcomes.

TABLE 1: MARKETPLACE EXAMPLES OF CURVED AND SHARP ANGLED CTA ELEMENTS

	Curved CTA Elements	Sharp Angled CTA Elements
Websites	*Walmart* 	*Food City* 
Online Ads	*On* 	*Hertz* 

To ensure ecological validity, we focus on curved versus sharp angled shapes since these are the two shapes primarily used for CTA buttons and website elements. A curved element is

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one with rounded edges, while sharp angled elements are rectangular or square with 90-degree angles for the edges. See web appendices A and B (and also table 1) for examples of curved and sharp angled elements currently used in the marketplace. There is variance in the shapes of virtual elements on e-commerce sites, even within the same industry. For example, in September 2023, while the websites of *Accor Hotels*, *Walmart*, and *Aerie* had curved virtual elements, *Hyatt Hotels*, *Food City*, and *Express* had sharp angled virtual elements. Web appendix B and table 1 show examples of how element shapes may also differ for online ads. Little is known about how these seemingly random design choices influence consumer click actions.

Interestingly, companies keep changing the shapes of their web elements at random intervals. Some companies engage in A/B testing to make more informed design decisions (see the *USA Today* example in web appendix B, among the other ad examples). These illustrative examples highlight that focusing on how the shape of web elements (curved vs. sharp angled) influences click likelihood has strong practical relevance.

Building on research in visual aesthetics and behavioral reactions, we hypothesize that consumers are more likely to click an online ad or a CTA button when the virtual elements are curved (vs. sharp angled). We tested our hypotheses with the help of 16 experiments (eight reported in the main text and eight reported in the web appendix), including three studies conducted in the field and an eye tracking study. Next, we develop our theoretical framework.

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THEORETICAL BACKGROUND

Even though consumers are increasingly using digital interfaces, there has been no academic research on the shapes of virtual elements and their implications for click behavior for

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online ads or websites. Prior work on online behavior has focused on such topics as reactions (e.g., "like" buttons) and follows in social media environments (Bhattacharya and Bose 2020; Kim, Sung, and Kang 2014; Naylor, Lamberton, and West 2012). Studies have also examined how using certain colors (e.g., blue) in web elements influences the trustworthiness and aesthetic ratings of e-commerce sites (Nissen 2020). Additionally, research has examined how the characteristics of web and banner ad design elements, such as their color and interactivity, influence click-through rates (see Kim, Kang, and Lee 2021 for a detailed literature review).

While research has investigated the links between certain website design elements and outcomes related to perceptions (Garett et al. 2016; Kim et al. 2021; Nissen 2020), very few studies have examined actual click behavior. In digital marketing, arguably, the two most important metrics are the click-through rates for online ads and call-to-action buttons on websites, as well as subsequent conversion rates because these are directly linked to revenue outcomes (Crowe 2019). Studies have examined how flow and banner ad elements (e.g., interactivity and animation) influence click-through rates (McDowell, Wilson, and Kile 2016). However, to the best of our knowledge, no study has investigated the effects of website and online ad element shapes on click behaviors. We propose that the visual appeal of curved versus sharp angled elements would differ, which in turn will induce approach-avoidance motivations, subsequently influencing click likelihood. We elaborate on these next.

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Visual Perceptions for Curved versus Sharp Angled Elements

While all our sensory systems are employed in forming judgments of the environment around us (Biswas, Szocs, and Abell 2019), the visual system plays an especially dominant role

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in forming impressions of encountered stimuli (Hoegg and Alba 2007). Moreover, these visual judgments are formed very quickly and often non-consciously (Willis and Todorov 2006). Hence, visual features related to size, direction, and contour influence judgments (Ghoshal, Boatwright, and Malika 2016; Bar, Neta, and Linz 2006).

Research from different aspects of design has established that humans generally prefer curvy and rounded shapes (Bertamini et al. 2016), with smooth curvature being linked with the concept of beauty (Bertamini and Sinico 2021). Curves and curvy objects tend to be associated with friendliness, softness, harmony, and approachability, while sharp angles and sharp angled objects induce associations related to toughness, hardness, and threats (Bar and Neta 2006; Becker et al. 2011; Gomez-Puerto, Munar, and Nadal 2016; Jiang et al. 2015; Zhang, Feick, and Price 2006; Westerman et al. 2012). That is, curvy objects prompt positive affective feelings related to approachability and friendliness, while sharp angled objects induce negative feelings.

Extant research has explored different avenues to explain why individuals prefer curvy shapes over angular ones. Most arguments are based on the idea that the positive reaction to rounded (over sharp) shapes is automatic and implicit and does not require conscious shape processing. Bar and Neta (2006) argue that disliking sharp shapes stems from a feeling of threat. Bertamini et al. (2016), however, suggest that a positive response to curved objects may be rooted in liking and preference per se, which is not necessarily rooted in fear response to angular shapes. Wang, Zhang, and Jiang (2022), who investigated an association of rounded (sharp angled) shapes with healthy (unhealthy) foods, explain their effects by measuring a sense of "feeling right". Specifically, this automatic preference for rounded stimuli may be explained by an evolutionary preference for round shapes (such as the face of a baby) over sharp shapes (a cactus, a tooth) (Bar and Neta 2006; Ghoshal et al. 2016). In addition, individuals demonstrate

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preferences for safety and softness and smiling faces over angry ones, which are often symbolized by sharp angles in the chin or eyebrows (Aronoff, Woike, and Hyman 1992).

We propose that consumers will exhibit an automatic positive affective reaction to curved (i.e., rounded) shapes, whether they are non-clickable elements or placed with the intent to generate actionable responses (i.e., clicks). This positive reaction toward predominantly curved (vs. sharp angled) shapes should lead to perceptions of favorable visual appeal and attractiveness (e.g., Friedenberg and Bertamini 2015; Westerman et al. 2012). Accordingly, we propose that curved (vs. sharp angled) digital elements would be perceived as visually more appealing (i.e., more aesthetically pleasing), given people's inherent favorable evaluation of curved shapes over sharp angled ones.

An argument can be made, though, for a competing hypothesis. Research (e.g., Larson, Aronoff, and Stearns 2007) suggests that sharp angled objects more readily grab visual attention since such shapes are perceived as threatening or risk-related. In marketing practice, visual stimuli that grab attention are often more effective (Smith 2022). Therefore, if the attention-grabbing aspect holds, then sharp angled web elements should generate higher clicks than curved ones. While it is possible that sharp angled virtual elements are more attention-grabbing, we make the case for an opposite pattern of effects in terms of clicks. We propose that in the context of digital elements, curved (vs. sharp angled) web elements should lead to higher click likelihood due to greater visual appeal inducing approach motivation.

Next, we elaborate on the conceptualizations for the direct mediation effect of visual appeal on click behavior (i.e., element shape → visual appeal → CTR) as well the serial mediation effects of visual appeal influencing approach-avoidance motivation and subsequently CTR (i.e., element shape → visual appeal → approach-avoidance → CTR).

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Visual Appeal, Approach-Avoidance Motivation, and Click Likelihood

Visual appeal is associated with the perceived aesthetics of a stimulus (Longstreet, Valacich, and Wells 2021). When a stimulus is perceived as visually attractive (i.e., aesthetically pleasing), the eyes and the related visual system automatically gaze toward that stimulus (Berridge 2009). Accordingly, we propose that curved (vs. sharp angled) web and online ad elements would receive greater visual attention. This is because paying attention to visually appealing objects has rewarding benefits (Aharon et al. 2001). Such objects tend to be more desirable and have higher perceived reward value (Lemay Jr., Clark, and Greenberg 2010). Visually attractive objects have been linked to greater visual attention and higher purchase intentions (Orth and Crouch 2014). In the context of online behavior, several virtual elements compete to attract the consumer's attention. Therefore, any element that gets gaze revisits would have a higher chance of getting clicked or chosen. If, as conceptualized, curved (vs. sharp angled) web elements are visually more appealing, they will receive greater visual attention, which in turn would enhance click-through rates (CTR).

