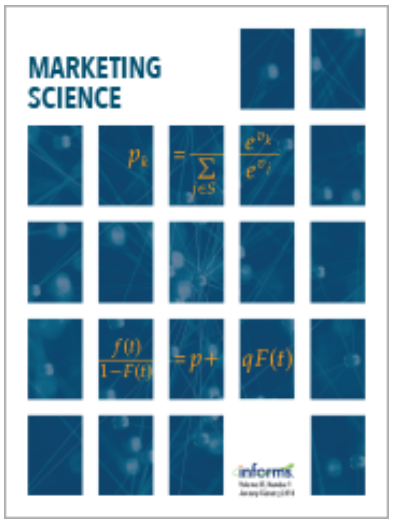


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# Where Does Advertising Content Lead You? We Created a Bookstore to Find Out

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**Abstract.** We study how advertising content influences consumers' decisions. To this end, we create a simulated online bookstore that imitates a real online shopping experience. We then conduct a preregistered and incentive-compatible experiment in which we randomly expose store visitors to display ads, randomizing both advertising exposures and content. We find that ad content plays a major role in shaping advertising effects. Ads that reveal a book's low price consistently increase demand for the advertised book relative to ads that do not reveal price. By contrast, ads that reveal the book's genre induce some consumers to search and buy the book but lead others to reject it without search. We show these polarized responses can increase or decrease the total number of searches and purchases of the advertised book depending on the share of consumers who favor the revealed genre. Our findings suggest that advertisers should carefully choose which product attributes to reveal in their ad copies. We also show that revealing product attributes in ads does not change the total amount of search. Taken together, our results suggest the primary role of ad content is to affect consumers' beliefs about the advertised book rather than to alter the perceived benefits from search.

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**Keywords:** advertising effects • advertising content • consumer search • laboratory experiment

## 1. Introduction

An advertisement is like the opening act of a play: presenting the right information can engage the audience from the first curtain rise, while failing to do so may squander their attention. Accordingly, the success of a campaign may depend on which product attributes firms choose to spotlight in their ads. By advertising specific attributes, firms hope to entice consumers into considering their product more closely. Chevrolet and Ford, for instance, highlight horsepower, fuel efficiency, and durability in their truck ads, while Apple and Samsung emphasize the battery life, camera quality, and price of their smartphones. Although there is broad consensus that choosing the right ad content can indeed play a crucial role in driving ad effects,[1] firms receive contradictory advice on which product attributes to advertise: some practitioners advocate emphasizing unique product attributes, while others advise revealing attributes that matter most to consumers.[2]

In this paper, we study how consumers respond to ad content that reveals product attributes, and we provide both theoretical and empirical results to guide firms in making their ad content choices. Studying these questions presents several challenges. Most researchers do not observe ad creatives and can only present indirect evidence of ad content effects.[3] Even when they do observe ad content, it is hard to disentangle how different elements of multidimensional ad creatives shape advertising effects. Further, researchers need to address endogeneity concerns that arise because firms target ads at specific consumer segments and during particular time periods. For example, firms may advertise prices during the season of holiday discounts, in which case the ad content consumers see will correlate with temporary demand changes.

To address these challenges, we design and implement an experiment that randomizes both advertising exposures and content. Using web development tools, we create a simulated online bookstore that imitates a

real online shopping experience. We then conduct a preregistered experiment in which we recruit around 11,500 participants on Amazon Mechanical Turk and ask each of them to select an e-book from our store. When participants visit the store, we expose them to display ads, randomizing whether an ad is shown and also whether the ad copy reveals the book's genre ("genre ad"), its price ("price ad"), or does not reveal any attributes other than the title and cover image ("plain ad"). The participants then browse the store and purchase e-books as they normally would when shopping online. We record the entire search process using advanced tracking tools. To elicit realistic shopping behavior, we make the experiment incentive-compatible by sending participants the e-books they selected.

Using experimental data, we study the effects of advertising content on consumers' decisions. Laying the foundation for our main analysis, we first estimate *exposure effects* by comparing the behavior of consumers under plain ads to that in the no ad control group. Exposure effects may arise because ads signal the book's high quality (Nelson 1974, Milgrom and Roberts 1986) or because they help consumers discover the advertised book and offer an easy way to click through to the book's product page (Arbatskaya 2007, Armstrong et al. 2009, Haan and Moraga-González 2011). Consistent with these theories, we find that plain ads substantially increase the search and purchase rates of the advertised book. These *exposure effect*s establish a benchmark against which we measure the incremental effects of revealing attributes in ads.

