The Freedom to Choose:
The Effects of Ad Choice Architecture
on Video Ad Performance in Online Streaming

Abstract: Many consumers view advertisements as a nuisance, one that is forced on them. We explore the prospect that consumers may react more positively to ads if granted some control over ad delivery. We undertake a study in the context of online video advertising. Building on recent work, we consider the impact of providing consumers with two forms of consumer control: control over ad content and delivery timing, examining the influence of each on various outcomes of interest, including consumer attention, annoyance, brand recall, and brand perceptions. Our studies reveal that providing consumers with either form of control significantly enhances their attention to ads, resulting in better brand recall, reduced annoyance, and more positive attitudes toward the advertised brand and product. These results demonstrate the benefits of ceding control to consumers over different aspects of their advertising experiences.

Keywords: ad choice, attention, eye tracking, ad annoyance, consumer attitudes, purchase intention, video platforms

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1 Introduction

Online video streaming platforms have become the main source of entertainment for millions of consumers. Approximately 99% of US households now subscribe to at least one streaming service (Forbes 2023). By offering consumers flexible access to content, video streaming platforms have heralded a shift in media consumption – consumers now prefer on-demand content, personalized to their tastes, and available at their convenience. Yet, providing consumers access to a continuous stream of new content requires continual investments, which is difficult to sustain and erodes platform revenues. To offset content development costs, platforms have been increasing subscription fees associated with ad-free subscription offerings (Jaeger and Grant 2023). Interestingly, however, they have also begun introducing (and, in some cases, reintroducing) ad-sponsored subscription tiers, whilst continually increasing the number of advertisements they deliver to users (Benveniste 2023). Indeed, regarding the latter, Amazon Prime Video, Hulu, Disney+, YouTube Live, and Netflix have all recently begun to provide ad-sponsored subscription tiers (Clark 2023, Roth 2024). With these changes, advertising revenue is expected to increase to $120B in 2029, a significant rise from the $77B earned in 2023 (Statista 2024).

Brands are more than happy to take advantage of these digital advertising opportunities, in part because video streaming services offer several unique benefits to an advertiser (Miller 2023, Heydari 2024). Streaming platforms collect rich data on consumer characteristics and behavior, enabling targeted advertising that can increase consumer purchase intentions (Summers et al. 2016, Deng et al. 2019). These platforms can also track consumer interactions with advertisements, yielding more granular measures of ad effectiveness than are available in other advertising formats, e.g., TV (iSpot 2024). Moreover, from the consumer's perspective, ad-sponsored streaming options serve two purposes: they provide an entry-level option for new users to trial the service, and they provide a low-cost alternative for established users. Despite these benefits of ad-sponsored streaming, platforms must contend with a significant challenge – consumers dislike it when ads disrupt their streaming experience (Nesler 2024).

Although financial hardship has increased consumers' preferences for free or low-priced ad-sponsored streaming options, consumers would generally prefer an ad-free experience (Majidi 2023). However, with ad delivery historically being fully mediated and coordinated by streaming platforms, consumers have generally had little control over their ad experience. During video content delivery, a platform typically offers advertising slots to consumers via auction, allowing advertisers to participate in auctions and thus target and display their ads to consumers based on a variety of consumer characteristics and budgeting parameters. In most cases, the only form of control that consumers have over their exposure to

advertisements is to avoid them entirely, e.g., by paying for an ad-free subscription. Consumer sentiment toward this status quo has become increasingly hostile, with unwelcome ad experiences fueling annoyance and ad avoidance (Connatix 2023). In short, consumers want more control over their ad experiences (Sanchez 2021).

Some streaming platforms have recently begun to experiment with granting consumers control over aspects of their advertising experience. As one notable example, Hulu allows consumers to select their advertising content from among a set of alternatives (Hulu 2024). Intuitively, providing consumers with greater control has the potential to reduce annoyance and improve attention. However, prior work has considered the impacts of control on attention (e.g., Nettelhorst and Brannon 2012, Luo et al. 2023). It remains unclear whether those increases in attention translate to reduced annoyance, greater receptivity, and, ultimately, improved ad performance. This is the first gap our work tackles; we examine the consequences of ad content choices for a variety of outcomes related to ad performance. More formally, we will first address the following question:

RQ1: *To what extent does providing consumers with control over ad content affect brand recall, brand attitude, and ad annoyance?*

Beyond this, we also explore the impact of offering consumers alternative forms of control over the advertising experience. The nascent prior literature has focused on one form of control to date: granting consumers choice over the content of the advertisement they will view, i.e., enabling consumers to select an advertisement from among a set. Although this approach is intuitive and has been shown to drive greater attention to ads, it presents several practical challenges.

First, platforms typically have a fixed inventory of ads, which limits the diversity of advertisement options they can provide consumers. Second, and related, although some platforms may have large ad inventories, by allowing consumers to select an ad, the platform loses the ability to ensure that a given ad receives a certain amount of exposure to consumers. Some advertisements and advertisers may thus gain greater exposure than anticipated or requested, while others may receive relatively little exposure, despite advertisers being willing to pay a great deal for impressions.

Third, if a consumer is to choose among a set of advertisements, this requires active participation on their part. Consumers may perceive the selection interface as an additional demand on their time, effort, and attention, increasing their displeasure. For these reasons, it is important to explore other forms of control over the advertising experience that platforms might provide to consumers. We do so here, considering the influence of providing consumers with control over the *timing* of advertisements rather than the content. This investigation is crucial as video platforms embrace providing consumers with other forms of control.

For instance, Hulu's Branded Entertainment Selector (BES) allows viewers to choose between watching a long commercial at the beginning of their program or regular interruptions throughout the program (DesignLoud 2024). Yet, empirical evidence on the effectiveness of this approach is limited, motivating the current research.

Granting consumers control over ad timing rather than ad content can address the various implementation issues noted earlier in the following ways. First, in situations with limited ad inventory, offering rotating timing options—such as viewing ads before or during a video—rather than repeatedly showing the same content choices can reduce the negative impact of ad fatigue. While consumers may choose to see an ad more than once, platforms can better manage ad distribution by controlling exposure frequency through timing. In contrast, providing repetitive content choices may trigger user fatigue or annoyance, reducing engagement. By focusing on ad timing rather than content selection, platforms can maintain better control over how often ads are shown and optimize ad placement for attention, ultimately improving the overall revenue-generating potential through more effective inventory management and sustained viewer engagement (Morshed 2023).

Second, even in situations where ad inventory is not constrained, timing options can allow platforms to maintain oversight over the degree of exposure that different advertisements receive. By inserting ads at the times chosen by the consumer, platforms can avoid a skewed distribution of advertisement views and associated imbalances in advertiser costs.

Third, providing control over ad timing rather than ad content may reduce cognitive effort for consumers, leading to a smoother user experience. While choosing between several thumbnail ads might not always seem cognitively demanding, deciding when to view ads (e.g., now or later) offers a simpler, more immediate decision that aligns with viewers' consumption preferences. Research on cognitive load suggests that decisions grounded in temporal choices, such as timing can feel less effortful because they require fewer comparative evaluations than abstract content-based choices (Kahneman 2011). Furthermore, timing decisions are typically more habitual and context-dependent, whereas selecting ad content involves evaluating and comparing potentially unfamiliar options (Kahneman 2011, Phillips-Wren and Adya 2020). By offering timing control, platforms can minimize the perceived burden of decision-making, contributing to a better user experience.

Despite the potential value and relative simplicity of granting consumers control over ad timing, we are aware of no prior work studying the efficacy of the approach. More specifically, work is lacking that examines how delegating control over ad-timing may impact consumer attention to video ads. Further, work is lacking that examines whether delegating control in this manner will translate to improvements in other advertising outcomes. This is the second gap our work addresses. More formally, we address the following research questions:

RQ2: *To what extent does providing consumers with control over ad timing improve their attention to ads?*

RQ3: *To what extent does providing consumers with control over ad timing affect brand recall, brand attitude, and ad annoyance?*

To address our research questions, we conduct a series of controlled experiments. We investigate the effects of two-choice architectures on several advertising outcomes, including attention to the ad, recall, annoyance, and perceptions of the advertised brand and its product or service. Study 1 (N = 279) investigates the effects of providing consumers with control over ad content in an online video streaming setting on various previously unconsidered ad performance outcomes. Study 2 (N = 991) then investigates the effects of providing consumers with an alternative form of control, namely the freedom to choose when an ad will be displayed. In both studies, we leverage eye-tracking technology and survey responses to quantify our ad performance measures, including attention, brand recall, brand perception, and annoyance.

The implications of this research are significant for both academia and practice. Our contributions to the academic literature build upon literature in marketing and information systems. Our results provide evidence that both types of consumer control over the advertising experience (content and timing) lead to improvements in attention and brand-relevant outcomes. These results highlight the psychological pathways that link choice, attention, consumer annoyance, and consumer attitudes. Control over the ad experience enhances consumer attention to advertising while reducing annoyance. Reducing annoyance leads to enhanced attitudes toward the advertised brands and increases purchase intention.

Our findings yield actionable insights for practice as well, particularly marketers. While the results broadly suggest the benefits of allowing consumers to control their ad experience, as these efforts drive improvements in a variety of advertising outcomes, our findings also speak to real practical challenges that can arise depending on the nature of control that is delegated. Our results highlight the value of alternative forms of control that users may be assigned, as certain forms of control may be more easily accommodated in practice (i.e., timing control is likely easier to delegate than content control). Our findings make clear that even more limited forms of control, like timing, can continue to yield significant improvements in ad performance.

In summary, this research can motivate platforms to develop and explore alternative ad choice architectures, enhancing user experiences and fostering more positive attitudes. For advertisers, the results suggest that collaborating with platforms that empower consumers may lead to increased attention to their advertisements, improved brand perceptions, and greater purchase intent.

2 Literature Review

Our work broadly contributes to different streams of literature, namely those dealing with 1) online streaming platforms and advertising within that context, 2) consumer control over advertisements, and more broadly, 3) user autonomy, as well as 4) attention and memory. Next, we elaborate on relevant literature from each of these domains.

2.1 Streaming Platforms and Advertising Effectiveness

The rapid growth of streaming platforms like Netflix, Hulu, and YouTube over the last several years (Statista 2023) has significantly impacted how video content is consumed, produced, and delivered (Fang et al. 2023). Whereas traditional television involves the broadcast of video content tailored toward the broad preferences of a mass audience, streaming platforms aim to cater to individuals, allowing consumers to consume content on demand (Novak 2017). Streaming platforms invest significant resources to enrich content libraries to retain existing consumers, attract new consumers, enrich the consumer experience (e.g., Larsen 2024), and enhance consumer engagement (Pansari and Kumar 2017). In this changing media environment, streaming platforms uniquely appeal to advertisers, allowing them access to multitudes of diverse consumers (Joa et al. 2018). However, as platforms increasingly shift to ad-sponsored models, they must balance the revenue potential with the negative consequences of ads on consumer engagement.

Ad interruptions can disrupt the video-watching experience (Li et al. 2002; p. 39), resulting in irritation, consumer disengagement (Wang and Calder 2006, Goodrich et al. 2015, Tripathi et al. 2021) and other negative psychological consequences, like weakened attention (Edwards et al. 2002, Goldstein et al. 2014). Consumers may also perceive forced exposure to ads as restricting their autonomy, evoking psychological reactance (Brehm 1966), which compounds irritation and annoyance (Edwards et al. 2002, Li et al. 2002).

Consumers find advertisements particularly disruptive (Goldstein et al. 2014) and annoying (Todri et al. 2020, Arora et al. 2021) when they are not aligned with the consumer's interests (Tam and Ho 2006). Even when an ad is personalized, there is a risk that the consumer will perceive that the ad has been targeted based on the consumer's characteristics or recent online behavior, leading, in turn, to a perceived privacy violation (Aguirre et al. 2015).

In-stream ads typically appear at different points in a video; streaming platforms may present ads before (pre-roll), during (mid-roll), or after a video (post-roll). Compared to mid-roll ads, pre-roll ads are considered less intrusive (Frade et al. 2023). However, pre-roll ads are associated with lower consumer attention because consumers have yet to develop cognitive involvement (Li and Lo 2015).

In summary, prior research in video streaming reveals that forcing consumers to view ads can result in feelings of annoyance, leading to decreased engagement with the ad. However, allowing consumers to skip ads can reduce critical revenues generated from serving ads. Thus, methods must be investigated to mitigate

the negative consequences of forced exposure while ensuring that ad exposure is not hurt. In the following subsection, we discuss how strategies based on consumer control over advertising can encourage ad engagement.

2.2 Consumer Control over Advertising

Past research has explored several methods to encourage consumer participation in advertising. For instance, Sen et al. (2017) conducted a randomized field trial to investigate the effect of opt-in (sponsored) advertising on consumers' willingness to watch and share ads. Consumers could opt-in to watch interruptive ads in exchange for data rewards on a mobile app that mimicked the functionality of YouTube. The authors find that, while financial incentives (reduced data plan cost) can significantly increase ad viewership and social sharing, the amount and type of incentive play an essential role in that variable rewards encourage higher engagement with ads. In contrast, fixed rewards encourage sharing and exposure but do not foster engagement. Relatedly, Joe-Wong et al. (2018) investigate how sponsored mobile data (where content providers subsidize data costs) affects user demand, benefits for content providers, and overall social welfare. They show that although incentivizing consumers to opt into sponsored content benefits both content providers and consumers, consumers tend to benefit more from these arrangements, particularly price-sensitive consumers. These results highlight that in settings where the benefits of consuming ads are discernable, empowering consumers with control over ads can significantly impact ads' exposure and consumption.