While visual appeal can have a direct mediating effect on click behavior, there can be serial mediation effects with approach-avoidance motivation included in the model, especially for clickable elements (such as CTA buttons). Approach motivation is defined as the direction of behavior toward desirable stimuli, while avoidance motivation is the direction of behavior away from undesirable stimuli (Elliot 2006). For instance, moving the hand/finger (or the mouse cursor) toward a clickable element for the purpose of clicking it would be a form of approach motivation behavior. While visual appeal and the approach-avoidance framework are

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conceptually distinct, studies have demonstrated that visually appealing cues tend to activate approach-oriented behaviors. For example, research in child development has demonstrated that even newborns and infants get visually drawn toward attractive stimuli (Slater et al. 1998, 2001). Neuroscience research also highlights how visually appealing (unappealing) stimuli induce an approach (avoidance) motivation (Corr and McNaughton 2012).

Moreover, a visually appealing stimulus inducing an approach motivation reduces the breadth of attention, leading to a greater focus on the relevant item (Gable and Harmon-Jones 2008). In addition, in social interaction contexts, people prefer closer proximity to stimuli they perceive as visually more (vs. less) attractive (Burgoon and Jones 1976; Niesta, Elliot, and Feltman 2010). Approach motivations are related to physical movements such that individuals who are motivated by approach are more likely to engage in motions that bring them closer to the stimulus they find desirable (Seibt et al. 2008). In digital marketing, where translating visual attention into consumer action and conversion is of critical importance, we speculate that the role of approach-avoidance becomes especially relevant when it comes to taking action for clickable elements like CTA buttons.

To summarize, since curved (vs. sharp angled) virtual elements are perceived as visually more appealing, they will receive greater visual attention, manifesting in higher click likelihood. While we believe this mediation effect of visual appeal would hold across different contexts, we also hypothesize a serial mediation effect involving visual appeal and approach-avoidance motivation, which becomes especially relevant for CTA buttons. Formally stated:

H1 (main effect)**:** An online ad/website with curved (vs. sharp angled) elements gets higher click-through rates.

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H2 (two-step process)**:** An online ad/website with curved (vs. sharp angled) elements has higher visual appeal, leading to greater approach motivation, which in turn leads to higher click-through rates.

H3 (one-step process)**:** An online ad/website with curved (vs. sharp angled) elements has higher visual appeal, leading to higher click-through rates.

OVERVIEW OF STUDIES

Sixteen experiments, including three field studies and an eye tracking study, tested our hypotheses. Eight of these experiments are reported in the main text, and eight are reported in the web appendix. See table 2 for an overview of all the studies.

For all our lab (Prolific) studies reported in the main text, we aimed for 50+ (200+) participants per condition, consistent with current practices (Melzner and Raghubir 2023; Yang and Hsee 2022). Seven of the studies (1, 3, 6a, 6b, and 7 in the main text, and the studies reported in web appendices D and E) were preregistered, and all data files are available at OSF (https://osf.io/x9wg6/?view_only=6850950eda0e421396b49df6c33b1c61).

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TABLE 2: OVERVIEW AND SUMMARY OF STUDIES

Study	Type of Study	Dependent Variable	Study Findings
1	Google Ads field experiment	CTR (real click behavior)	Higher CTR for digital ads with curved (vs. sharp-angled) elements (H1).
2	Field experiment at e-commerce site	CTR (real click behavior)	Higher CTR for e-commerce website with curved (vs. sharp-angled) elements (H1).

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	Web appendix C reports the findings from another field experiment with CTR (H1).		
3	Lab experiment	CTR (real click behavior)	Participants are more likely to click a link when the CTA button is curved (vs. sharp angled) (H1).
	Web appendix D provides a replication of study 3		
4	Lab experiment	Number of items selected (real click behavior)	More items are selected when web elements are curved (vs. sharp angled) (H1).
5	Prolific Experiment	Click likelihood	Curved (vs. sharp angled) elements enhance visual appeal, which increases approach motivation, leading to higher click likelihood (H2 and H3).
	Web appendix E provides a preregistered direct test of H3, and web appendices F and G provide replications of this study. Web appendices G and H report studies conducted to rule out alternative explanations.		
6a	Prolific Experiment	Click likelihood	Approach-avoidance motivation framing moderates the effect of curved (vs. sharp angled) element shape on click likelihood. There is a higher click likelihood for a curved CTA button when it is paired with approach (vs. avoidance) language (H4).
6b	Lab experiment	CTR (real click behavior)	Higher CTR for curved (sharp angled) CTA button for approach (avoidance) motivation (H4).
	Web appendix I examines the moderating effect of individual traits related to approach motivation.		
7	Eye tracking experiment	Visual attention	Higher visual gaze and gaze revisits for curved (vs. sharp angled) virtual elements.

STUDY 1: GOOGLE ADS FIELD STUDY

We conducted a display ad campaign with the Google Ads platform to test consumer click likelihood for curved versus sharp angled shaped ad elements. This Google Ads field experiment was conducted in collaboration with a restaurant in a major US city. Google Ads reports the number of impressions generated by the ad and the number of clicks, allowing us to calculate the resulting click-through rate (which is total clicks divided by the number of impressions). This experiment was preregistered (https://aspredicted.org/3j4xt.pdf).

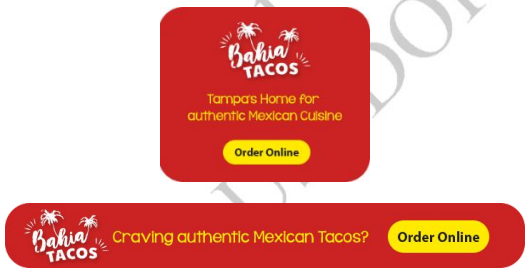
Procedure

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In collaboration with the restaurant management, we set up the campaign for a duration of ten days with a daily budget of $20, for an overall campaign budget of $200. These types of Google Ads experiments are always scheduled for a specific time and cannot be extended once they have started. The ads were shown to a target audience within a specific geographic area (metro area) where the restaurant is located. Additional targeting included food-related interests. Members of the target audience were randomly shown one of two image variations: A curved ad with a curved CTA button (either rectangle or leaderboard banner format) or a sharp angled ad with a sharp button (also provided to Google as a rectangle or banner format). Two different ad formats were used (rectangle in 300x250 px and leaderboard banner in 728x90 px) to ensure that the ads could be placed on many potential websites that are part of the Google Display Network; see table 3 for smaller images and web appendix J for larger images. We used the Google Ads experiment function, with an even budget split between the curved and sharp angled conditions. Google Ads uses cookie splits to ensure that users see only one experimental condition's stimulus; that is, no individual would be exposed to both a curved ad and a sharp angled ad.

TABLE 3: STUDY 1 STIMULI

Curved	Sharp Angled
	

Results and Discussion

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The Google ads campaign generated 945 clicks and 148,826 views for a total spent budget of $192.82. The Google algorithm spent $92.90 for the curved ad condition and $99.92 for the sharp angled ad condition, for an even budget split, based on Google's algorithm. The curved ads received 65,495 impressions, while the sharp angled ads received 83,331 impressions. The curved (sharp angled) ads generated 466 (479) clicks. Consistent with hypothesis 1, the click-through rate (calculated as clicks divided by impressions) was higher for the curved ads (CTR_{curved} = .71%, CTR_{sharp}= .57%, $\chi^2 = 10.86$, $p < .001$).

Overall, the observed click-through rate in this study is slightly better than the average marketplace CTR rate, which is around .35% for display ads (Rechberg 2021). In sum, the results of this study showed that for online ads, click rates are higher when the ad has visual elements in curved (vs. sharp angled) shapes.

We would like to acknowledge that A/B testing on advertising platforms such as Google Ads or Meta Ads is developed for practitioners, with a strong focus on ad efficiency. Therefore, these ad management platforms have algorithms that prioritize ads that will generate lower cost-per-click metrics in the bidding algorithm. These, in turn, can lead to misinterpretations of the causal effects since the assignment of consumers to ads is not randomized (see Braun et al. 2023, for details). We acknowledge this shortcoming of study 1 and accordingly mitigated this limitation by conducting additional studies in different settings (such as on an e-commerce site in study 2, a hotel website in web appendix C, and lab studies with actual click behavior).

STUDY 2: FIELD EXPERIMENT AT E-COMMERCE SITE

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The purpose of study 2 was to demonstrate the effects of the shapes of website elements (curved vs. sharp angled) on click behavior at an e-commerce site. This study was conducted in collaboration with the management of a services e-commerce business that organized virtual events. For the experiment, we changed the website element shapes on the company's homepage and used the testing platform *Google Optimize* to perform the test. (*Google Optimize* was a conversion optimization tool provided by Google to test different website versions.)

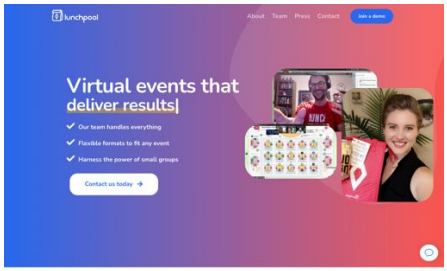
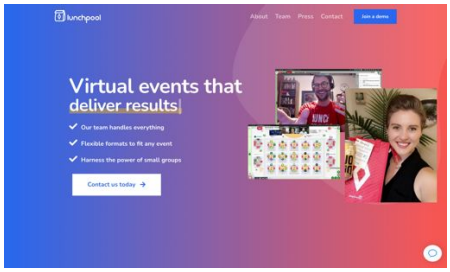
Procedure

The study was conducted on the company's homepage as an A/B split test. As the company was in the process of redesigning its website, they were willing to change major website elements for the duration of our study. The original website utilized some rounded elements in combination with sharp angled images. For the experiment, we created one version with curved shapes (images and CTA buttons) and one version with sharp angled elements (see table 4 for the smaller images and web appendix K for larger images). For the duration of the study (which was conducted over three weeks), about 50% of website traffic was directed to the homepage showing curved shapes, and the other 50% was directed to the homepage showing sharp angled shapes. Similar to other A/B testing tools, Google Optimize ensures that individual users would be exposed to only one of the experimental conditions. Both conditions were distributed evenly across sessions and days. The website had two primary actionable CTA buttons on the website. Clicks on either one of the visible buttons on the homepage ("Join a demo" and "Contact us today") were counted for computing the click-through rates (i.e., button clicks out of total visits).

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TABLE 4: STUDY 2 STIMULI

Curved Elements	Sharp Angled Elements
	

Results and Discussion

Over the three weeks, the website generated 919 visits. For the "curved elements" condition, there were 474 visits; for the "sharp angled elements" condition, there were 445 visits. For the "curved" condition, 53 visitors clicked on the button(s), resulting in a conversion rate of 11.18%. For the "sharp angled" condition, 32 visitors clicked on the button(s), resulting in a conversion rate of 7.19%. Consistent with hypothesis 1, the conversion rate was higher when the web element shapes were curved (vs. sharp angled) (11.18% vs. 7.19%; $\chi^2 = 4.35$, $p = .037$).

The results of this study indicate that websites with curved web elements (such as images and buttons) generate higher conversion rates through clicks. While study 1 tested the effects of element shapes for online ads, study 2 demonstrated similar effects with clicking on a website's CTA buttons. In studies 1 and 2, all the critical website elements (CTA buttons and non-CTA images) were manipulated. Web appendix C reports the findings of a field study conducted at a hotel chain's website, with only the CTA button changed.

We acknowledge that A/B testing has certain shortcomings. Specifically, by utilizing Google Ads and Google Optimize, we rely on the Google algorithms for performing the tests.

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However, we conducted our own analyses based on the raw data. To ensure the robustness of our effect, we also conducted a series of controlled lab studies, many with consequential click behaviors.

STUDY 3: EFFECTS OF BUTTON SHAPE ON CLICKS IN LAB SETTING

While studies 1 and 2 showed the effects of web element shapes on click behavior in the field, study 3 demonstrated the main effect of web element shapes on consequential click behavior in a controlled lab environment. This study was preregistered (https://aspredicted.org/5746s.pdf).

Procedure

Volunteering undergraduate students from two sections of introductory marketing classes arrived in the lab to participate in a series of studies that were unrelated to this research. Toward the end of the session, after completing the other surveys, participants were told that they had successfully completed the studies they had signed up for and had already received the extra credit points. They were then invited to an optional survey, and it was emphasized that participation in this survey was fully optional, and they could leave if they wished (see table 5 for a brief overview and web appendix L for details on the procedure).

The experiment had a two-cell between-subjects design, with participants randomly seeing either a curved or a sharp angled button for taking the optional survey (see table 5 below). The Qualtrics buttons for survey submission or moving to the next page were disabled so that

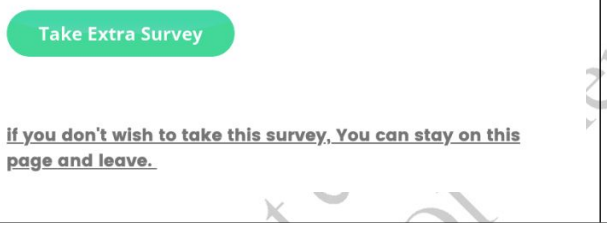
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participants would not see any competing shapes on the survey page. Clicking on the button led participants to a separate (optional) survey. One hundred and four students (48% female; M_{age} = 21) were given the opportunity to participate in this optional survey; the demographic information was obtained from a previous survey in the sequence.

Participants who decided to skip the optional survey left the lab after this. Those who opted to click on the survey were taken to another survey that was unrelated to this research. All participants who clicked the button completed the additional survey. The key dependent variable was the click rate on the button for taking the optional survey (i.e., the number of participants who clicked on the curved or sharp button out of the total number of participants accessing the survey). Since additional time and effort are needed to complete any additional survey, this task made the decision outcome consequential.

TABLE 5: STUDY 3 STIMULI

Curved	Sharp Angled
	

Results and Discussion

Fifty-four participants saw the curved button, and 50 participants saw the sharp angled button. In the curved button condition, 41 participants volunteered to take the extra survey. In the sharp angled button condition, 26 participants volunteered for the extra survey. Consistent with hypothesis 1, there was a higher click-through rate when the button was curved (vs. sharp angled) (CTR_{curved} = 75.93% vs. CTR_{sharp} = 52.00%; $\chi^2 = 6.48$, $p = .01$). Another preregistered

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study (reported in web appendix D) replicated this finding in a different context. Next, study 4 broadens the generalizability of the phenomenon.

STUDY 4: NUMBER OF ITEMS CHOSEN

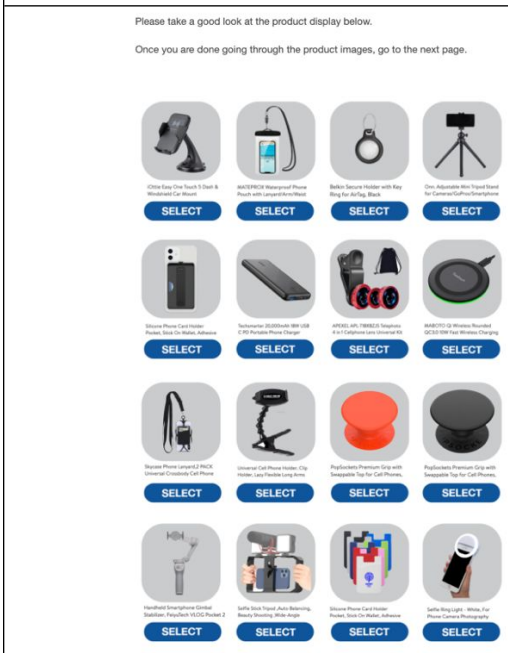
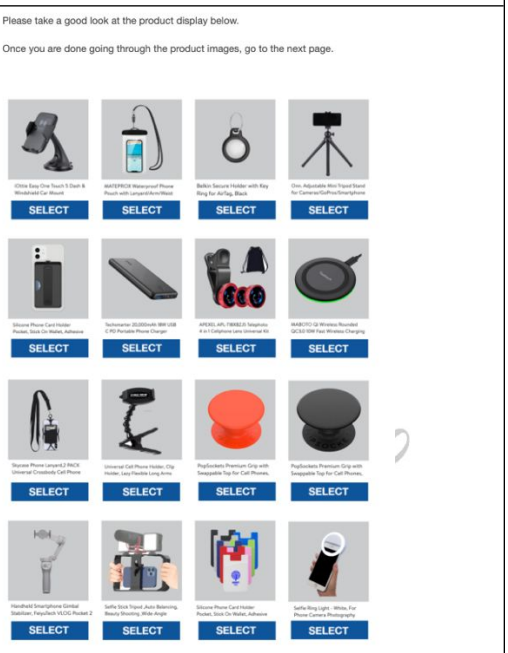
While studies 1-3 examined clicks for online ads or action buttons, study 4 broadened the context and examined the effects of virtual element shapes on number of items clicked for purchase. If, as conceptualized, curved (vs. sharp angled) elements induce approach motivation, then this should lead to opting for a higher number of items for purchase when the elements on a website are predominantly curved (vs. sharp angled). We tested this in study 4.