However, other research in the advertising space has found relatively weak effects of offering consumers control over their ad experience, particularly in settings where consumers have more to gain from the information provided by ads. Research has shown that contextual cues influence consumer perceptions of the benefits they obtain from control over ad experiences. Using a between-subjects lab experiment, Petty et al. (1983) show that choice over ad content results in greater ad consumption and sharing for consumers, particularly among those who are highly involved with the advertised product or who perceive a higher congruency between the ad and the focal video content (Belanche et al. 2017). Control over ad content can also have heterogeneous impacts on ad-performance measures, including consumer attitude toward the ad, an essential precursor to positive brand attitude and purchase intention (Muehling and McCann 1993). Notably, prior literature has primarily focused on the effects of control over ad content; other forms of control have yet to receive scholarly attention, a gap we address here. We next elaborate on literature dealing with consumer control over ad content before discussing consumer control over ad timing.

2.2.1 *User Control over Advertising Content*

Research on consumer control over ad content indicates that such control can improve consumer attitudes

toward advertised products. In an early experiment by Schlosser and Shavitt (2009), some consumers were randomly given a choice over the nature of product 'messaging' that they received, holding the content of messaging fixed. Specifically, treated consumers were allowed to select among alternative web pages emphasizing different aspects of a fictional pair of sunglasses (value, style, or quality). Treated consumers had more favorable and resilient attitudes toward the product. At the same time, however, those effects were found to backfire when the provision of choice was made salient to consumers, as consumers began to perceive the delegation of control as a persuasive tactic.

Since that early work, subsequent research has investigated the impact of giving consumers control over various aspects of the ad experience. Luo et al. (2023) recently studied how choice over ad content affects consumers' attention to the ad. Those authors showed that control over ad content can trigger a consumer to engage in a "conjecture-formation-and-confirmation" process, especially when the initial ad content (e.g., a thumbnail) is unfamiliar. Control over ad content was thus found to encourage greater consumer attention toward ads.

In contrast, Nettelhorst et al. (2017) investigated choice overload, assessing the cognitive impact of presenting consumers with an ad content choice. Consumers were randomized into several choice conditions, including a no-choice condition and conditions requiring a choice between two, three, or six alternative advertisements. Those authors found a curvilinear relationship between the number of alternatives consumers must select from and the cognitive effort they expend. They found that consumers exhibited significantly more cognitive effort when presented with two or three alternative advertisements, compared to a no-choice setting or a choice among six ad alternatives. This finding suggests that affording too much control to consumers may be detrimental.

Iyengar and Lepper (2000) demonstrated that cognitive overload can arise even when consumers select among just a few alternatives if those alternatives are difficult to compare. Thus, requiring consumers to choose between very different brands or entirely different products, such as choosing between Coke and Sony headphones, or across various product categories, may be perceived as more complex or effort-intensive (Nettelhorst and Brannon 2012a, 2012b, Nettelhorst et al. 2014). This variation in complexity suggests that the type of options presented significantly influences the potential for choice overload, with more straightforward choices being more desirable.

In summary, this stream of literature suggests control over advertisements can positively impact ad performance measures. However, contextual factors like brand familiarity, product involvement, and ease of comparison can influence the benefits of providing consumers with control. Moreover, by allowing consumers to choose which ad they will view, platforms lose control over the degree of exposure that different advertisements and advertisers receive. Recognizing the potential value of simple forms of control and the logistical challenges of delegating control over ad content, we next consider delegation of a novel

form of control: ad timing.

2.2.2 *User Control over Advertisement Timing*

Granting consumers control over ad timing rather than content can allow platforms to better rotate a limited ad inventory. Choices of ad timing are also more straightforward and likely to require less cognitive effort on the part of a consumer. Despite the potential value of offering control over ad timing, we are aware of no prior work that has studied this approach. That said, a rich stream of related literature addresses the efficacy of forced advertisement exposure at different points in the consumer streaming experience, i.e., pre-, mid-, and post-roll advertisements (e.g., Freeman et al. 2022). That work has revealed the important influence of ad timing on consumer emotion and attention toward ads.

For instance, Freeman et al. (2022) found that mid-roll ads are perceived as more intrusive than pre-roll ads, leading to greater anger and negatively affecting ad and brand attitudes. Anger negatively impacts consumer purchase intention as well, mediating the relationship between ad placement and sales outcomes. Li and Lo (2015) reported that mid-roll ads lead to better brand recognition than pre-roll and post-roll ads. Those authors conclude that this occurs because mid-roll ads receive greater attention spillovers.

Krishnan and Sitaraman (2013) found that mid-roll ads were 18.1% more likely to be fully viewed than pre-roll ads and that the latter were 14.3% more likely to be fully viewed than post-roll ads. Moreover, they found that the rate at which ads were fully viewed decreased with ad length. These studies collectively show that mid-roll ads are more likely to receive attention and be watched to completion despite being perceived as more intrusive and eliciting negative emotional responses. In summary, although it is evident that ad timing is an important factor for ad performance, it remains unclear how choice over ad timing affects ad performance. In the following section, we elaborate on the likely cognitive mechanisms that may result from delegating control to consumers over ad timing.

2.3 Role of Consumer Control in Influencing Consumer Outcomes

Perceptions of consumer control can be critical in shaping behavioral and attitudinal responses toward advertising. For example, consumers' perceptions of control over their personal information affect how likely they are to click on online advertising (Tucker 2014). In this subsection, we synthesize the literature on Self-Determination Theory and Cognitive Dissonance Theory to explain how consumer control can impact consumer outcomes.

When consumers exercise control over the content they consume, it can enhance their perceptions of autonomy. Autonomy, the freedom to make decisions based on one's values and interests, is a key element in Self-Determination Theory (SDT; Ryan and Deci 2000). Supporting autonomy in online platforms enhances intrinsic motivation, leading to positive outcomes such as increased attention and satisfaction (Deci and Vansteenkiste 2004, Shi et al. 2014) and increased gaming enjoyment (Ryan et al. 2006, Jung

2011, Wottrich et al. 2017). In other words, increases in perceptions of autonomy can make it less likely for consumers to find ads intrusive, influencing their reactance and subsequent ad avoidance behaviors (Youn and Kim 2019). The explanation is that giving consumers control can reduce the psychologically aversive states (Wang et al. 2022) that arise from holding conflicting beliefs or attitudes. For instance, when consumers consciously choose to engage with an ad, they may experience “choice justification" or "post-decisional dissonance reduction." If consumers choose to view a particular ad, that behavior may conflict with their negative attitudes or beliefs about the advertisement and brand. Consumers may attempt to resolve that discrepancy, justifying their choice by positively evaluating their selection. By viewing the advertisement more favorably, consumers reduce the dissonance from choosing to engage with it. This adjustment in attitudes and behavior can benefit both the platform and the advertiser.

This explanation has been employed by prior research studying consumer control over ad content (Nettelhorst and Brannon 2012 a, b, Nettelhorst et al. 2014, Nettelhorst et al. 2017, Bellman et al. 2021). However, the literature reports mixed evidence for the positive impact of ad control (e.g., Nettelhorst and Brannon 2012b). Accordingly, it is unclear whether a mechanism of dissonance may emerge in real-world settings, which we strive to resolve in this research.

Given inconsistencies in the results of prior work studying ad content choices, Luo et al. (2023) suggest that an alternative mechanism may also be at play. Those authors report that familiarity with the ad content can moderate a “conjecture-formation-and-confirmation” process, where unfamiliar ads capture more attention as consumers try to verify their assumptions. While this explanation applies to cases where ad content varies in familiarity, it does not extend to situations where ad information is absent or where ads are familiar. Nevertheless, we control prior familiarity in our studies.

Importantly, prior familiarity with advertisements has little potential to play a role in the effects of providing consumers with control over ad timing. Choices of ad timing are unlikely to elicit a “conjecture-formation-and-confirmation” process, warranting an investigation of control over ad timing. We will next discuss the work of consumer attention and memory in advertising.

2.4 Attention and Memory

Memory is closely intertwined with consumer attention (Pieters et al. 2007). The connection between visual attention and memory is integral to online ad performance, as consumer attention in online settings is often scarce. Simmonds et al. (2020) stress the importance of this link, highlighting the role of attention in shaping brand memories and influencing consumers' propensity to purchase.

Advertising aims to effectively build and refresh links to a brand in consumer memories (Romaniuk 2009, Erfgen et al. 2015). Attention has conventionally been measured via self-report, leading to a great deal of noise in past empirical work (Lin et al. 2008). However, recent technological advancements have

enabled more objective measurement of attention by monitoring consumers' vision, a dominant sensory modality, which plays a crucial role in shaping memory effects in advertising (Cohen 2014). Eye-tracking technology has enabled researchers and marketers to gain uniquely granular insights into the mechanisms underlying visual attention and its correlation with memory processes (Orquin and Holmqvist 2018).

Within advertising-related memory processes, i.e., encoding, retention/consolidation, and retrieval (Keller 1987), autonomy and interactive elements have the potential to play a significant role. The strength of encoding, determined by the attention allocated to an ad, influences information decay over time and the accuracy of memory retrieval (Venkatraman et al. 2021). Autonomy-supporting elements within advertisements, e.g., control over content and timing, necessitate active engagement by the consumer, enhancing cognitive processing and attention.

This study seeks to fill this existing research gap by exploring how autonomy-supporting interactive elements and visual attention influence memory processes in advertising. Integrating these factors into the research on visual attention and memory helps address research gaps in advertising strategies and brand memorability while contributing to a better understanding of consumer behavior in video streaming settings.

3 Hypothesis Development

Viewed from the lens of SDT and cognitive dissonance, there are several reasons why affording consumers control over their ad experience should lead to positive outcomes. First, the ability to choose among alternative courses of action in a way that conforms with one's goals and attitudes can produce a sense of autonomy. Second, the changes in one's environment that arise from consumers' selections can evoke feelings of competence and self-efficacy. Third, as part of the decision-making process, consumers may feel better connected with the online environment. Collectively, these effects can lead to an intrinsic motivation to engage with the content or service (e.g., Thom et al. 2012, Sailer et al. 2017). In the following subsections, we explain how consumer control over their ad experience can influence attention, annoyance, recall, and attitudes toward advertisements.

3.1 Consumer Control and Attention to Advertisements

Attention is a critical factor in ad effectiveness, as consumers' cognitive resources are finite and often stretched thin in online environments (Barreto 2013). Engaging consumers through greater autonomy can lead to more focused attention on advertisements. Prior research has shown that providing control over ad content can increase engagement because consumers feel more involved in the experience (Luo et al. 2023). By offering consumers control, either over ad content or timing, advertisers can tap into consumers' intrinsic motivation to pay attention. The fulfillment of autonomy is linked to higher cognitive involvement

(Wottrich et al. 2017), which in turn is associated with increased attention. When consumers are empowered to make choices about their ad experience, they are more likely to be engaged and attentive, leading to more favorable advertising outcomes. Thus, we hypothesize:

H1: *Consumer control will increase their attention to the advertisement.*

3.2 Consumer Control and Annoyance with Advertisements

Annoyance is one of the primary reasons consumers avoid or resist advertisements (Quick and Stephenson 2007). Forced ad exposure, in particular, can trigger feelings of psychological reactance (Brehm 1966), leading to negative emotions and behaviors such as ad-skipping or avoidance. By providing consumers with control over their ad experience, advertisers can reduce these adverse reactions and mitigate the annoyance typically associated with ads. When consumers perceive that their autonomy is supported, their annoyance toward advertisements is diminished (Edwards et al. 2002). This reduction in annoyance can improve the overall experience, as consumers no longer feel that their freedom is being infringed upon. Therefore, we propose:

H2: *Consumer control will reduce annoyance with ads.*

3.3 Consumer Control, Attention, and Ad Recall

Attention plays a central role in the encoding of memory, which directly influences ad recall (Keller 1987). Increased attention leads to more robust encoding, which enhances memory retention (Pieters et al. 2007). When consumers are given control over their ad experience, the heightened attention they pay to the advertisement is likely to result in improved recall. This is particularly true in the context of visual attention, where eye-tracking studies have shown a positive relationship between visual focus and memory (Orquin and Holmqvist 2018). When consumers are allowed the freedom to control their ad experience, whether control over content or timing, it can encourage consumers to pay more attention, which, in turn, enhances their ability to recall the ad. Therefore, attention likely serves as a mediator between the freedom to choose, i.e., the autonomy afforded to consumers, and their memory of the advertisement. Thus, we hypothesize:

H3: *Consumer control will increase user attention to the advertisement, increasing ad recall.*

3.4 Consumer Control, Annoyance, and Attitudes Toward the Brand

When consumers are exposed to advertisements they cannot control, feelings of annoyance arise, which can negatively impact their attitudes toward the brand (Dillard and Shen 2005). These negative attitudes are often a result of the psychological reactance triggered by forced exposure. By contrast, when consumers are given control over their ad experience, their autonomy is supported, leading to reduced annoyance and

improved attitudes toward the brand. Prior research has demonstrated that reduced annoyance can foster more positive consumer attitudes (Homer 2006). As consumers become less frustrated with ads, they are more likely to form favorable attitudes toward the advertised brand. This positive shift in attitude can be essential for brand-building efforts and long-term consumer loyalty. Therefore, we propose:

H4: *Consumer control will reduce annoyance with ads, increasing consumer attitudes toward the advertised brand.*

3.5 Consumer Control, Annoyance, and Value Perceptions of the Product

Advertisements serve to inform consumers about the value of a product. However, when ads are perceived as intrusive or annoying, the perceived value of the product can be diminished (Goldstein et al. 2014). By reducing annoyance, advertisers can enhance the perceived value of the product being advertised. When consumers are less annoyed by the ad experience, they are likely to better focus on the content of the advertisement and the value it communicates. This can lead to a higher perceived value of the product, as the consumer is less likely to be distracted by negative emotions triggered by the ad itself. Thus, reducing annoyance can be a key driver of improved product perceptions. Accordingly, we hypothesize:

H5: *Consumer control will reduce annoyance with ads, increasing value perceptions of the advertised product.*

3.6 Consumer Control, Annoyance, and Purchase Intentions

Purchase intentions are closely tied to consumers' emotional responses to advertisements. When consumers experience annoyance, their likelihood of purchasing the advertised product decreases (Gardner and Leshner 2016). Conversely, by reducing annoyance through consumer control, advertisers can increase the probability that consumers will consider purchasing the product. Reduced annoyance not only improves attitudes and value perceptions but also creates a more conducive environment for consumers to process the ad's message. This leads to higher purchase intentions, as the consumer is more likely to engage with the product positively when their ad experience is less frustrating. Therefore, we propose:

H6: *Consumer control will reduce annoyance with ads, increasing the probability of purchasing the advertised product.*

In the following sections, we present two studies addressing our various hypotheses (see Table 1). Study 1 examines how consumer control over ad content affects attention and attitudes toward advertised brands. Offering choice over ad content has been shown to increase consumer attention in some past work. We revisit that relationship, testing the impact of ad content choice in a controlled setting that closely emulates a real-world video streaming context. Further, we explore a variety of additional outcomes not considered

in past work, namely annoyance, brand recall, value perceptions, and intention to purchase.