Procedure

We invited 200 students from a large US university's subject pool to participate in an online study. One hundred eighty-four students volunteered to participate in this research in exchange for course credit (42% female, $M_{age} = 21$). Participants were shown a product overview grid with smartphone accessories (see table 6). Participants were randomly assigned to one of two conditions: all product images were curved (with a curved "select" button underneath) or sharp angled (with a sharp angled "select" button). Participants were instructed to select all the items they would be interested in purchasing if they were shopping on this website. We used the heatmap feature in Qualtrics that allows participants to select (that is, click on) predefined areas on an embedded image. Each product was provided with a defined area. The dependent variable was the count data for clicks on each of the product images.

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TABLE 6: STUDY 4 STIMULI

Curved Elements	Sharp Angled Elements
	

Results and Discussion

A Poisson log-linear regression for the count data (e.g., Biswas et al. 2023) revealed a significant main effect, with participants selecting a higher number of items when the web elements were curved (vs. sharp angled) (M_{curved} = 3.47 vs. M_{sharp} = 2.76; Wald χ^2 = 7.34, p = .007). The goodness of fit for deviance (value/df) was 1.17. The main effect remained unchanged when excluding the ten participants who did not click on any item (M_{curved} = 3.75 vs. M_{sharp} = 2.85; Wald χ^2 = 10.60, p = .001). The results of this study again demonstrate greater click likelihood for virtual elements when they are curved versus sharp angled. Next, study 5 provides process evidence through a test of mediation.

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STUDY 5: PROCESS EVIDENCE THROUGH TEST OF MEDIATION

Study 5 tested hypotheses 2 and 3 by examining the serial mediation path of curved (vs. sharp angled) element shape influencing visual appeal, which in turn influences approach motivation, which subsequently leads to higher click likelihood.

Procedure

This study had two between-subjects conditions (curved ad shapes vs. sharp angled ad shapes). Five hundred Prolific workers (45% female, M_{age} = 36) participated in this study for monetary compensation.

TABLE 7: STUDY 5 STIMULI

Curved	Sharp Angled
	

Participants were randomly assigned to one of the ads (curved vs. sharp angled); see table 7. They were asked to indicate the visual appeal of the ad using two items ("This ad is attractive", "This ad is aesthetically pleasing", 1= strongly disagree and 7 = strongly agree, r = .86; adapted from Sevilla and Meyer 2020). We measured approach-avoidance motivation using two items based on prior research (Velasco et al. 2016); participants were told: "From the following word-pairs, please indicate which best match the ad design:" (1 = retreat/escape, 7 = advance/seek; r = .67); a higher (lower) value signifies approach (avoidance) motivation. Click

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likelihood was measured by asking: "If you were planning to order some food, and you come across this ad, how likely would you be to click on the "order online" button?" (1= not at all likely, 7 = very likely). The sequential order of the three variables (visual appeal, approach-avoidance motivation, and click likelihood) was randomized in the survey.

We also tested if the mediators (visual appeal and approach-avoidance orientation) and the DV (click likelihood) are distinctively different variables (Pieters 2017). A principal component factor analysis of all the mediator and DV measures confirmed the different dimensions of the measures, with the different constructs loading highly on unique components; see table 8 for details.

TABLE 8: FACTOR LOADINGS AFTER VARIMAX ROTATION

Item	Component		
	1	2	3
Visual Appeal Measures			
"This ad is attractive"	**.93**	.09	.24
"This ad is aesthetically pleasing"	**.94**	.08	.21
Approach-Avoidance Measures			
"Retreat – Advance"	.07	**.90**	.15
"Escape – Seek"	.08	**.92**	.01
Click Likelihood Measure	.34	.12	**.93**

Results

Main effects. As hypothesized, the curved (vs. sharp angled) ad led to higher click likelihood (M_{curved} = 4.18 [SD = 1.62] vs. M_{sharp} = 3.58 [SD = 1.76]; $F(1, 498) = 15.36$, $p < .001$, $\eta_p^2 = .03$) and more favorable visual appeal (M_{curved} = 4.67 [SD = 1.32] vs. M_{sharp} = 4.16 [SD = 1.44]; $F(1, 498) = 17.09$, $p < .001$, $\eta_p^2 = .03$). The direct effect of ad shape on approach

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motivation was not significant (M_{curved} = 4.32 [SD = 1.52] vs. M_{sharp} = 4.26 [SD = 1.50]; $F(1, 498) = .21$, $p = .65$, $\eta_p^2 = .00$).

Serial mediation tests. We conducted a serial mediation analysis with PROCESS Model 6 (Preacher and Hayes 2008; Hayes 2017), with "curved" coded as 2 and "sharp angled" coded as 1. Ad shape had a significant effect on visual appeal (B = .5107, SE = .1235; $t(498) = 4.13$, $p < .001$; CI_{95}: [.2680, .7534]), which in turn had a significant effect on approach motivation (B = .2031, SE = .0482; $t(497) = 4.21$, $p < .001$; CI_{95}: [.1084, .2979]), which subsequently influenced click likelihood (B = .1487, SE = .0425; $t(496) = 3.50$, $p < .001$; CI_{95}: [.0651, .2322]). There was an overall significant serial mediation for the "ad shape → visual appeal → approach → click" effect (B = .0154, BootSE = .0071, CI_{95}: [.0044, .0320]). This is consistent with hypothesis 2. For a serial mediation test with the visual appeal and approach variables sequentially reversed (i.e., ad shape → approach → visual appeal → click), there was no significant effect for this reversed sequence of the mediators (Model 6; B = .0066, BootSE = .0154, CI_{95}: [-.0230, .0389]).

Mediation tests. Ad shape had a significant effect on visual appeal (B = .5107, SE = .1235; $t(498) = 4.13$, $p < .001$; CI_{95}: [.2680, .7534]), which in turn had a significant effect on click likelihood (B = .6616, SE = .0462; $t(497) = 14.31$, $p < .001$; CI_{95}: [.5708, .7524]). There was an overall significant "ad shape → visual appeal → click" mediation effect (Model 4; B = .3379, BootSE = .0864, CI_{95}: [.1744, .5109]), consistent with hypothesis 3. The "ad shape → approach → click" mediation path was not significant (Model 4; B = -.0063, BootSE = .0212, CI_{95}: [-.0504, .0356]).

Discussion

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The findings of this study provide empirical support for hypotheses 2 and 3. Specifically, there are significant mediation (ad shape → visual appeal → click) and serial mediation (ad shape → visual appeal → approach → click) effects. Interestingly, the simpler mediation model (ad shape → visual appeal → click) has a similar R^2 value and relatively higher F-statistics for the model summary effects for click likelihood compared to the serial mediation model (ad shape → visual appeal → approach → click) ($R^2 = .3130$; $F(2, 497) = 113.24$, $p < .001$ vs. $R^2 = .3296$; $F(3, 496) = 81.28$, $p < .001$). Overall, this study demonstrates that consistent with our conceptualization, curved (vs. sharp angled) ads lead to more favorable visual appeal, which induces an approach motivation, which leads to higher click likelihood. Moreover, visual appeal also influences click likelihood as a standalone mediator.