Study 2 extends the first investigation, exploring an alternative form of control, namely consumer control over ad timing. The second study thus addresses the extent to which other forms of control can yield improved ad outcomes, considering forms of control that help to avoid the logistical limitations of delegating control over ad content. This choice architecture gives consumers control over *when* ads appear. The second study is again conducted in a setting closely resembling a real-world streaming context, employing an actual YouTube channel.

Table 1. List of Hypotheses Tested Across Studies

Hypothesis	Details	Study 1	Study 2
H1	*Consumer control will increase their attention to the advertisement.*	✓	✓
H2	*Consumer control will reduce annoyance with ads.*	✓	✓
H3	*Consumer control will increase user attention to the advertisement, increasing ad recall.*	✓	✓
H4	*Consumer control will reduce annoyance with ads, increasing consumer attitudes toward the advertised brand.*	✓	✓
H5	*Consumer control will reduce annoyance with ads, increasing value perceptions of the advertised product.*	✓	✓
H6	*Consumer control will reduce annoyance with ads, increasing the probability of purchasing the advertised product.*	✓	✓

4 STUDY 1: CHOICE OVER AD CONTENT

4.1 Participants and Procedure

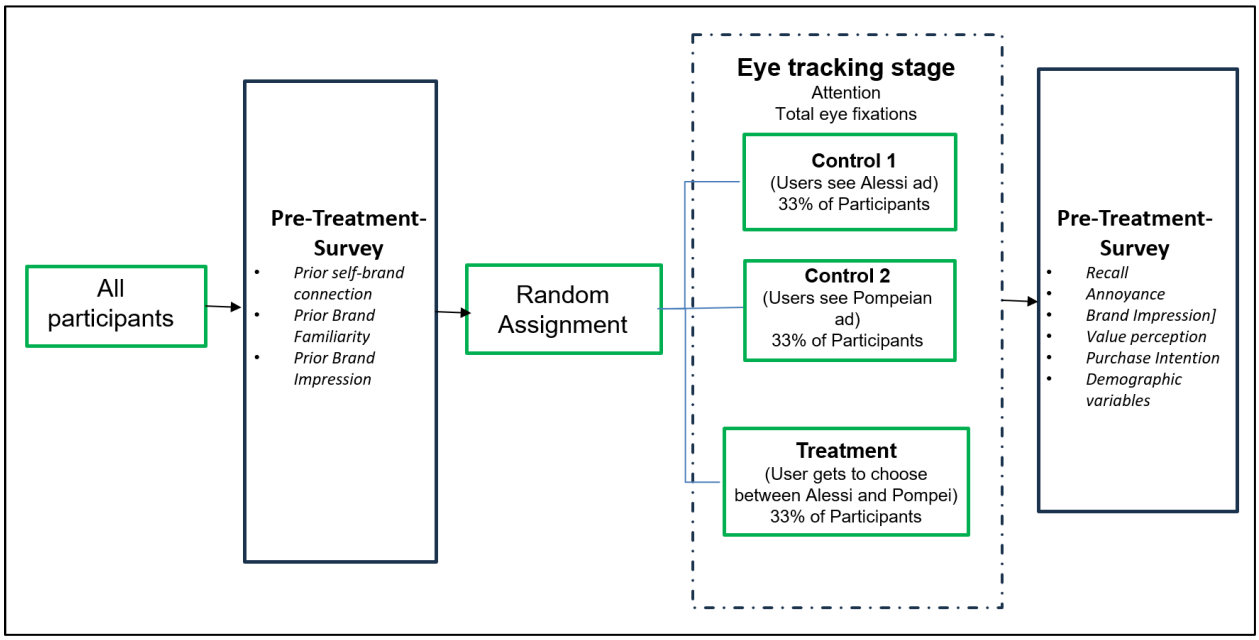
Three hundred participants were recruited from Prolific, with the promise of a nominal payment, to participate in a between-subjects design. These participants were randomized into one of three conditions: control condition 1, control condition 2, or treatment. All participants viewed the same 4-minute travel video about Venice hosted on a large university's private video platform, allowing us to insert our preselected ads into the video. Since this was the university's private platform, outside advertisers were not allowed. The video was interrupted by a 15-second ad at the 2:00-minute mark. To ensure that participants viewed the video in its entirety, the play and pause controls were disabled.

Two olive oil brands that had aesthetically similar YouTube ads were chosen. Participants in control condition 1 saw an ad featuring the popular olive oil brand Pompeian (we refer to this as Ad_1), while those in control condition 2 saw an ad featuring Alessi, another popular olive oil brand (Ad_2). In contrast, participants in the treatment condition were prompted to choose between the two ads via a video overlay interface (see Figure 4). As shown in the flowchart in Figure 1, all participants completed a pre-treatment survey, an eye-tracking study, and a post-treatment survey.

4.1.1 *Pre-Treatment Survey*

All participants responded to survey items measuring their perceptions of the two brands appearing in the advertisements. The two focal brands were presented along with three decoy brands in random order. Participants responded to items measuring *Prior Brand Familiarity*, *Prior Brand Perceptions*, and *Prior Self-Brand Connection* (see Section 5.4 for details). Recognizing that having control over what ad content one sees may be an entirely novel experience for some participants, potentially yielding novelty effects, we presented all subjects with an initial message explaining standard (i.e., forced) advertisements and the idea of ad content choice (as in Figure 2). Participants were then randomly assigned to their experimental condition and taken to the eye-tracking platform.

Figure 1. Study 1: Experiment Design



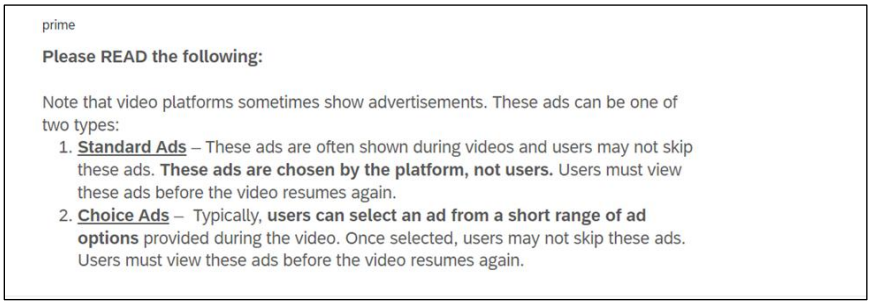
4.1.2 *Eye-tracking component*

We used Real Eye to record participants' eye gaze data while viewing the travel video, which integrated the video ad. Real Eye captures gaze data using the online participant's webcam and provides attention metrics such as the number of eye fixations on the video. As shown in Panel A of Figure 3, in both the control conditions, participants were notified via a countdown timer that an ad was about to be displayed; they could not choose the advertisement. An on-screen timer of this sort is a common feature of video streaming platforms, including YouTube and Hulu (Schoon 2023).

In contrast, participants in the treatment condition were prompted to choose between the two ads via a video overlay interface (see Figure 4). A countdown timer notified that they were about to be presented

with an ad choice (see Panel B, Figure 4). Following this, the choice options, Ad_1 and Ad_2, were displayed for 15 seconds (see Panel C, Figure 4), allowing the participant to enter their selection. If participants did not choose either ad, they were shown Ad_1[1] (however, most participants made an active choice, as reported in Section 5.6.2). The travel video continued to play while the choice message was displayed, and the choice was made. At the 2:00-minute mark, the chosen ad was displayed. In all the experimental conditions, the travel video resumed playing from the 2:00 minute mark following the advertisement.

Figure 2. Study 1: Message Shown to All Participants



4.1.3 *Post-Treatment Survey*

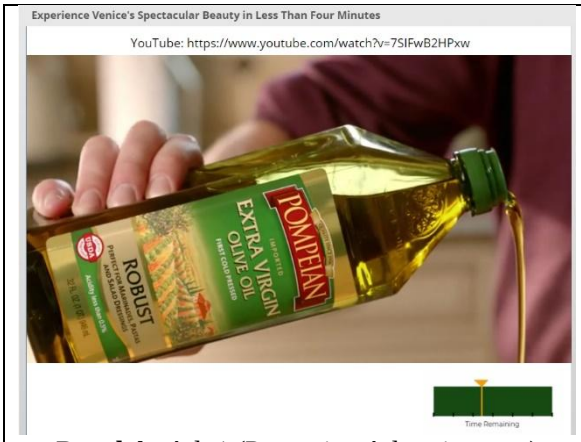
Participants responded to items related to their video-viewing experience (*Annoyance*) and attitudes toward the advertised brand and product (*Brand Impression*, *Value Perception*, and *Purchase Probability;* see Section 5.3 for details). Finally, demographic information (*Age*, *Gender*, *Race*, *Education Level*) was also collected.

4.2 Independent Variables

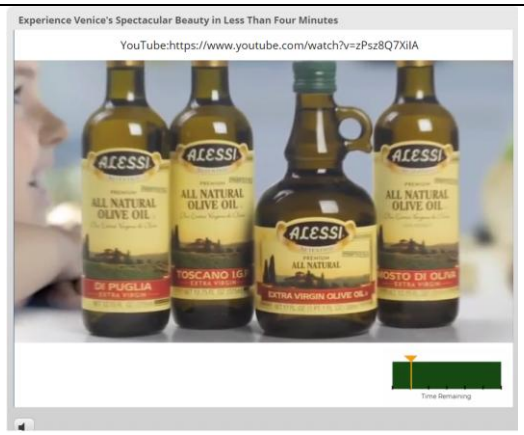
The key independent variable of interest is *AdChoice*, a binary indicator of whether a participant was randomly assigned to a treatment condition (*AdChoice* = 1) or control (*AdChoice* = 0). In Study 1, the treatment refers to a choice over ad content, reflected by the subscript 'content,' i.e., $AdChoice_{Content}$**.** Note that in Study 2 (Section 6), the treatment refers to control over ad timing, i.e., $AdChoice_{Timing.}$

[1] We found a split of 51-40 among the advertisements watched. This argues against any selection issues.

Figure 3. Study 1: Screenshots of Ads

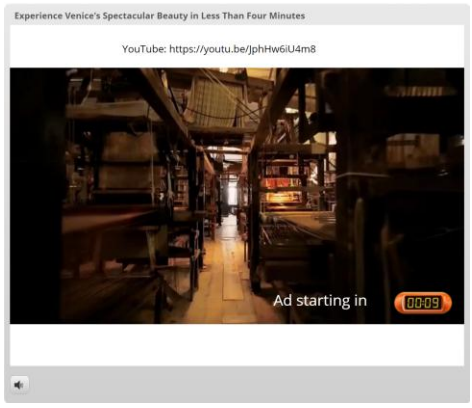


Panel A: Ad_1 (Pompeian Advertisement)



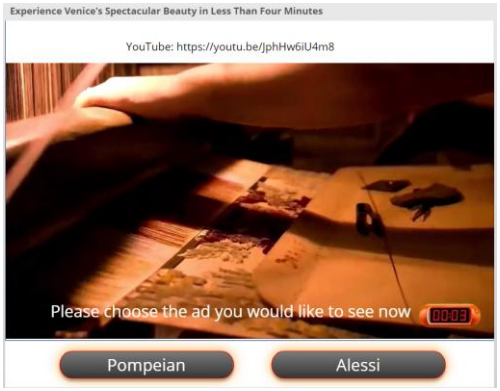
Panel B: Ad_2 (Alessi Advertisement)

Figure 4. Study 1: Screenshots of Message Alerts



Panel A: Ad Reminder (Control Condition)

Panel B: Ad Reminder (Treatment Condition)



Panel C: Ad Choice Condition

4.3 Dependent Variables

Table A1 in the Online Appendix A reports the survey items we employ across the two studies.

4.3.1 *Attention*

To measure consumers' attention, we employ Real Eye[2], a remote eye-tracking service used extensively in prior research (Menges et al. 2018, Williams et al. 2023, Federico et al. 2023).[3] Previous research has shown that higher eye fixations represent a greater accumulation of information and imply greater attention (Wedel and Peters 2000). This attention is a measure of advertisement involvement. A higher level of cognitive involvement is more likely to result in a more enduring memory (Petty and Cacioppo 1986). *Attention* reflects the total number of recorded eye fixations for a given participant, reported by our eye-tracking software. We specifically consider eye fixations associated with the portion of the screen in which the advertisement was displayed.

4.3.2 *Annoyance*

Annoyance measures a participant's negative reaction to an advertisement (Quick and Stephenson 2007). Participants responded to statements such as, "I found the advertisement to be:" distracting, irritating, disturbing, intrusive, disruptive, and annoying.

4.3.3 *Ad Recall*

The measure, *Ad Recall,* captures the participant's ability to recall the advertised brand following prior literature (Aaker 1992, Walsh 2008). This value is measured based on a survey item: "Which brand was featured in the advertisement you saw? Please select from the options below." There was a total of 7 brands: 1 correct and 6 incorrect brands, that participants had to choose from. Please see Table A1 in the Online Appendix A for more details.

4.3.4 *Brand Impression*

Often, an advertisement aims to improve attitudes toward the advertised brand or product. By generating positive attitudes, an advertisement can create a halo effect for the advertised brand and product (MacKenzie et al. 1986). Our measure of *Brand Impression* reflects whether the participant had a positive or negative impression of the brand (Mitchell 1986). The measure is based on a combination of survey items assessing their overall impression of the brand shown in the advertisement, including their liking for it and its reputation (Miniard et al. 1990). Please refer to the measures in Table A1, Online Appendix A for details.

4.3.5 *Value Perception*

Advertisements can influence consumers' perception of brand value. Ads that are evaluated favorably can

[2] https://www.realeye.io/
[3] https://www.realeye.io/for-education

enhance brand perceptions (Mitchell 1986). By generating emotional connections with the brand, advertisements aim to enhance the perceived value of the advertised brand (Otamendi and Sutil Martin 2020). Negative emotions stemming from perceptions of ad annoyance can reduce the brand's perceived value (Goldstein et al. 2014). Thus, it is necessary to gauge how advertising interventions affect a brand's perceived value. *Value Perception* relates to the participant's assessment of the product's value and purchase worthiness, measured using the items in Table A1, Online Appendix A.

4.3.6 *Purchase Probability*

Purchase probability refers to the likelihood that a participant would consider purchasing the product after viewing the advertisement. Our measure of *Purchase Probability* is based on a survey item adapted from Chattopadhyay and Basu (1990), as shown in Table A1, Online Appendix A.

4.4 Controls

4.4.1 *Prior Self-Brand Connection*

Self-brand connection refers to how individuals integrate a brand into their self-concepts, creating a meaningful and personal bond (Escalas and Bettman 2003). This construct reflects the degree to which consumers identify with a brand. A self-brand connection can strengthen a consumer's involvement with and enjoyment of an advertisement, indirectly influencing their attitude. Consumers with a strong self-brand connection may develop more favorable attitudes toward advertisements because of their positive association with the brand. When consumers perceive their values and identity reflected in a brand's advertising, they are more likely to respond positively to those advertisements. As such, we need to control for a consumer's SBC to isolate the effects of ad choice treatments. We measure *Prior Self-Brand Connection (SBC)* by employing the set of survey items proposed by Escalas and Bettman (2003).

4.4.2 *Prior Brand Familiarity and Prior Brand Impression*

Brand familiarity and preexisting attitudes toward brands influence consumer decision-making. For example, consumers are more likely to purchase from brands they recognize (Thoma and Williams 2013). Accordingly, controlling for a consumer's prior familiarity and impression of the brand is necessary to isolate the causal impact of advertising interventions from the effects of pre-existing attitudes or differences in brand popularity. We capture *Prior Brand Familiarity* and *Prior Brand Impression* employing survey items adapted from prior literature (Mitchell 1986, Miniard et al. 1990) including "Do you recognize this brand?", "How much do you like the brand shown in the ad?", "I feel the brand has a good reputation", and "I can trust the brand."

4.4.3 *Demographic Measures*

We also control for demographic features, including *Age*, *Gender*, *Race*, and *Education Level*.

4.5 Empirical Approach

The data in our samples is generated via controlled experiment. To identify the causal impact of providing a participant with control over ad content, we conduct a series of regressions on the resulting data. We first regress our *Attention* and *Annoyance* outcomes on the *AdChoice* dummy, including controls, employing OLS regression, as reflected by Equation (1):

$$Y = \alpha + \beta_1 AdChoice + \beta_2\ Controls\ + \epsilon_Y \quad (1)$$

As noted earlier, *AdChoice* is a dummy indicator of treatment assignment. *Controls* refers to all control variables noted earlier, including *Prior Brand Familiarity*, *Prior Self-Brand Connection*, *Prior Brand Impression*, and demographic information, including *Age*, *Gender*, *Race*, and *Education Level*. Finally, ϵ_Y is the idiosyncratic error term. Subsequently, we conduct a series of moderation tests, employing the causal mediation framework of Tingley et al. (2014), as reflected by Equations (2) and (3):

$$M = \alpha + \beta_1 AdChoice + \beta_2 Controls + \epsilon_M \quad (2)$$

$$Y = \gamma + \beta_3 M + \beta_4 AdChoice + \beta_5 Controls + \epsilon_Y \quad (3)$$

Here, *M* refers to one of two possible mediator variables (*Attention* or *Annoyance*), and *AdChoice* again reflects treatment assignment. In these models, we consider a host of outcomes, including *Ad Recall*, *Brand Impression*, *Purchase Intention*, and *Value Perception*.

Our causal mediation tests recover a series of parameters, namely the Average Causal Mediation Effect, or ACME, the Average Direct Effect, or ADE, and the Total Effect, or TE (Tingley et al. 2014). The ACME represents the effect of the treatment variable on the outcome via mediating variable *M*. The ADE represents the direct, unmediated effect of the treatment variable on the outcome. Finally, TE represents the overall effect of *AdChoice* on the outcome, the net of the direct and mediated effects.

In our mediation analyses, we test the mediating roles of *Attention* and *Annoyance* in the broader effect of *AdChoice* on *Recall* and consumer attitudes (*Brand Impression*, *Value Perception*, and *Purchase Probability*). As discussed in Section 3.1, it is intuitive that an increase in attention, i.e., the number of eye fixations, to the ad could result in an increase in recall of the advertised product. However, it is not apparent whether any increase in attention will lead to changes in various other consumer attitudes and perceptions of interest. Consider, for example, that consumers may pay attention to ads that they find annoying, e.g., Goldstein et al. (2014).

4.6 Results

Of the 300 participants recruited, 21 failed to complete all survey items and were thus removed from the sample (12 from the control conditions and 9 from the treatment group). Notably, the likelihood that participants failed to complete the survey was balanced across conditions. Approximately one-third of participants (N=91 or 32.5%, Mean Age = 41.37, SD = 14.57) were assigned to the treatment group, while the remaining two-thirds (N=188 or 67.4%, Mean Age = 40.54, SD = 13.25) were assigned to one of the two control conditions. 55.19% of the sample identified as male, 42.29% as female, and the remaining 2.50% did not specify a gender. Table 2 reports the descriptive statistics for our focal variables, contrasting the treatment group with the pooled control conditions. We evaluated the efficacy of randomization via a series of *t*-tests comparing the pooled control and the treatment condition on various dimensions. None of the tests revealed statistically significant differences in means.

4.6.1 *Attention*

We report the effect of $AdChoice_{Content}$ on *Attention* in Table 3. The results reveal that allowing consumers to choose which ad they see increased their attention toward viewed advertisements. Specifically, as reported in Column 1 of Table 3, $AdChoice_{Content}$ had a significant positive effect on *Attention* ($\beta = 11.37$, $p < .05$) controlling for prior brand familiarity, brand connection, and demographics. This result suggests that receiving control over ad content increases the number of eye fixations by approximately 11 (an increase of 9% relative to the no-choice control group), in line with hypothesis H1 that consumer control will increase their attention to the advertisement. We find a similar positive effect of $AdChoice_{Content}$ on *Attention* when we condition on the ad a user ultimately viewed, via an ad dummy (see Column 2 of Table 3).[4] Note controlling for *Prior Brand Familiarity* and *Prior Brand Connection* can help mitigate potential biases due to pre-existing brand preferences.

4.6.2 *Annoyance*

The results indicate that control over ad content also reduces consumer annoyance, consistent with H2. Specifically, as reported in Column 3 of Table 3, $AdChoice_{Content}$ had a significant negative effect on *Annoyance* ($\beta = -0.607$, $p < .10$), equivalent to a 16.72% decline relative to the control group. This result again persists when we incorporate a dummy indicator for the ad an individual viewed (see Column 4 of Table 3), further supporting H2 that consumer control will reduce annoyance with ads.

[4]We found a split of 51-40 among the advertisements watched. This argues against any selection issues.

Table 2. Study 1: Ad Choice over Content: Descriptive Statistics

	Treatment (N=91)	**Pooled Control (N=188)**	**t-Test**	***p***
Attention	116.43 (38.23)	107.08 (43.53)	1.829	0.068
Annoyance	3.19 (2.53)	3.63 (2.55)	-1.358	0.18
Recall (proportion correctly recalled)	0.96	0.90		
Brand Impression	6.89 (1.90)	6.72 (1.52)	0.746	0.46
Purchase Probability	6.63 (2.28)	6.32 (2.11)	1.091	0.28
Value Perception	6.99 (1.76)	6.87 (1.45)	0.564	0.57
Controls:				
Prior Brand Familiarity (Brand 1)	3.56 (2.91)	3.68 (2.98)	-0.320	0.75
Prior Brand Familiarity (Brand 2)	2.28 (2.17)	2.05 (2.02)	0.849	0.40
Prior Brand Impression (Brand 1)	4.44 (1.94)	4.60 (1.99)	-0.640	0.52
Prior Brand Impression (Brand 2)	3.94 (2.03)	3.92 (1.83)	0.080	0.94
Prior SBC (Brand 1)	3.20 (1.93)	3.36 (2.01)	-0.640	0.52
Prior SBC (Brand 2)	3.03 (1.90)	2.67 (1.69)	1.537	0.13
Age	41.37 (14.57)	40.54 (13.25)	0.459	0.65
Gender:				
Male	63.74%	51.06%,	55.19%	
Female	35.16%	45.74,	42.29%	
Other	1.1%	3.19%	2.50%	
Race:				
White				
Black/African American	78.02%	74.47%	72.51%	
American Indian/Alaskan	6.59%	10.64%	8.93%	
Native	0.00%	1.06%	0.69%	
Asian	9.89%	6.91%	7.56%	
Native Hawaiian/Pacific	2.20%	2.66%	2.41%	
Islander	3.30%	4.26%	3.78%	
Other				
Education Level:				
CHD	68.08%,	70.32%,	68.9%	
LCD	31.91%	29.67%	31.1%	

Note: Standard deviations reported in parentheses, M = Male, F = Female, O = Other, CHD = College Degree and higher, LCD = Lower than college degree.

Table 3. Study 1: Effect of Ad Choice Content on Attention and Annoyance

	(1) *Attention* (OLS)	(2) *Attention* (OLS FE)	(3) *Annoyance* (OLS)	(4) *Annoyance* (OLS FE)
$AdChoice_{Content}$	10.330**	11.370***	-0.607**	-0.570**
	(5.528)	(5.528)	(0.323)	(0.325)
constant	102***		3.903***	
	(13.620)		(0.796)	
Controls:				
Prior Brand Familiarity (Brand 1)	-1.951	-1.768	0.157*	0.163**
	(1.394)	(1.391)	(0.082)	(0.082)
Prior SBC (Brand 1)	3.519	3.803	-0.279*	-0.269*
	(2.724)	(2.715)	(0.159)	(0.159)
Prior Brand Impression (Brand 1)	1.424	1.133	-0.184	-0.194
	(2.773)	(2.763)	(0.162)	(0.162)
Prior Brand Familiarity (Brand 2)	-0.033	-0.129	-0.207*	-0.2104*
	(1.765)	(1.757)	(0.1032)	(0.1032)
Prior SBC (Brand 2)	-1.686	-2.304	0.322*	0.300*
	(3.045)	(3.047)	(0.178)	(0.179)
Prior Brand Impression (Brand 2)	-1.657	-1.221	0.076	0.091
	(2.630)	(2.627)	(0.154)	(0.154)
Age	-0.143	-0.117	-0.0235*	-0.0226*
	(0.193)	(0.192)	(0.0113)	(0.0113)
Race	0.070	0.042	0.012	0.011
	(0.151)	(0.151)	(0.009)	(0.009)
Gender	0.703	0.082	-0.014	-0.036
	(4.802)	(4.789)	(0.281)	(0.281)
Education Level	2.736	2.353	0.329***	0.316***
	(1.987)	(1.987)	(0.116)	(0.117)
Ad Fixed Effects	No	Yes	No	Yes
Observations	279	279	279	279
R^2	0.036	0.049	0.106	0.110
Within R^2	--	0.038	--	0.099

Note: Signif. codes: '***' < 0.01, '**' < 0.05, '*' < 0.1. Standard errors in parenthesis. Fixed Effects models estimate intercepts; however, they are not reported for brevity.

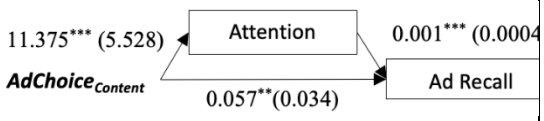
4.6.3 *Ad Recall*

We test hypothesis H3 that ad choice will increase attention and, thereby, *Ad Recall*, employing causal mediation analysis. We utilize the 'mediation' package in R for this purpose (Tingley et al. 2014), employing 5,000 bootstrap iterations. We first examine the indirect effect of $AdChoice_{Content}$ on *Ad Recall* via *Attention* and find a significant indirect effect ($\beta = .014$, $p < .10$). These results, shown in Panel A of Table 4, support H3.