We conducted a preregistered study (https://aspredicted.org/9d7ek.pdf) that tested hypothesis 3; this study is reported in web appendix E. The results of this study showed that curved (vs. sharp angled) web elements lead to more favorable visual appeal, which in turn enhances click likelihood.

While we hypothesize the role of visual appeal as the mediator for the effects of online ad/website element shapes (curved vs. sharp angled) on click likelihood, alternative processes can predict similar outcomes. For example, curved objects and figures are often marketed more to women, while sharp angled objects are targeted toward men (Ghoshal et al. 2016). Studies have also shown preferences of females for rounded objects (Munroe, Munroe, and Lansky 1976) and a general perception of rounded products as being more feminine (van Tilburg et al. 2015). Similarly, feminine qualities are preferable and perceived to be more attractive (Oh, Grant-Villegas, and Todorov 2020). Hence, one could argue that curved buttons may be perceived as more feminine, which can influence click likelihood. We examine (and rule out)

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this alternative process in web appendix study G. We also examine and rule out the role of participants' gender as having any influence; see web appendix P.

Another alternative explanation is related to the realism and uniqueness of the CTA button. The sharp angled button may look more realistic or stereotypical of a button design, which can influence attractiveness perceptions (Martindale and Moore 1988). On the other hand, a curved button may be more distinctive, unique, or creative and be perceived as a less common shape, which can lead to increased attention (Warlop and Alba 2004; Jeck et al. 2019). Three studies reported in the web appendix (see web appendices G and H) rule out these possible alternative processes, such as perceived femininity, uniqueness, and realism, among others. Next, study 6a examines the effects of a managerially relevant variable related to approach-avoidance motivation framing.

STUDY 6A: MODERATING EFFECT OF APPROACH-AVOIDANCE MESSAGE FRAMING

E-commerce sites often have language on their action buttons that are framed as approach motivated (e.g., "opt in," "more info," "buy now") or framed as avoidance motivated (e.g., "opt out," "decline"). We examined this practically relevant phenomenon in study 6a by manipulating the language on the action buttons being approach or avoidance motivated.

We propose a moderating effect of approach-avoidance motivation. Specifically, we conceptualized that curved (vs. sharp angled) elements induce higher approach motivation due to the higher visual appeal. Hence, for approach motivation messages, curved (vs. sharp angled) elements should lead to higher clicks. This should attenuate in the case of avoidance motivation

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messages since sharp angles are more closely aligned with avoidance (Bertamini et al. 2016). Accordingly, we hypothesize a moderating effect of approach-avoidance motivation. Formally stated:

H4: For approach motivation messages, an online ad/website with curved (vs. sharp angled) elements gets higher click-through rates. For avoidance motivation, this effect attenuates.

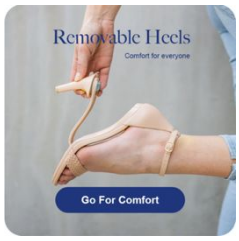
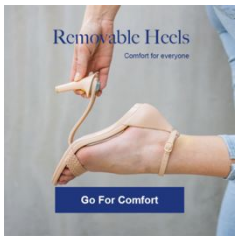
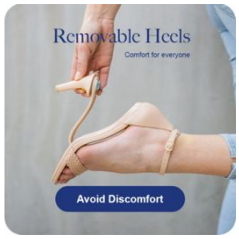
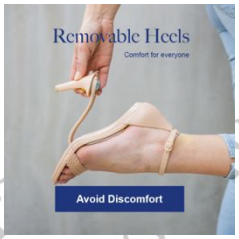
Procedure

We tested hypothesis 4 in study 6a by framing the same message of opting for a comfortable shoe in approach or avoidance language. This 2 (element shape: curved vs. sharp angled) X 2 (message framing: approach vs. avoidance) between-subjects experiment was preregistered (https://aspredicted.org/zt8vx.pdf). Ladies' shoes with detachable heels were used as the product. Given the target market for these shoes, and consistent with our preregistration, we recruited 30-50-year-old female participants on Prolific (N = 800; M_{age} = 39). For the first factor, participants saw a digital ad image with curved or sharp angled elements. For the second factor, the phrase "Go For Comfort" (approach framing) or "Avoid Discomfort" (avoidance framing) was inserted in the ad. See table 9 for the stimuli images.

The dependent variable of click likelihood was captured by asking: "How likely would you be to click anywhere in the ad above to learn more about the offer?" (1 = not at all likely, 7 = very likely). As a manipulation check, participants were asked: "How would you describe the ad image in terms of its shape ranging from being sharp angled to being curvy?" (1 = very sharp angled, 7 = very curvy).

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TABLE 9: STUDY 6A STIMULI

	Curved Elements	Sharp Angled Elements
Approach Framing		
Avoidance Framing		

Results

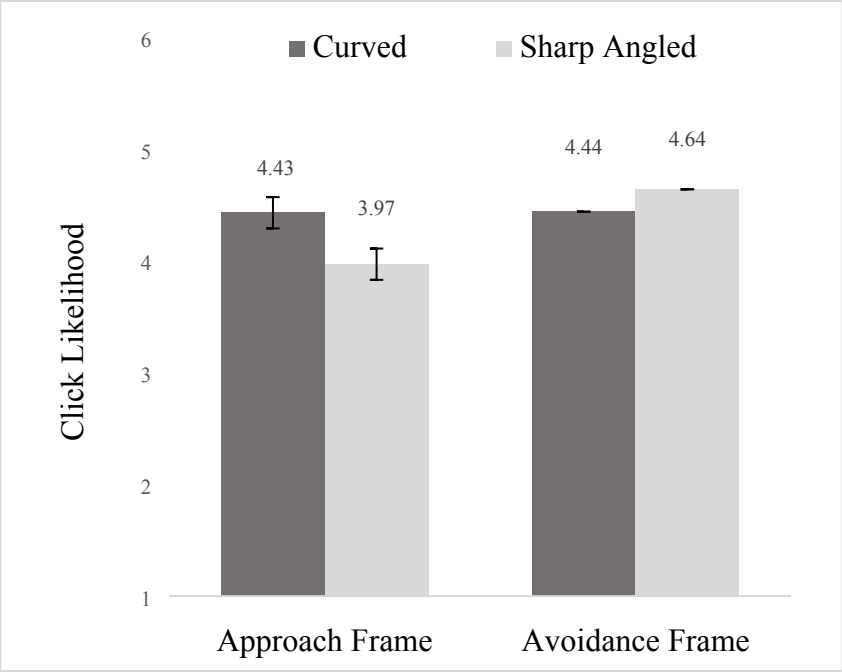
For the manipulation check, as expected, the ad image with curved (vs. sharp angled) elements was perceived as being curvier (M_{curved} = 5.00 [SD = 1.10] vs. M_{sharp} = 4.42 [SD = 1.34]; $F(1, 798) = 44.293$, $p < .001$, $\eta_p^2 = .05$).

There was a 2 (element shape) X 2 (approach-avoidance framing) interaction effect on click likelihood ($F(1, 796) = 5.29$, $p = .02$, $\eta_p^2 = .01$). Follow-up tests show that when the ad message was framed as approach motivated, the image with curved (vs. sharp angled) elements led to higher click likelihood (M_{curved} = 4.43 [SD = 2.04] vs. M_{sharp} = 3.97 [SD = 2.11]; $F(1, 796) = 5.21$, $p = .02$, $\eta_p^2 = .01$). This effect got attenuated when the ad message was framed as avoidance motivated (M_{curved} = 4.44 [SD = 1.94] vs. M_{sharp} = 4.64 [SD = 1.97]; $F(1, 796) = .94$, $p = .33$, $\eta_p^2 = .001$). There were no differences between the curved-approach, curved-avoidance, and sharp-avoidance framing (all p's > .29) but all of these were significantly higher than the

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sharp-approach (all *p*'s < .03); see Figure 1 for a graphical representation of the cell means. This suggests that sharp angled elements are incompatible with an approach framed message and more compatible with an avoidance framed message. These findings provide evidence in support of hypothesis 4.