Table 4. Study 1: Mediation Analyses of The Impact of Ad Content Choice

Panel A

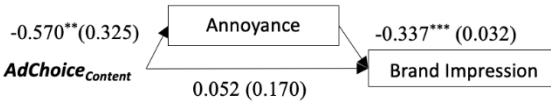
Mediator: Attention
DV: Ad Recall



	Estimate	95% CI Lower	95% CI Higher	*p*-value
ACME	0.014	0	0.04	0.040**
ADE	0.05	-0.004	0.12	0.070*
TE	0.07	0.009	0.13	0.023 **
PM	0.186	-0.012	0.95	0.068*

Panel B

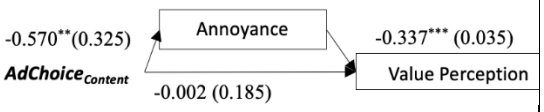
Mediator: Annoyance
DV: Brand Impression



	Estimate	95% CI Lower	95% CI Higher	*p*-value
ACME	0.194	-0.021	0.42	0.075*
ADE	0.05	-0.336	0.43	0.801
TE	0.243	-0.182	0.66	0.272
PM	0.623	-4.626	0.96	0.273

Panel C

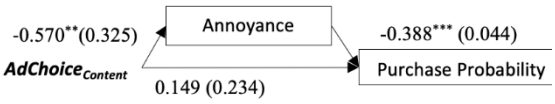
Mediator: Annoyance
DV: Value Perception



	Estimate	95% CI Lower	95% CI Higher	*p*-value
ACME	0.169	-0.023	0.37	0.087*
ADE	0.031	-0.354	0.42	0.876
TE	0.199	-0.222	0.63	0.356
PM	0.577	-6.172	6.15	0.354

Panel D

Mediator: Annoyance
DV: Purchase Probability



	Estimate	95% CI Lower	95% CI Higher	*p*-value
ACME	0.222	-0.032	0.49	0.080*
ADE	0.15	-0.334	0.64	0.55
TE	0.372	-0.187	0.9	0.17
PM	0.534	-2.455	4.19	0.19

Note: ACME = Average Causal Mediated Effect, ADE = Average Direct Effect, TE = Total Effect, PM = Proportion Mediated. Signif. codes: '***' < 0.01, '**' < 0.05, '*' < 0.1. Standard errors in parenthesis.

4.6.4 *Brand Impression*

Next, we examined the *Annoyance*-mediated effects of $AdChoice_{Content}$ on *Brand Impression* to test hypothesis H4. Once again performing a causal mediation analysis (see Panel B of Table 4) with 5,000 bootstrap iterations, we observe a significant indirect effect of $AdChoice_{Content}$ on *Brand Impression* via *Annoyance* ($\beta = 0.075$, $p < .10$), supporting H4 that consumer control will reduce annoyance with ads, increasing consumer attitudes toward the advertised brand.

4.6.5 *Value Perception*

To test H5 that ad choice reduces *Annoyance*, leading to an increase in *Value Perception* for the brand advertising the product, we investigate the indirect effect of $AdChoice_{Content}$ on *Value Perception* via

Annoyance. As reported in Panel C of Table 4, a causal mediation analysis with 5,000 bootstrap iterations yielded a significant indirect effect of $AdChoice_{Content}$ on *Value Perception* via *Annoyance* ($\beta = .22$, $p < .10$). These results provide support for H5.

4.6.6 *Purchase Probability*

To test H6 that ad choice reduces annoyance leading to an increase in the probability to purchase the advertised product, we investigate the indirect effect of $AdChoice_{Content}$ on *Purchase Probability* via *Annoyance*. As reported in Panel D of Table 4, the causal mediation analysis with 5,000 bootstraps reveals that a significant indirect effect of $AdChoice_{Content}$ on *Purchase Probability* via *Annoyance* was significant ($\beta = 0.16$, $p < 0.10$). These results provide support for H6.

4.7 Robustness

4.7.1 *Estimating the Local Average Treatment Effect of Ad Content Choice*

In this section, we employ a LATE framework to address a key challenge in interpreting the causal effects of $AdChoice_{Content}$: the potential for non-compliance. As mentioned earlier in Section 1 page 2, the freedom to choose is likely to induce demand on participants' cognitive resources to process the choice information and decide. As such, there is a potential that some participants find this additional demand burdensome and thus may not want to make a choice, i.e., they do not wish to comply with the ad choice treatment. Non-compliant participants would not exercise their choice by clicking on one of the options presented; instead, they would consume the ad presented to them by the system. In contrast, compliers would change their behavior in response to the treatment (i.e., they would exercise their choice when given the freedom to do so). Thus, the true effect of treatment on outcomes such as attention and annoyance could be biased by non-compliers.

To overcome estimation biases introduced by potential non-compliance and estimate the effect of treatment for compliers, i.e., who make a choice when given the freedom to do so, we utilize the framework introduced by Imbens and Angrist (1994). Specifically, we aim to estimate the local average treatment effect (LATE), the effect of treatment for compliers, of ad choice on our key outcomes, *Attention* and *Annoyance*. In this context, we can interpret equation 1, specified earlier controlling for ad fixed effects, as the reduced form effect of being given the freedom to choose the ad content. Here, coefficient of treatment β_1 (the intention to treat or ITT) is the average effect on the outcome for those assigned to treatment (those who had the freedom to choose) minus the average of those assigned to control (those who did not have the freedom to choose).

$$ITT: DV = \beta_1 Treatment + \beta_2 Covariates + \beta_3 Ad\ Fixed\ Effects$$

The ITT does not account for the proportion of the group that actually complied with the treatment. We

account for the proportion of compliers by estimating Equation 4 as follows:

$$choice\_exercised = \delta_1 Treatment + \delta_2 Covariates + \delta_3 Ad\ Fixed\ Effects \quad (4)$$

choice_exercised is a binary variable indicating whether the participant exercised a choice by clicking on an option (*choice_exercised* = 1) or did not (*choice_exercised* = 0). Regressing *choice_exercised* on the treatment allows us to capture the effect of treatment on inducing compliance. We also include demographic covariates and fixed effects for the ad options presented, since they are likely to influence participants' decisions about whether to comply with the treatment and choose a particular ad option. Following Finkelstein et al. (2012), we can interpret the ratio of the coefficients β_1 (from equation 1 specified earlier) and δ_1 (from equation 4) as the local average treatment effect (LATE). The LATE identifies the causal impact of freedom to choose among the subset of individuals who would exercise a choice on being given the freedom to choose and would not exercise a choice without being given the freedom to choose (i.e. the compliers).

We leverage participants' screen recordings to identify compliers and estimate the LATE. Specifically, we analyze each screen recording and identify whether participants who had the freedom to choose (treatment group) actively selected an ad content by clicking on one of the presented options. If a participant clicked on a choice, it indicates compliance, meaning they were influenced by the freedom to choose. If a participant did not click an option despite being given the freedom to do so, it indicates non-compliance. This approach allows us to distinguish between participants who exercised their choice and those who did not, refining our estimate of the treatment effect. We present our LATE estimates next. Please refer to Table A5 in Online Appendix A for all the ITT and LATE estimates.

The LATE analyses revealed a significant effect of $AdChoice_{Content}$ on *Attention* (LATE = 14.28, SE = 6.59, z = 2.17, p = .03), suggesting that participants who exercised their choice paid significantly more attention to the ads compared to those who did not, indicating that providing the freedom to choose ad content enhanced consumer attention. (We apply the Delta Method to estimate standard errors for these estimates (Wooldridge 2002)). Moreover, the estimated LATE for *Annoyance* was significant (LATE = -0.72, SE = 0.39, z =−1.82, p = .068), suggesting that participants who exercised their choice when given the freedom to choose experienced less annoyance relative to those who were not given a choice or did not exercise their choice. In summary, the LATE estimates indicate that participants who exercised their choice in the treatment group (the compliers) showed significantly greater attention to the ads and experienced lower levels of annoyance.

4.7.2 *BH Correction*

Since we have performed multiple hypotheses tests, we implemented the Benjamini-Hochberg (BH) correction procedure, to account for false discovery rate (FDR). Table A3 in Online Appendix A shows

the current *p*-values and the adjusted *p*-values for all our hypotheses. As can be seen, all our results and conclusions persist following that correction.

4.7.3 *Randomization Inference*

To further assess the robustness of the effect of the ad choice treatment on our key outcome variables, we employed randomization inference. Randomization inference is a non-parametric technique that leverages the random assignment of treatments to evaluate whether the treatment effect is zero for each participant, providing exact, empirical *p*-values by comparing the observed test statistic, such as the regression coefficient in a regression of the outcome on treatment and controls, to a distribution generated through repeated random shuffling of the treatment vector (Heß 2017, Young 2019). Unlike conventional methods that rely on large-sample approximations, this approach relies on variation due to randomized assignment in the experiment.

To implement this test, we first estimated the observed treatment effect by fitting Equation 1 and extracted the observed coefficient of $AdChoice_{Content}$, the effect of treatment on the outcome. We then created a function to shuffle the treatment assignments, re-estimate the model, and extract the coefficient of $AdChoice_{Content}$. This permutation process was repeated 10,000 times to generate a distribution of the coefficient under the null hypothesis of no treatment effect (that the coefficient of $AdChoice_{Content} = 0$). Finally, we compared the observed coefficient to the distribution of coefficients observed under the null (alternative permutations of the treatment vector), to calculate an empirical *p*-value. We report the observed treatment effect (from fitting Equation 1) and the associated randomization inference *p*-values for each of our outcome variables next.

For the outcome variable *Attention*, the observed treatment effect was 11.37. The randomization inference *p*-value was .041, indicating that the estimated effect observed in the true data was more extreme than ~96% of values obtained under the null. For *Annoyance*, the observed treatment effect was -0.57, with a randomization inference *p*-value of 0.0786, indicating significance at the 10% level.

4.7.4 *Bootstrap Standard Errors*

In our ANOVAs, we examine the direct effect of $AdChoice_{Content}$ on *Attention* and *Annoyance* (Table 3). To test the robustness of our results, we next estimate our focal direct effect using 5,000 bootstrap iterations and check if the results hold. Table 5 shows the 95% confidence intervals after running the bootstrapping procedure, and the corresponding *p*-values. As shown in Table 5, all results remain consistent.

Table 5. Study 1: Bootstrapped Estimates of Direct Effects

Effect	Original *p*-value	Bootstrapped Estimates		
		95% CI-Low	95% CI High	*p*-value
Impact of $AdChoice_{Content}$ on *Attention*	0.030	1.41	21.85	0.0252
Impact of $AdChoice_{Content}$ on *Annoyance*	0.068	-1.2172	0.0310	0.0668

4.8 Discussion

Study 1 explored the effects of one type of choice architecture: allowing consumers to choose *which* ad they will view in an online video streaming context. The findings supported our hypotheses, demonstrating the potential of choice over ad content to enhance ad effectiveness and the user experience. Study 1 showed that consumer control over content can increase attention to a viewed ad and reduced ad annoyance, increasing brand recall, value perceptions, and purchase intentions.

Despite these advantages, ceding control to consumers over which ads they view comes with various implementation challenges, as discussed in Section 1. First, platforms typically have a limited ad schedule, limiting the ad options they can provide. Second, although some platforms may have large ad selections, if most consumers systematically select one ad over others, it places undue monetary pressure on one advertiser to pay for impressions/clicks/actions while reducing the incentive for other advertisers (as their ads aren't viewed as much). Third, if several ads are to be displayed, ad choices would demand active participation from consumers, which consumers may view as additional demands on their time, effort, and attention. In contrast, allowing consumers to choose the timing of their advertisement exposure, e.g., at the beginning versus in the middle of a video, can offer some degree of control to consumers while avoiding these implementation challenges. Thus, in Study 2, we build on the initial study by investigating the effect of a second type of choice architecture: allowing consumers to choose *when* ads will be displayed.

5 STUDY 2: CHOICE OVER AD TIMING

Study 2 investigates a novel ad choice intervention, ad choice over timing. Allowing consumers to choose the timing of the ads can have several advantages over ad content choices. For instance, publishers can show ads from multiple advertisers to minimize ad repetition and control ad exposure levels. However, prior research has not investigated its potential. Study 2 thus aims to contribute to this critical gap. In addition, this experiment aims to (1) investigate ad choice in a real-world setting (YouTube channel of a large university), (2) incorporate a variety of ads, which would aid in assessing the generalizability of the results, and (3) uncover the underlying mechanism.

5.1 Participants and Procedure

We recruited 1,000 participants from Prolific for a between-subjects experiment with two experimental conditions: a control and a treatment. The study consisted of a pre-treatment survey, an eye-tracking component, and a post-treatment survey, like Study 1. After completing the pre-treatment survey (measures are similar to Study 1), participants were randomized into control or treatment conditions, redirected to Real Eye for eye tracking, and finally, to the post-treatment survey. Different from Study 1, however, participants in the control condition were further randomized into one of two ad timing conditions: Before or During. In the Before group, participants viewed two 15-second ads sequentially before viewing the 4-minute travel video from Study 1. In the During group, participants viewed two 15-second ads inserted at different points in the travel video, one at the 1:30 minute mark and the second at the 2:30 minute mark.

In the Treatment condition, participants were further randomized into one of two ad choice default conditions (Before or During) and allowed to choose when to see the ads (i.e., view the ads before or during the video). Specifically, in the Before (During) default condition, the Before (During) option was preselected for users (Figures B6 and B7 in Online Appendix B present snapshots of the exact messages). The ad default design serves as a tool to explicate whether the participant exercised a choice by changing from the preselected default to another option (we use this variation to identify the local average treatment effect in Section 5.3.1). Participants in the treatment condition were required to select either "Before" or "During" before watching the video (please see Figures B5, B6, and B7 in Online Appendix B). The ad choice options were not displayed on the video.