FIGURE 1: STUDY 6A RESULTS



Discussion

Study 6a demonstrates that the main effect for curved versus sharp angled elements holds when an ad message is framed as approach motivated, with this effect attenuating when the ad message is framed as avoidance motivated. While in the approach motivated conditions, curved elements lead to higher click likelihood than the sharp angled button, there were no differences between the sharp angled and curved buttons in the avoidance motivation conditions. In fact, the mean click likelihood for both button shapes in the avoidance motivation conditions was

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relatively high. One possibility for this could be the phenomenon that negative frames or attributes (e.g., "discomfort") can have a stronger influence on overall attention and interest than positive frames or attributes (e.g., "comfort") (e.g., Ito et al. 1998).

Additionally, the way message framing influences behaviors is dependent on the context (Rothman and Salovey 1997). It is possible that in the context of shoes, avoiding discomfort is a strong enough motivation to override potential effects of element shapes; this might explain the relatively high click likelihood values for the "Avoid Discomfort" conditions. Next, study 6b examines the moderating effect of approach-avoidance motivated message framing in a different context and with a different manipulation of approach and avoidance.

STUDY 6B: APPROACH-AVOIDANCE MOTIVATION AND CLICKS

This study examined the effect of approach-avoidance messages using a different setting than that used in study 6a. As in study 6a, we expect the main effect of curved (vs. sharp angled) elements to lead to higher click likelihood to hold when a message is framed as approach motivated, with this effect getting attenuated when the message is framed as avoidance motivated. This study manipulated approach-avoidance motivation in a different way than what was done in study 6a; that is, by showing two buttons simultaneously with different wordings instead of framing the same message in approach or avoidance language.

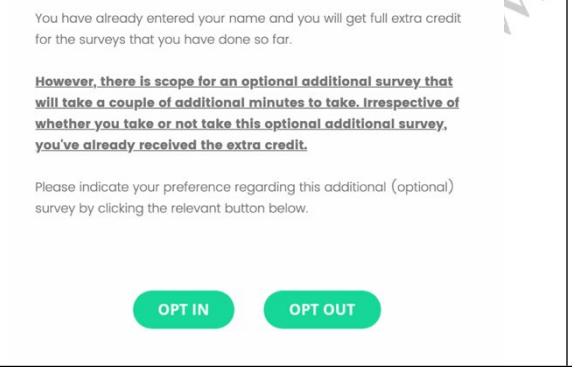
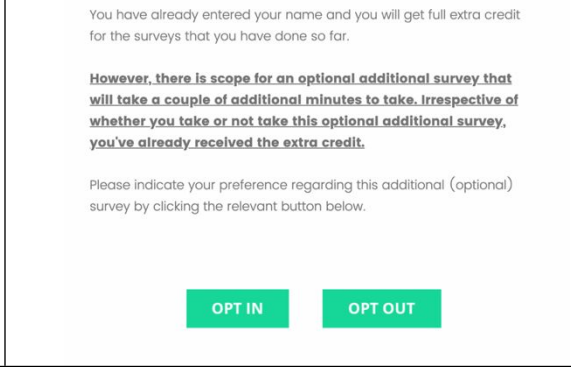
Procedure

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In this preregistered study (https://aspredicted.org/ra473.pdf), we tested our claims through approach and avoidance motivation messages interlinked with curved versus sharp angled elements. That is, this was a 2 (element shape: curved vs. sharp angled) X 2 (action button motivation: approach vs. avoidance) mixed design experiment with the first factor being between-subjects and the second factor being within-subjects.

Volunteering undergraduate students from a major US university arrived at a lab to participate in studies that were unrelated to this experiment. Toward the end of the session, after completing the other surveys, participants were told that they had successfully completed the studies they had signed up for and that they had already received the extra credit points. They were then invited to an optional survey, and it was emphasized that participation in this survey was entirely optional. The surveys had the clickable CTA elements either curved or sharp angled in their shapes; see table 10 for the smaller images and web appendix M for enlarged images of the stimuli.

TABLE 10: STUDY 6B STIMULI

Curved	Sharp Angled
	

Note: The lateral positions of the two buttons were counterbalanced in the experiment.

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Two hundred and forty-four students (50.6% female, $M_{age} = 20$) arrived at the lab to participate; the demographic information was retrieved from one of the earlier surveys. For the optional survey, all participants had to click on one of the options ("opt in" or "opt out") to proceed to the next page. The lateral positions of the "opt in" and "opt out" buttons were counterbalanced.

The "next" button in Qualtrics was disabled for this survey to eliminate the presence of any other action buttons or shapes. Participants who decided to click on "opt out" were taken to a separate survey that said, "Thank you for your participation." Participants who decided to click on "opt in" were taken to a pretest survey for an unrelated project. The dependent variable was the click rate on the "opt-in" versus "opt-out" button for taking the optional survey, calculated the same way as in study 3 (i.e., total clicks divided by total visits). Since taking another survey involves additional time and effort, this task made the decision outcome consequential.

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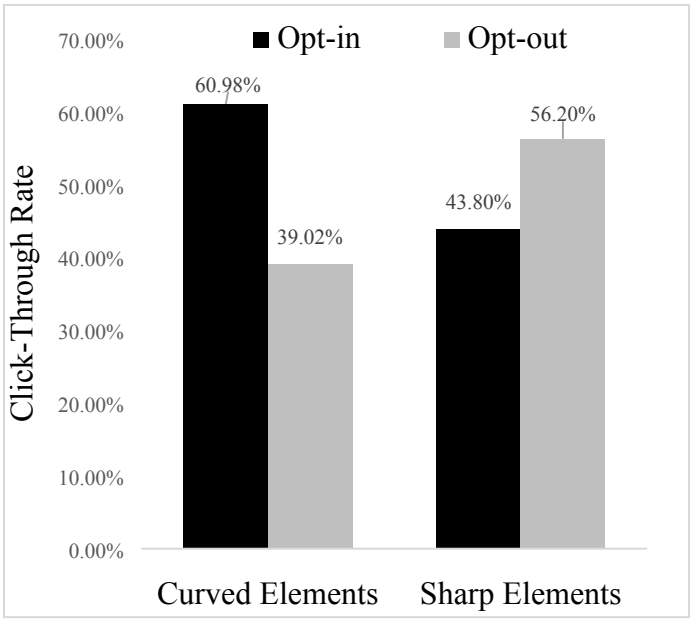
Results

As expected, the click rate for the "opt in" button was higher when the elements were curved (vs. sharp angled) ($Proportion_{curved} = 60.98\%$ vs. $Proportion_{sharp} = 43.80\%$; $\chi^2 = 7.21$, $p = .007$). As a corollary, the click rate for the "opt out" button was higher when the elements were sharp angled (vs. curved) ($Proportion_{sharp} = 56.20\%$ vs. $Proportion_{curved} = 39.02\%$; $\chi^2 = 7.21$, $p = .007$). A non-parametric chi-square test for the curved elements condition revealed a higher click rate for the "opt in" (vs. "opt out") button (opt-in = 60.98% vs. opt-out = 39.02%; $\chi^2 = 5.93$, $p = .015$). For the sharp angled elements condition, the effect attenuated with the direction of the cell

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means reversed (opt-in = 43.80% vs. opt-out = 56.20%; $\chi^2 = 1.86$, $p = .17$). Figure 2 graphically represents these findings.

FIGURE 2: STUDY 6B RESULTS



Discussion

The results of this study demonstrate that curved elements lead to higher clicks for the approach (vs. avoidance) motivated action button with the effects not only attenuating but the direction of effects getting reversed for sharp angled elements, whereby the avoidance (vs. approach) motivated action button leads to higher clicks (see Figure 2).