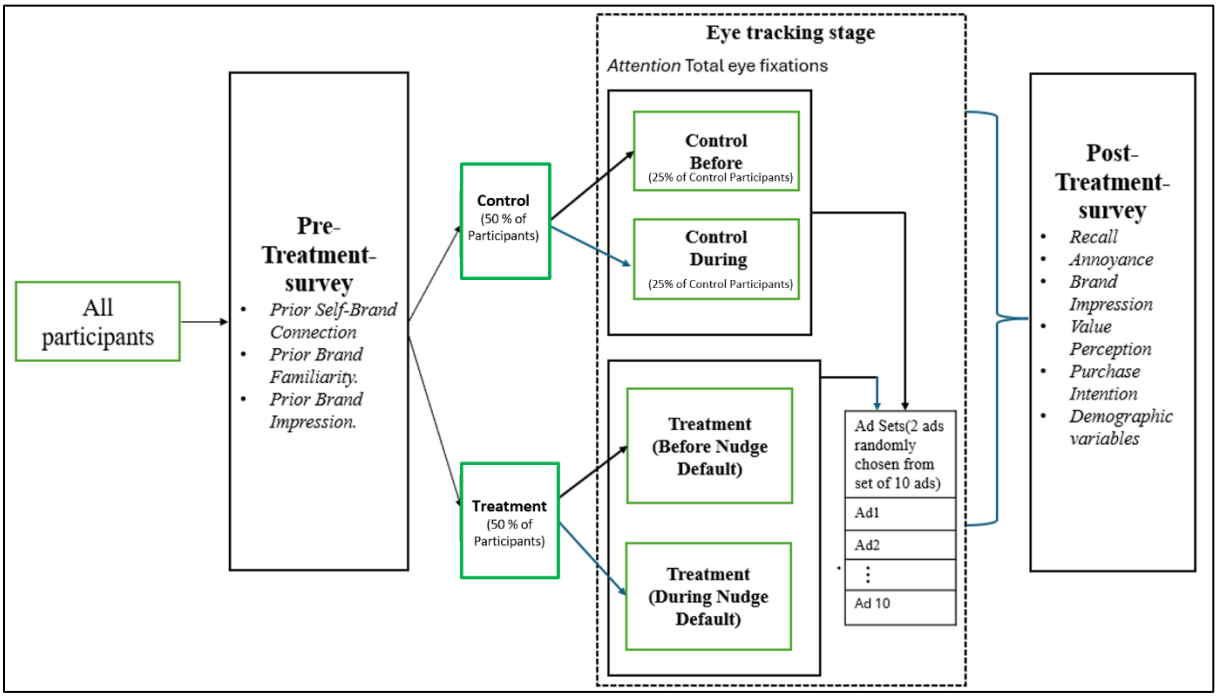
In all conditions, the two advertisements were selected randomly from a pool of ten ads representing various industries, brands, and products to eliminate any potential bias issues related to the chosen brands (see Table A2 in the Online Appendix A for a complete list of ads). Additionally, the display order for each pair of ads was randomized to overcome any possible order effects. Online Appendix B reports screenshots of the ads (Figures B1 and B2 show two ads played sequentially before the travel video, while Figures B3 and B4 show ads played during the video, at 1:30 and 2:30 minutes, respectively).

Once participants had completed the pre-treatment survey and been randomized into control or treatment conditions, they were redirected to Real Eye, where their eye gaze data was recorded as they watched the travel video. The video in Study 2 was hosted on YouTube to achieve greater external validity. Eighty variants of the travel video (embedding different combinations of ads shown before or during) were created in advance and uploaded to a private YouTube channel operated by a large university's marketing team (see Figures B1 to B4 in Online Appendix B). Using a popular YouTube channel was necessary as only those channels with more than 1,000 subscribers can disable YouTube ads displayed by the platform[5].

[5] https://www.forbes.com/sites/johnkoetsier/2020/11/18/youtube-will-now-show-ads-on-all-videos-even-if-creators-dont-want-them/

Disabling YouTube ads allowed us to monitor and control ad exposure ourselves. Since the ads were embedded into the travel video and the information overlays were created to resemble YouTube, our participants had a YouTube-like experience, where the ads we created felt like actual ads on the platform. Participant behavior on YouTube was not restricted, replicating an authentic field environment. Following the assignment of a video, participants were at liberty to utilize the platform in any way they desired. Upon completion of eye tracking, the experiment automatically progressed to the post-treatment survey. Figure 5 shows the experiment design.

Figure 5. Study 2: Experiment Design



5.2 Results

Of the 1000 responses received, 9 participants were removed due to incomplete post-survey responses. Out of the 991 participants, 489 belonged to the control group (mean Age = 40.34, SD = 13.07), while 502 belonged to the treatment group (mean Age = 40.10, SD = 13.30). 49.44% of the sample identified as male, 48.73% as female, and the remaining 1.81% did not specify a gender. The descriptive statistics of our focal variables are reported in Table 6. Like Study 1, The OLS regressions and mediation analyses reported here control for participant demographics and pre-treatment brand perceptions. The focal independent variable is $AdChoice_{Timing}$, a categorical variable indicating whether the participant was in the treatment ($AdChoice_{Timing} = 1$) or control ($AdChoice_{Timing} = 0$) conditions.

5.2.1 *Attention*

Study 2 results reveal that the choice of ad timing led to higher attention to the ad, as measured by eye tracking. As shown in Column 1 of Table 5, $AdChoice_{Timing}$ had a significant and positive effect on *Attention* ($\beta = 7.30$, $p < .001$), indicating that the ad choice increased eye fixations by approximately 7 fixations or 15.1% relative to the control condition. The results remain consistent after including fixed effects for the ads (see Column 2 of Table 7), supporting H1 that ad choice would increase the attention to the ad.

Table 6. Study 2: Descriptive Statistics

	Treatment (N = 502)	**Control (N = 489)**	**t-Test**	***p***
Attention	53.88 (25.74)	46.16 (24.54)	4.833	<.001
Recall (proportion correctly recalled)	0.82	0.81		
Annoyance	2.61 (1.83)	2.83 (2.04)	-1.786	0.074
Brand Impression	6.23 (1.44)	6.18 (1.52)	0.531	0.595
Purchase Probability	5.11 (2.19)	5.04 (2.26)	0.495	0.621
Value Perception	6.11 (1.56)	6.09 (1.63)	0.197	0.844
Controls:				
Prior Brand Familiarity (Brand 1)	0.86 (0.33)	0.90 (0.66)	-1.202	0.230
Prior Brand Impression (Brand 1)	5.48 (1.99)	5.61 (2.07)	-1.007	0.314
Prior Brand Familiarity (Brand 2)	0.69 (0.76)	0.62 (0.77)	1.440	0.150
Prior Brand Impression (Brand 2)	5.47 (2.09)	5.25 (2.11)	1.649	0.100
Prior SBC (Brand 1)	3.71 (2.46)	3.76 (2.44)	-0.321	0.748
Prior SBC (Brand 2)	3.03 (2.30)	3.23 (2.41)	-1.336	0.182
Age	40.10(13.30)	40.34 (13.07)	-0.287	0.775
Gender:				
Male	49.20%	49.6%		
Female	49.10%	48.41%		
Other	1.64%	1.99%		
Race:				
White				
Black/African American	74.23%	71.51%		
American Indian/Alaskan	8.99%	9.36%		
Native	0.81%	0.79%		
Asian	9.40%	10.95%		
Native Hawaiian/Pacific	0.20%	0%		
Islander	6.33%	7.56%		
Other				
Education Level:				
CHD	68.10%,	73.71%,		
LCD	31.90%	26.29%		

Note: Standard deviations reported in parentheses, M = Male, F = Female, O = Other, CHD = College Degree and higher, LCD = Lower than college degree.

5.2.2 *Ad Annoyance*

The results reveal that the ad choice decreased annoyance with the ad. As shown in Column 3 of Table 7, $AdChoice_{Timing}$ had a significant negative effect on *Annoyance* (β = -.23, p < .10), suggesting that the ad choice reduced annoyance by approximately .3 units or 8.1% relative to control. The results remain consistent after including fixed effects for the ads (see Column 4 of Table 5), supporting H2 that ad choice would reduce the annoyance associated with viewing ads.

Table 7. Study 2: Effect of Ad Timing Choice on Attention and Annoyance

	(1) *Attention* (OLS)	(2) *Attention* (OLS FE)	(3) *Annoyance* (OLS)	(4) *Annoyance* (OLS FE)
$AdChoice_{Timing}$	7.323***	7.507***	-0.226*	-0.229*
	(1.602)	(1.609)	(0.119)	(0.118)
Constant	50.710***		4.927***	
	(4.971)		(0.369)	
Controls:				
Prior Brand Familiarity (Brand 1)	-0.309	-0.566	0.153	0.015
	(1.534)	(1.812)	(0.114)	(0.133)
Prior Brand Familiarity (Brand 2)	-1.051	-0.665	-0.033	-0.177*
	(1.084)	(1.300)	(0.080)	(0.096)
Prior SBC (Brand 1)	-0.813*	-0.715	-0.006	-0.002
	(0.453)	(0.484)	(0.034)	(0.036)
Prior SBC (Brand 2)	0.272	0.277	-0.032	-0.033
	(0.432)	(0.468)	(0.032)	(0.034)
Prior Brand Impression (Brand 1)	-0.026	-0.315	-0.207***	-0.201***
	(0.526)	(0.557)	(0.039)	(0.041)
Prior Brand Impression (Brand 2)	-0.498	-0.290	-0.0883*	-0.0883*
	(0.464)	(0.489)	(0.0359)	(0.035)
Age	-0.047	-0.054	-0.019***	-0.019***
	(0.062)	(0.062)	(0.005)	(0.005)
Ethnicity	-0.057	-0.049	-0.006	-0.009
	(0.127)	(0.128)	(0.009)	(0.009)
Gender	-1.500	-1.406	-0.040	-0.032
	(1.482)	(1.496)	(0.110)	(0.110)
Education level	1.682**	1.707**	0.075	0.091*
	(0.660)	(0.668)	(0.049)	(0.050)
Ad Fixed-Effects	No	Yes	No	Yes
Observations	991	991	991	991
R^2	0.039	0.056	0.093	0.127
Within R^2	--	0.039	--	0.096

Note: Signif. codes: '***' < 0.01, '**' < 0.05, '*' < 0.1. Standard errors in parenthesis. Brand 1 refers to the brand in Ad 1, Brand 2 refers to the brand in Ad 2. Ad 1 was displayed prior to Ad 2.

5.2.3 *Ad Recall*

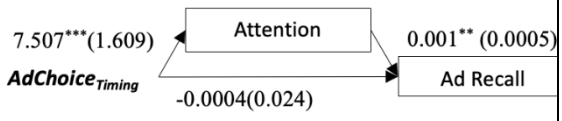
A mediation analysis reveals that the choice of ad timing increased ad recall and that this effect was

mediated by attention. The results of a causal mediation analysis with 5,000 bootstraps, reported in Panel A of Table 8, indicate that the indirect effect of $AdChoice_{Timing}$ on *Recall* via *Attention* was significant (β = .014, $p < .10$). These results support H3 that attention mediates the effect of ad choice on ad recall.

Table 8. Study 2: Mediation Analyses of The Impact of Ad Timing Choice

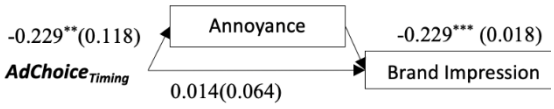
Panel A

Mediator: Attention
DV: Ad Recall



Panel B

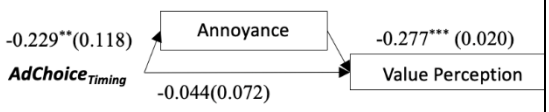
Mediator: Annoyance
DV: Brand Impression



	Estimate	95% CI Lower	95% CI Higher	*p*-value	Estimate	95% CI Lower	95% CI Higher	*p*-value
ACME	0.007	-0.0003	0.020	0.059*	0.052	-0.002	0.110	0.058*
ADE	-0.0003	-0.052	0.050	0.982	0.015	-0.118	0.150	0.817
TE	0.007	-0.043	0.060	0.787	0.067	-0.075	0.210	0.356
PM	0.117	-4.190	4.390	0.816	0.524	-5.661	6.710	0.359

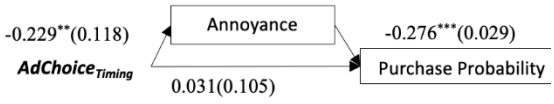
Panel C

Mediator: Annoyance
DV: Value Perception



Panel D

Mediator: Annoyance
DV: Purchase Probability



	Estimate	95% CI Lower	95% CI Higher	*p*-value	Estimate	95% CI Lower	95% CI Higher	*p*-value
ACME	0.066	-0.004	0.140	0.066*	0.052	-0.002	0.110	0.058*
ADE	-0.042	-0.184	0.100	0.561	0.015	-0.118	0.150	0.817
TE	0.024	-0.135	0.190	0.782	0.067	-0.075	0.210	0.356
PM	0.575	-10.793	11.730	0.743	0.524	-5.661	6.710	0.359

Note: ACME = Average Causal Mediated Effect, ADE = Average Direct Effect, TE = Total Effect, PM = Proportion Mediated. Signif. codes: '***' < 0.01, '**' < 0.05, '*' < 0.1. Standard errors in parenthesis.

5.2.4 *Brand Impression*

A mediation analysis reveals that the choice of ad timing reduced ad annoyance, thereby increasing the perceived impression of the advertised brand (Figure 9). The causal mediation analysis with 5000 bootstraps

(see Panel B of Table 8) revealed that the indirect effect of $AdChoice_{Timing}$ on *Brand Impression* through *Annoyance* was significant ($\beta = .05$, $p < .10$). These results support H4 that annoyance mediates the effect of ad choice on brand impressions.