The pattern of effects for the interplay between element shape and approach-avoidance motivation differs across studies 6a and 6b. Both studies show higher clicks or click likelihood for curved (vs. sharp angled) buttons in the approach motivation framing. While study 6b showed approach (vs. avoidance) leading to significantly higher clicks for the curved element

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and directionally lower clicks for the sharp angled element, study 6a showed no effect of approach versus avoidance on the curved condition. One major difference between studies 6a and 6b is that the latter involved actual clicks while the former involved click likelihood measured on a scale. It is not clear if actual clicking behavior led to stronger effects than expressing an intention to click.

Importantly, avoidance motivation was manipulated differently. In study 6b, clicking on the opt-out button had a completely different consequence, such that a participant would not complete an additional task (i.e., the opposite consequence of opting in). In study 6a, however, in both the approach and avoidance conditions, the click outcome would be the same (learning more about the shoe), with merely the message framing being different. It is possible that these differences led to the variation in patterns of effects across studies 6a and 6b for the avoidance framing conditions.

The key takeaway from these two studies is that in an approach motivation context, curved (versus sharp angled) elements lead to higher clicks and click likelihood. Since most shopping contexts involve approach motivations and approach motivated framing, it is worth noting that curved elements outperform sharp angled elements in terms of likely clicks. This is also consistent with our other studies where the implicit contexts were approach motivated.

In addition to the manipulation of approach and avoidance context and message framing in studies 6a and 6b, we also conducted a study (see web appendix I) that measured approach motivation as an individual trait difference. In this study, we found that curved (compared to sharp angled element shapes) led to higher click likelihood, with this gap getting magnified for people inherently higher on the BAS (behavioral approach system) dimension related to fun seeking. We focused on the fun seeking aspect, which measures individuals' desire to engage in

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rewarding activities, given the hedonic approach associated with that study's food shopping context (e.g., Gomez and Gomez 2002). See web appendix I for the study details, including the floodlight analyses and graphical representations of the Johnson-Neyman points of significance. Next, study 7 provides empirical evidence for our conceptual claims related to how curved versus sharp angled elements influence visual gaze.

STUDY 7: MEASURING GAZE PATTERNS THROUGH EYE TRACKING

We conceptualized that curved (vs. sharp angled) elements of an online ad or website would be perceived as more visually appealing, leading to greater approach motivation towards the stimulus, which will translate into higher click-through rates. This is because higher visual appeal and approach motivation lead to greater visual gaze (Yasui et al. 2019), which in turn tends to lead to higher click likelihood (e.g., Egner et al. 2018). A curved (vs. sharp angled) element (such as a CTA button) should receive higher total gaze time, a higher number of gaze revisits, and higher total fixation counts. We tested these conceptual claims in study 7.

Procedure

This preregistered study (https://aspredicted.org/ht6wp.pdf) had two between-subjects conditions (website elements: curved vs. sharp angled). The study was conducted in a behavioral lab, with each workstation equipped with a Tobii eye tracking device mounted on a desktop computer. The software for the eye tracking study was iMotions 8.0. Two hundred twenty-nine undergraduate students participated in exchange for extra credit (46% female; $M_{age} = 20$).

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The usual eye tracking study protocols were followed (e.g., Hagtvedt and Brasel 2016; Hong, Misra, and Vilcassim 2016; Townsend and Kahn 2014). After participants arrived at the lab workstation, a calibration task was undertaken. After that, participants were shown the instructions on the screen, followed by a blank screen with a black dot in the center, which stayed for 5 seconds. Next, the study stimulus was displayed on the screen, and this stimulus stayed on the screen for exactly 10 seconds. We used the image from study 2; see table 4 and web appendix K. The area of interest (AOI) was the key action element of "Contact us today." Consistent with our preregistration, the key measures of interest were the total time spent gazing at the button and the number of gaze revisits. In addition, we analyzed total fixation count. We also examined time to first fixation to examine the role of the attention-grabbing feature of the button as an alternative explanation.

Results and Discussion

The curved (vs. sharp angled) element received a higher total gaze time (M_{curved} = 740.50 ms [SD = 604.66] vs. M_{sharp} = 575.91 ms [SD = 497.84]; $F(1, 227) = 5.05$, $p = .026$, $\eta_p^2 = .02$). Given the relatively high standard deviation, we also tested for skewness of the data. There was slight skewness (skewness statistic = 1.45; SD = .16) with the data being right skewed (Shapiro-Wilk W (229) = .887, $p < .001$). Hence, we also conducted a Mann-Whitney U test, which again showed a significant effect of element shape, with the curved element (coded as 1) (vs. sharp angled element [coded as 2]) receiving a higher total gaze time (U = 5512.50; z = -2.08; p = .038).

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Since the number of gaze revisits and fixation counts are count data, we conducted Poisson log-linear regression for these two variables. As predicted, the number of gaze revisits was higher for the curved (vs. sharp angled) element (M_{curved} = 1.10 vs. M_{sharp} = .68; Wald χ^2 = 11.59, $p < .001$). The goodness of fit for deviance (value/df) is 2.05; hence, we also conducted a negative binomial regression. The results of the negative binomial regression again show a significant effect of element shape on gaze revisits (Wald $\chi^2 = 6.31$, $p = .01$).

Also, a Poisson log-linear regression shows that the total number of fixation counts was higher for the curved (vs. sharp angled) element (M_{curved} = 1.90 vs. M_{sharp} = 1.35; Wald χ^2 = 10.66, $p = .001$). Since the goodness of fit for deviance (value/df) is 1.64, we also conducted a negative binomial regression, which again shows a significant effect (Wald $\chi^2 = 4.13$, $p = .04$).

There was no significant effect on time to first fixation, implying that neither shape had higher initial attention-grabbing capability (M_{curved} = 5319.21 ms [SD = 3158.35] vs. M_{sharp} = 5772.42 ms [SD = 3193.38]; $F(1, 227) = 1.17$, $p = .281$, $\eta_p^2 = .005$); this rules out attention grabbing property of either shape as an alternative explanation.

The results of this study demonstrate that consistent with our conceptualization, the curved (vs. sharp angled) button received a greater degree of visual gaze, presumably due to higher visual appeal leading to an approach motivation for the curved stimuli.

GENERAL DISCUSSION

Digital marketing has been growing in terms of importance. Visual cues play influential roles across a wide range of contexts and especially in digital settings. In that regard, there has been interesting research on how visual dimensions related to lines, shapes, colors, textures,

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forms, values, spaces, and human images influence visual appeal, aesthetics, and website perceptions (Cyr et al. 2009; Gorn et al. 2004; Longstreet, Valacich, and Wells 2021). In the context of e-commerce sites and online ads, click-through rate (CTR) is an essential metric. However, despite the importance of visual online elements and CTRs, no academic research, to the best of our knowledge, has examined how the shapes of elements of online ads and websites might influence click-through rates. This research takes a crucial first step in this direction and demonstrates how the shape of virtual elements in digital ads and websites influences consumer click behavior. The findings of this research have meaningful conceptual relevance. However, the stronger contributions are in the substantive phenomena related to digital marketing strategies.

A series of studies, including three field experiments, with Google Ads split tests and e-commerce landing page split tests, consistently demonstrate that curved (vs. sharp angled) elements in digital ads and websites lead to higher CTR. Process evidence suggests that this effect is driven by the higher visual appeal and approach (avoidance) motivations related to curved (sharp angled) elements. A majority of the studies, reported in the main text, capture click-through rates with actual clicking, and these studies involve consequential outcomes and, hence, are incentive-compatible. Three studies reported in the web appendix rule out several potential alternative processes, such as those related to the element shapes' uniqueness, femininity, and realism.

Overall, the findings of our study make important contributions to the digital marketing domain. The fact that curved elements generate higher CTR has implications for designing web elements, online advertisements, and websites in general. This research also contributes to the growing work on how visual cues influence online behavior (Brasel and Gips 2017). While prior

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research has examined a wide range of online design elements, such as color and interactivity, and how they influence click behavior (Kim et al. 2021), we take the novel approach of examining the shape of digital elements without changing any of the other factors or wordings.