5.2.5 *Value Perception*

A mediation analysis reveals that $AdChoice_{Timing}$ reduced ad annoyance, thereby increasing the perceived value of the advertised product (Figure 10). The causal mediation analysis with 5000 bootstraps (see Panel C of Table 8) revealed a significant indirect effect of $AdChoice_{Timing}$ on *Value Perception* through *Annoyance* ($\beta = .06$, $p < .10$). These results support H5 that annoyance mediates the effect of ad choice on the perceived value of the advertised product.

5.2.6 *Purchase Probability*

The results revealed that $AdChoice_{Timing}$ significantly increased a consumer's purchase probability for the advertised product via a reduction in *Annoyance*. A causal mediation analysis employing 5,000 bootstraps (see Panel D of Table 8) revealed that the indirect effect of $AdChoice_{Timing}$ on *Purchase Probability* via *Annoyance* was significant ($\beta = .22$, $p < .10$). These results support H6 that ad choice would reduce annoyance, thereby leading to an increase in the probability to purchase the advertised product.

5.3 Robustness Checks for Study 2

5.3.1 *Estimating the Local Average Treatment Effect of Ad Timing Choice*

We employ a similar framework discussed in Section 4.7.1 to estimate the LATE of $AdChoice_{Timing}$ on *Attention* and *Annoyance*. However, different from Study 1, where we used screen recordings to identify compliance, in Study 2, we leverage the randomly assigned default option to identify compliers and estimate the LATE. Recall that participants in the treatment group were nudged toward a specific choice (either "before" or "during" the video) via a randomly assigned default. Since compliers are participants in the treatment group who actively respond to the freedom, we can identify a subset of compliers by analyzing whether they made a decision different from the default option presented to them. If a participant changed the default choice, it indicates compliance—meaning they were influenced by the freedom to choose. This approach allows us to distinguish between participants who exercised their choice and those who passively accepted the default, refining our estimate of the treatment effect. Thus, we specify the following equation:

$$choice\_exercised \sim \gamma_1 * treatment + \gamma_2 * demographic\ covariates$$

In Equation 5, we don't include brand covariates (such as prior brand impression) or ad fixed effects. This is because in Study 2's treatment condition, participants didn't see information about the ad content. Instead, they were given the freedom to choose the ad timing. Please refer to Table A6 in Online Appendix

A for all the ITT and LATE estimates for Study 2.

The LATE analyses revealed a significant effect of $AdChoice_{Timing}$ on attention (LATE = 20.57, SE = 4.58, z = 4.49, p < .001), suggesting that participants who exercised their choice paid significantly more attention to the ads compared to those who did not, indicating that providing the freedom to choose ad timing enhanced consumer attention. Moreover, the estimated LATE for annoyance was significant (LATE = -0.63, SE = 0.33, z =−1.91, p = .057), suggesting that participants who exercised their choice when given the freedom to choose an ad timing experienced less annoyance relative to those who were not given a choice or did not exercise their choice. In summary, the LATE estimates indicate that participants who exercised their choice in the treatment group (the compliers) showed significantly greater attention to the ads and experienced lower levels of annoyance.

5.3.2 *BH Correction*

As in Study 1, because we implemented multiple statistical tests on the same sample, we implemented the Benjamini-Hochberg (BH) correction procedure to account for false discovery rate (FDR). Table A4 in Online Appendix A reports the result of this correction. As can be seen, all of our results remain consistent after applying the correction.

5.3.3 *Randomization Inference*

We implement the randomization inference techniques described in Section 4.7.3 and report the observed treatment effect (from fitting Equation 1) and the associated randomization inference *p*-values for each of our outcome variables next. For the outcome variable *Attention*, the observed treatment effect was 7.51. The randomization inference *p*-value was less than .001, indicating a highly significant effect. For *Annoyance*, the observed treatment effect was -0.23, with a randomization inference *p*-value of 0.0557.

5.3.4 *Bootstrap Standard Errors*

As in Study 1, we have ANOVAS looking at the direct effect of $AdChoice_{Timing}$ on *Attention* and *Annoyance*. To test the robustness of our results further, we bootstrap the estimates using 5000 bootstraps and check if the results remain consistent. Table 9 shows the 95% confidence intervals after running the bootstrap estimates and the corresponding *p*-values. As shown in Table 9, all our results remain consistent.

Table 9. Study 2: Bootstrapped Estimates of Direct Effects

Effect	**Original *p*-value**	**Bootstrapped Estimates**		
		95% CI-Low	**95% CI High**	***p*-value**
Impact of $AdChoice_{Timing}$ on *Attention*	3.63e-06	4.34	10.74	<0.001
Impact of $AdChoice_{Timing}$ on *Annoyance*	5.54e-02	-0.4611	-0.0004	0.049

6 Discussion and Conclusion

In this research, we explore the impact of ad choice architecture on video ad performance in online streaming environments, specifically examining how different forms of consumer control, over ad content and ad timing, influence key advertising outcomes. Study 1 examined the effects of allowing consumers to choose the *content* of the advertisement they would view. This experiment involved 279 participants recruited through Prolific, who were exposed to a controlled online video environment where they could select between two different ads. Using eye-tracking to measure attention and online surveys to assess emotional and cognitive responses, the study revealed that providing consumers with control over ad content significantly enhanced their attention to the advertisements. Participants who were allowed to choose the ad content exhibited a 9% increase in attention, which translated into improved brand recall. Furthermore, the ability to choose ad content significantly reduced consumer annoyance, leading to more positive attitudes toward the advertised brand, better perceptions of the brand's value, and increased purchase intentions. These findings suggest that when consumers are given control over the ads they view, they engage more deeply with the content, enhancing the overall effectiveness of the advertisement.

Study 2 extended the investigation to explore the effects of giving consumers control over the *timing* of ad exposure. This study involved a larger sample of 991 participants, who were allowed to choose when they preferred to view ads within a streaming session on YouTube, either before or during the video content. Again, using eye-tracking and surveys, the study found that control over timing also positively impacted ad performance. Participants who could choose when to view the ads showed a 15.1% increase in attention compared to those who had no choice. Additionally, allowing consumers to control ad timing significantly reduced ad annoyance, while increasing brand recall, brand attitude and purchase intention. This indicates that the act of making a choice, whether regarding content or timing, heightens consumer engagement. That even simple forms of consumer control, such as control over ad timing, can lead to meaningful improvements in ad performance, make it a practical option for platforms aiming to enhance user experience without complicating the ad delivery process.

6.1 Theoretical Contributions

This study makes several significant contributions to the academic literature on online advertising, consumer autonomy, and digital marketing strategies. First, it extends the application of Self-Determination Theory (SDT) to the context of digital advertising. We demonstrate that consumer autonomy, as manifested through the ability to choose ad content or timing, enhances cognitive and emotional responses to advertisements. By linking autonomy to improved attention, reduced annoyance, and positive brand attitudes, this study enriches our understanding of how consumer control mechanisms can drive engagement and satisfaction in advertising, thus contributing to the literature on SDT (Deci and Ryan 1987, Ryan and

Deci 2000).

Second, this study introduces ad timing control as a novel ad choice mechanism to foster consumer autonomy. Previous literature has explored the impact of ad content control (e.g., Luo et al. 2023), but this research shows that control over ad timing also significantly increases attention and reduces annoyance. This insight is crucial as it suggests that even less complex forms of control can lead to meaningful improvements in ad performance. Highlighting how consumer autonomy can be operationalized in different ways to enhance ad effectiveness contributes to the literature stream on ad choice (Nettelhorst and Brannon 2012a, Nettelhorst and Brannon 2012b, Nettelhorst et al. 2014, Nettelhorst et al. 2017, Luo et al. 2023).

Third, the study provides empirical evidence supporting the psychological mechanisms underlying the relationship between consumer control and ad effectiveness. The reduction in ad annoyance and the associated improvements in brand attitudes and purchase intentions suggest that consumer control mitigates the psychological reactance typically triggered by forced ad exposure. This contributes to the broader literature on consumer psychology (e.g., Brehm 1966) by illustrating how control mechanisms can be leveraged to reduce negative emotional responses and enhance cognitive processing in advertising.

Finally, this study addresses and resolves some of the mixed findings reported in prior studies regarding the effectiveness of ad choice (e.g., Nettelhorst and Brannon 2012b) by providing robust evidence that consumer control, whether over content or timing, consistently enhances ad performance metrics.

6.2 Practical Implications

The findings of this study have significant implications for practitioners in marketing, advertising, as well as for video streaming platforms. First, the research demonstrates that enabling consumers to control their ad experience, whether through content or timing, can lead to substantial improvements in key ad performance metrics. For advertisers, this means that adopting ad choice architectures can significantly enhance the impact of their campaigns by increasing consumer attention, improving brand recall, and fostering positive brand attitudes. These improvements are likely to translate into higher return on investment for ad campaigns, as better-engaged consumers are more likely to recall, value, and act upon the advertised messages.

The study also provides strategic guidance to video platforms for implementing ad choice architectures. While control over content offers significant benefits, it also presents logistical challenges, such as managing ad inventory and ensuring equitable exposure for advertisers. In contrast, control over timing is likely easier to implement while still mitigating the negative impacts of ad interruptions. By offering consumers the ability to choose the content or timing of their ads, platforms can reduce the annoyance associated with ad exposure, potentially leading to increased user retention and satisfaction. This is

particularly relevant for platforms looking to balance the need for ad revenue with the imperative to maintain a positive user experience. For instance, platforms like Twitch.tv, where users face similar choices between pre-roll and mid-roll ads, could benefit from offering timing control to improve viewer engagement (Reddit 2023). Likewise, podcasts could apply similar strategies, as research suggests that ad placement within episodes directly impacts listener engagement and conversion rates (Backtracks 2023).

Finally, the study highlights opportunities for differentiation in a competitive digital media landscape. Offering ad choice mechanisms can serve as a key differentiator for platforms, positioning them as more user-centric and potentially attracting a larger and more loyal user base. For advertisers, collaborating with platforms that offer such features can enhance their brand's appeal by associating it with positive consumer experiences.

6.3 Limitations and Future research

While this research provides valuable insights, it is important to acknowledge its limitations, which suggest directions for future research. First, Study 1 was conducted in a controlled environment, which, while allowing for precise measurement and control of variables, may not have fully captured the complexities of real-world consumer behavior. Study 2 was conducted in a YouTube environment that allowed for consumers' natural interactions with the video content such as pause/play. However, future research should replicate these findings in field settings, such as live streaming platforms to validate the generalizability of the results. Second, the study primarily focused on immediate ad performance metrics, such as attention, recall, and annoyance. While these are critical indicators of ad effectiveness, future research should explore the long-term impacts of ad choice architectures, including their effects on brand loyalty, customer lifetime value, and overall brand equity. Third, this study did not extensively explore how different consumer segments might respond differently to ad choice architectures. Future research could investigate the moderating effects of demographic variables, such as age, gender, and cultural background, as well as psychographic factors, such as consumer attitudes toward advertising and preferences for autonomy. Such insights could help tailor ad choice architectures to the needs and preferences of specific consumer groups. Finally, while this research focused on content and timing control, there are other potential forms of consumer control that could be explored, such as control over ad frequency, duration, and the ability to provide feedback on ads. Future studies could investigate the relative effectiveness of these different forms of control, as well as their potential interactions, to develop a more comprehensive understanding of how to optimize consumer autonomy in digital advertising.

6.4 Conclusion

In conclusion, this study contributes to the understanding of how consumer control in online advertising can significantly enhance ad performance. The findings highlight the importance of consumer autonomy in

reducing negative emotional responses and improving cognitive engagement with advertisements. For both academic and practical stakeholders, these insights pave the path to more effective and user-friendly advertising strategies in digital media environments. As the digital landscape continues to evolve, further research will be essential to explore the full potential of ad choice architectures and their implications for consumers, advertisers, and platform operators alike.