This research also contributes to the sensory marketing literature in the domain of digital contexts. Specifically, prior research has examined the effects of sensory cues such as scent, light, music, and design in the context of physical stores (Biswas and Szocs 2019; Madzharov, Block, and Morrin 2015). We contribute to the sensory marketing literature by examining the role of shape (i.e., a visual cue) of a virtual item (i.e., an online element) in a digital environment. While research has examined the effects of physical item shape, such as shapes of product packages (Raghubir and Greenleaf 2006), the focus on shapes of virtual items is novel.

Our research also contributes to the literature on digital aesthetics and how design elements interact with approach-avoidance framing. Specifically, it is important to optimally pair particular design elements with the appropriate approach and avoidance framing. That is, while curved elements perform better than sharp angled elements on click rates when the message is approach framed, the direction of this effect tends to reverse in the case of avoidance framing. Clearly, additional work is needed to better understand the interplay between digital design elements and different types of message framing.

A vast majority of digital interactions and engagements relate to clicking behavior. Hence, the findings of this research are important as we try to better understand the link between designs and shapes of visual stimuli in digital settings and click behavior.

Limitations and Future Research Directions

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We demonstrated the robustness of the phenomenon of linking online element shapes to click behaviors across a wide range of contexts and settings (e.g., online ads, e-commerce sites, and controlled lab studies). While we examined the moderating effects of message framing related to approach-avoidance motivation, there is scope for significant research to examine other moderators that can attenuate or magnify our observed effects. Potential moderators can be color contrasts on the website or interactions with other sensory elements (such as auditory cues). Also, web appendix study I explored how certain individual traits, such as the fun seeking dimension of the BAS, can moderate the effects of element shapes on click likelihood. However, there can be several other individual characteristics that can moderate the effects. For example, some people might have inherent preferences for sharp angled shapes. Also, can there be subsequent or longer term effects of element shapes? For instance, can there be downstream effects on spending or conversion?

We examined the shapes of online elements, including those of CTA buttons. However, beyond the types of elements examined in this research, other emerging features might not involve a traditional CTA button format. For example, the reaction options on Facebook involve clicking on emojis (e.g., "like," "love," and "haha"), and Instagram and X (Twitter) use a "heart" shape for likes. These are conceptually similar to virtual web buttons but have different shapes. There is scope for additional research to examine how shapes of elements beyond the traditional designs might influence click behavior or engagement. Also, in our studies, we examined contexts related to online advertising and e-commerce sites. Would these effects hold for other digital contexts, such as social media sites, which involve interactivity of a different kind?

Additionally, CTA buttons consist of two elements: the background shape and a short piece of text inviting an action. Prior research has investigated the links between certain word

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sounds (like "kiki" or "bouba") and shapes (sharp angled or rounded). Specifically, sharp angled shapes associated with pseudowords like "kiki" elicit higher arousal (Aryani, Isbilen, and Christiansen 2020). Additional work is needed to examine the potential sound-symbolic cross-modal correspondence of words on the CTA and its shape.

While examining element shapes, we focused on fully curved compared to fully angular (90°) rectangular buttons. Our designs were adopted based on button shapes we observed on different landing pages (see web appendix A for examples). However, the degree of curviness of buttons can vary, with the continuum ranging from fully angular to almost fully curved (see web appendix M). In addition, many websites use slightly but not fully rounded buttons. Additional work is necessary to examine varying curvature levels and their effects on consumer perceptions and behaviors. Lastly, some hybrid designs exist in which website clickable buttons are half angled and half curved (see web appendix M). Examining how consumers react to such non-traditional button shapes will be interesting.

While we examine click behaviors, future research needs to focus on other relevant dependent variables. For example, can website element shapes influence overall perceptions of the business, its products, or services?

Managerial Implications

The findings of this research have strong practical and managerial implications. As the findings from our field and lab studies demonstrate, curved (vs. sharp angled) elements increase click rates for online ads and e-commerce sites. Assuming higher click rates convert into higher revenue, companies can increase their revenues and get better returns on online ads by using

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more curved (vs. sharp angled) elements; see also the findings reported in web appendix C for a field study with a hotel chain that demonstrate similar results.

As highlighted earlier, different companies use different shapes for digital elements. Some company websites, such as Walmart Grocery (walmart.com), use primarily curved elements, while others, such as Food City (foodcity.com), use sharp angled elements (see table 1). Interestingly, Walmart Grocery changed its CTA button shapes in 2020 from sharp angled buttons to curved buttons (see web appendix N). Our research results demonstrate that curved elements are beneficial for online advertising and e-commerce sites. This suggests that Walmart's Grocery division might benefit from its recent decision to switch from sharp angled to curved CTA buttons.

Similarly, we came across an A/B test conducted by *USA Today* (in April-May 2023) to examine if curved buttons or sharp buttons would increase subscription likelihood (see web appendix B). Clearly, the influence of shapes on choices and click likelihood is of managerial interest. The findings of this research highlight when and how curved versus sharp angled elements are prudent to employ. For approach-related contexts and framing, which is the case for many shopping contexts, curved element shapes should be adopted since these shapes lead to higher clicks. In contrast, for avoidance-related contexts and framing (e.g., "Don't Drink and Drive" campaign), sharp angled elements would be more appropriate, given their higher click likelihood for such contexts and framing.

This research has a high potential for significantly impacting digital marketing practices since almost all commercial websites have clickable elements. Interestingly, we have already started seeing direct managerial effects of the findings of this research. The hotel chain that collaborated with us for the field study reported in web appendix C used to have sharp angled

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CTA buttons before the study was conducted. After we conducted the experiment and shared the study findings, the hotel management changed the CTA buttons on their website to curved buttons. Going forward, the findings of this research can potentially directly impact website design strategies in a similar manner for many other companies and industries.

As mentioned earlier, consumers are increasingly adopting and using digital devices for shopping and other activities, such as social media use and online games (Lamberton and Stephen 2016). Whether for shopping or on social media, almost all digital platforms involve clickable elements. Hence, the findings of this research have implications not only for design strategies for e-commerce sites and online advertising but also for clickable options across other digital platforms. In fact, at a broader level, our findings have implications for optimizing user experience by linking digital experiences with behavioral outcomes. Given the lack of academic research insights into how digital element shapes and designs might influence clicking behavior, we hope that our research will spur significant new work in this domain.

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DATA COLLECTION STATEMENT

Study 1 was a Google Ads study conducted in collaboration with Bahia Tacos (a restaurant located in Tampa, FL), in Spring 2022. Study 2 was conducted in collaboration with Lunchpool (an e-commerce business that organized virtual events) in Summer 2021. Study 3 was conducted at the University of South Florida (USF) in Spring 2022. Study 4 was conducted at the University of Tennessee, Knoxville (UTK) in Fall 2022. Study 5 was conducted on Prolific in Fall 2022. Study 6a was conducted on Prolific in Spring 2023. Study 6b was conducted at USF in Fall 2022. Study 7 was conducted at USF in Fall 2021. The web appendix C study was conducted in collaboration with a hotel chain under the supervision of the third author, a few years ago. As per a non-disclosure agreement with this hotel chain, we are not allowed to reveal the name/identity of the hotel chain nor the exact dates of the study. The study in web appendix D was conducted at USF in Summer 2021. Web Appendix E study was conducted on Prolific in Fall 2022. Web Appendix F study was conducted at USF in Spring 2020. Web appendix G study was conducted on Prolific in Spring 2022. Web appendix study H.1 was conducted on Prolific in Summer 2021. Web appendix study H.2 was conducted on Prolific in Spring 2022. Web Appendix I study was conducted at USF in Spring 2023. The first and second authors jointly managed the collection of data for all the studies except the study in web appendix C (which was conducted under the supervision of the third author). The first two authors independently analyzed the data for all the studies. The study data files are currently stored in a project directory on the Open Science Framework (https://osf.io/x9wg6/?view_only=6850950eda0e421396b49df6c33b1c61).

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