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ONLINE APPENDIX A

Table A1. Study Measures

Measure	Measurement
Attention	The objective measure *Attention* captures the total number of times a consumer's eyes fixated on the ad during its duration. To measure it, we monitored the eye movements of participants using eye-tracking software while they watched a video. We specifically focused on the portion that displayed an advertisement and tracked the number of eye fixations in it.
Ad recall	Which brand was featured in the advertisement you saw? Please select from the options below? 1 correct option, 5 incorrect options (i.e., decoy brands).
Brand Impression	A combination of 4 items on a 7-point Likert scale (1-Strongly Disagree to 7-Strongly agree) namely: In your opinion, your overall impression of the brand shown in the ad is: How much do you like the brand shown in the ad? How much do you agree or disagree with the following statements: I feel the brand has a good reputation. I can trust the brand.
Value Perception	Please indicate your agreement with the statement related to [Product Name] product shown in the advertisement. I feel the product is an excellent buy. I feel the product has good value. I feel there is nothing wrong with the product shown.
Purchase probability	There is a high probability that I will consider purchasing the product.
Ad annoyance	Please recall your video viewing experience and indicate your agreement with the statements below. In my opinion, I found the advertisement to be... on a 9-point Likert scale from 1(Not at all) to 9 (very much) 1)Distracting 2) Irritating 3) Disturbing 4) Intrusive 5) Disruptive 6) Annoying.
Brand familiarity	Do you recognize this brand? 1) Yes 2) No
Self-Brand Connection	Both items on a 9-point Likert scale (1-Strongly Disagree to 9-Strongly agree) I feel a personal connection to this brand. I have a good overall impression of this brand.
Demographic variables	What is your age (in years)? Textbox Choose one or more races that you consider yourself to be: 1)White, 2) Black or African American, 3) American Indian or Alaska Native, 4) Asian, 5) Native Hawaiian or Pacific islander, 6) Other. What gender do you identify with the most? 1)Male, 2) Female, 3) Other, 4) Prefer not to say. What is the highest level of education you have completed: Less than high school

	High School/GED Two-year College Degree Four-year College Degree Master's Degree Doctoral Degree Professional Degree (JD, MD)

Table A2. Brands displayed in Study 2

H&R Block
Red Lobster
Better Beer
BMW
Pop Tarts
TripAdvisor
Olive Garden
Ruffino Prosecco
Alfa Romeo
Barilla

Table A3. Study 1: BH Correction for hypotheses

Hypotheses	**Current *p*-values**	**Adjusted *p*-values (after BH correction)**	**Support**
H1	0.030	0.087	✓
H2	0.040	0.087	✓
H3	0.068	0.087	✓
H4	0.075	0.087	✓
H5	0.080	0.087	✓
H6	0.080	0.087	✓

Table A4. Study 2: BH Correction for hypotheses

Hypotheses	**Current *p*-values**	**Adjusted *p*-values (after BH correction)**	**Support**
H1	3.63e-06	2.18e-05	✓
H2	5.90e-02	6.60e-02	✓
H3	5.54e-02	6.60e-02	✓
H4	5.80e-02	6.60e-02	✓
H5	6.60e-02	6.60e-02	✓
H6	5.80e-02	6.60e-02	✓

Table A5. Study 1: Intention to Treat and LATE estimates

VARIABLES	**ITT** ***Attention***	**ITT** ***Annoyance***	***choice_exercised***	**LATE** ***Attention***	**LATE** ***Annoyance***
AdChoice_Content	11.37* (5.218)	-0.570. (0.311)	0.796* (0.042)	14.277** (6.594)	-0.715* (0.392)
Covariates:					
Prior Brand Familiarity (Brand 1)	-1.768 (1.535)	0.1633. (0.085)			
Prior SBC (Brand 1)	3.803 (2.899)	-0.2692. (0.151)			
Prior Brand Impression (Brand 1)	1.133 (2.507)	-0.1938 (0.159)			
Prior Brand Familiarity (Brand 2)	-0.1291 (1.860)	-0.2104* (0.102)			
Prior SBC (Brand 2)	-2.304 (3.135)	0.3003 (0.186)			
Prior Brand Impression (Brand 2)	-1.221 (2.126)	0.0910 (0.153)			
Race	0.0421 (0.032)	0.0105 (0.010)	0.0004 (0.0004)		
Gender	0.081 (4.596)	-0.0360 (0.289)	-0.004 (0.023)		
Education Level	2.353 (2.039)	0.3157** (0.118)	0.007 (0.011)		
Age	-0.116 (0.195)	-0.022* (0.010)	0.002* (0.001)		
Ad Fixed-Effects:	Yes	Yes	Yes		
Robust SE	Yes	Yes	Yes		
Observations	279	279	279		
R^2	0.049	0.110	0.738		
Within R^2	0.037	0.098	0.736		

Table A6. Study 2: Intention to Treat and LATE estimates

VARIABLES	**ITT** ***Attention***	**ITT** ***Annoyance***	***choice_exercised***	**LATE** ***Attention***	**LATE** ***Annoyance***
AdChoice_Timing	7.507*** (1.611)	-0.229. (0.119)	0.364*** (0.021)	20.569*** (4.582)	-0.628* (0.329)
Covariates:					
Prior Brand Familiarity (Brand 1)	-0.566 (0.986)	0.015 (0.091)			
Prior Brand Familiarity (Brand 2)	-0.664 (1.207)	-0.176** (0.068)			
Prior SBC (Brand 1)	-0.714 (0.489)	-0.001 (0.035)			
Prior SBC (Brand 2)	0.277 (0.465)	-0.032 (0.034)			
Prior Brand Impression (Brand 1)	-0.315 (0.587)	-0.200*** (0.042)			
Prior Brand Impression (Brand 2)	-0.289 (0.496)	-0.088* (0.037)			
Age	-0.053 (0.063)	-0.018*** (0.004)	-0.001 (0.0008)		
Race	-0.049 (0.092)	-0.008 (0.005)	0.002 (0.001)		
Gender	-1.406 (1.545)	-0.031 (0.114)	0.002 (0.020)		
Education Level	1.707** (0.658)	0.090* (0.045)	-0.013 (0.009)		
Constant			0.094. (0.055)		
Ad Fixed-Effects:	Yes	Yes	No		
Robust SE	Yes	Yes	Yes		
Observations	991	991	991		
R^2	0.056	0.127	0.225		
Within R^2	0.038	0.096	--		

ONLINE APPENDIX B: Screenshots of ads in Study 2

Figure B1. Study 2: Before ad scenario (Ad_1)

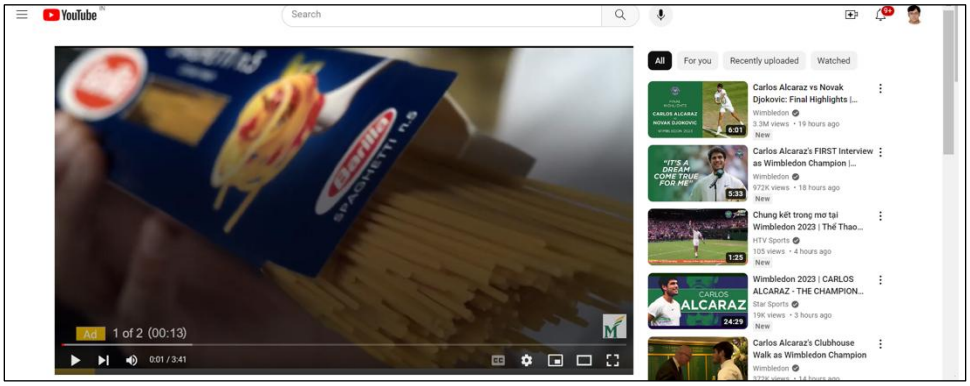

Figure B2. Study 2: Before ad scenario (Ad_2)

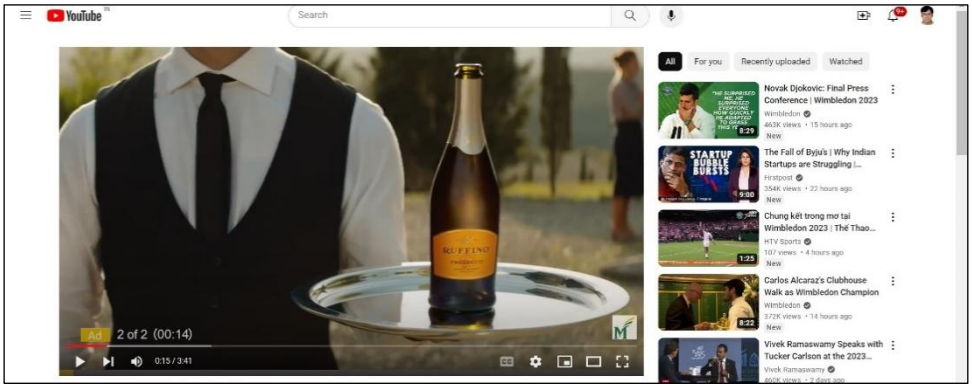

Figure B3. Study 2: During ad scenario (Ad_1)

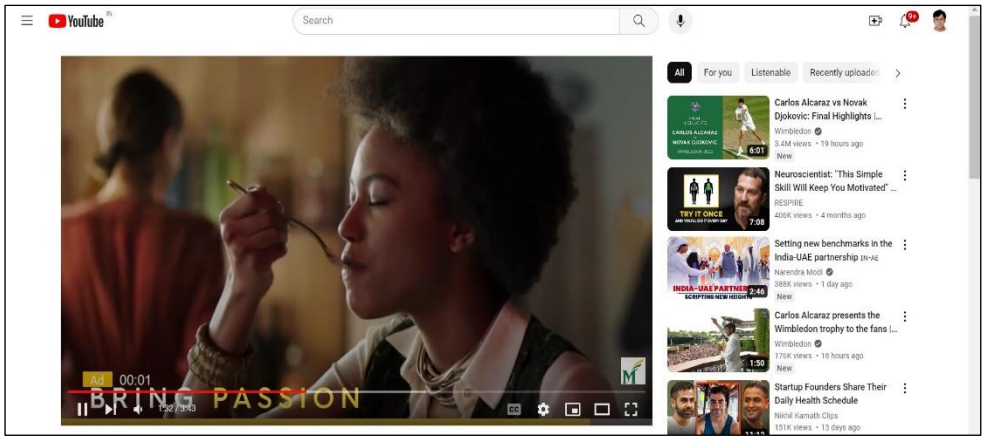

Figure B4. Study 2: During ad scenario (Ad_2)

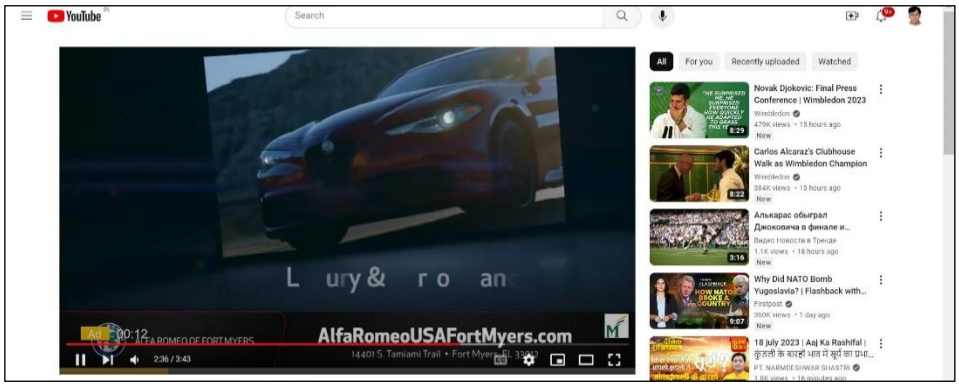

Figure B5. Study 2: Message shown to consumers before presenting ad choice over timing options

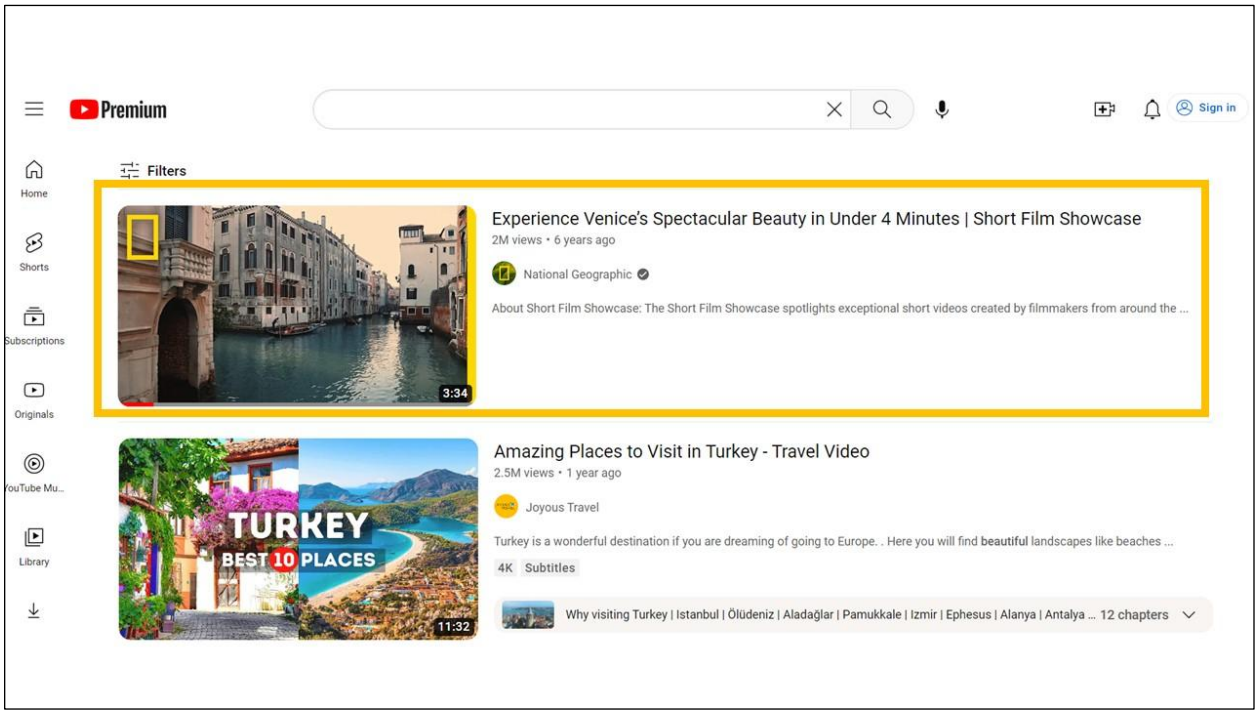

Figure B6. Study 2: Choice question with "before" set as default

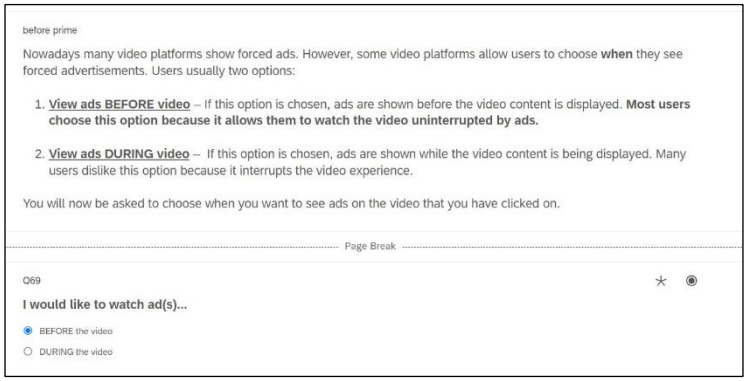

Figure B7. Study 2: Choice question with "during" set as default