Turning to our main analysis, we estimate *content effects* by studying how consumers respond to attribute ads relative to plain ads. Using a simple search model, we formulate hypotheses on how attribute ads should affect consumers' search and purchase decisions. In our experiment, attribute ads reveal either a book's low price—a vertical attribute that appeals to all consumers ("price ad")—or genre—a horizontal attribute that indicates the book's match value ("genre ad"). The model predicts that revealing a low price should weakly induce all consumers to search and purchase the advertised book. By contrast, revealing genre should induce some consumers to search the book because they learn it matches their tastes while discouraging others from searching it because they learn it is a bad match.[4]

We find our experimental results to be remarkably consistent with these theoretical predictions. Relative to plain ads, price ads increase searches and purchases of the advertised book regardless of consumers' genre preferences. Revealing price makes the ad, on average, 26% more effective at driving searches and 35% more effective at driving purchases. By contrast, genre ads induce polarized responses relative to plain ads: consumers who favor the revealed genre become more likely to search the book, while those who do not favor the genre discard the book without searching. As a result, revealing genre makes the ad more or less effective depending on the share of consumers who favor the revealed genre. For example, revealing a mainstream mystery genre makes the ad 15% more effective at driving searches and 12% more effective at driving purchases, whereas revealing a niche romance genre makes the ad less effective, decreasing ad effects on searches by 31% and on purchases by 16%.

At a high level, our results suggest revealing attributes in ads can influence choices by changing consumers' beliefs about the advertised book's attributes. At the same time, we find that ad content does not significantly alter how consumers conduct their search or how satisfied they are with their final choices. For example, price ads do not make consumers more likely to sort books by price or search other inexpensive books, and genre ads do not lead consumers to use genre-related filters or to search other nonadvertised books of the same genre. Revealing attributes in ads also does not change the total number of books consumers search or the time they spend searching. Thus, in our setting, ad content primarily affects consumers' beliefs about the advertised book's attributes instead of changing attribute salience or altering the perceived benefits from searching.

Our findings have several implications for managers who design ad campaigns. We document that revealing an attribute in ads can generate a spectrum of effects, from strongly positive to strongly negative, depending on how consumers value the revealed attribute. Consequently, advertisers should understand the distribution of tastes across consumers before choosing which attributes to reveal in their ads. Advertisers may also benefit from jointly optimizing the content of their ads and the scope of their advertising campaigns. If the product's attributes are relatively niche, the advertiser may want to run a targeted campaign, selectively revealing these attributes to consumers who value them the most. Our results suggest there can be meaningful gains from such targeting: we show that targeting genre and price ads based on estimated conditional ad effects increases the search probability by 14% relative to the best nontargeted policy. By contrast, an advertiser restricted to mass advertising campaigns may want to reveal appealing vertical attributes such as a low price.

Our paper contributes to the literature on whether and how consumers respond to ad content.[5] Most papers provide only correlational evidence of ad content effects (Stewart and Furse 1986, Chandy et al. 2001, MacInnis et al. 2002, Liaukonyte et al. 2015, Anderson et al. 2016, Hartnett et al. 2016, Du et al. 2019, Bruce et al. 2020, Guitart and Stremersch 2021, Dall'Olio and Vakratsas 2023). For example, Liaukonyte et al. (2015) find that TV ad effects correlate with whether the ads have an action, information, emotion, or imagery focus, and

Du et al. (2019) find stronger ad effects for creatives that consumers find informative and likable. Although these correlations are suggestive, they might be misleading if firms target ad creatives at specific customer segments or show them during peak-demand periods. A few authors attempt to address content endogeneity using quasi-experimental methods, but they characterize their own results as correlational and call for more experimental work on ad content (Lee et al. 2018, Tsai and Honka 2021, Dall'Olio and Vakratsas 2023).

Only a few papers address the endogeneity of ad content using randomized experiments. Lodish et al. (1995) conduct a meta-analysis of 96 TV advertising copy tests and find stronger ad effects for ad copies that introduce attributes such as flavor, brand, form, and packaging. Bertrand et al. (2010) randomize dimensions of ad content and find that ads for bank loans are more effective when ad content induces an intuitive rather than reasoned response. Finally, Biswas (2020) runs an experiment on a food delivery app and shows that revealing discount information in ads increases demand for advertised restaurants.[6] Building on these papers, we develop a theoretical framework to assist firms in choosing which attributes to advertise, and we present experimental evidence that consumers' responses to ad content are consistent with the theoretical predictions. We also use detailed browsing data to study whether ad content influences how consumers conduct their search, which is not done in this prior work.

Several papers study how advertising affects search by applying observational methods to nonexperimental data (Honka et al. 2017, Tsai and Honka 2021, Chiou and Tucker 2022, Ursu et al. 2024a). A notable exception is Fong (2017) who analyzes a field experiment designed to study how targeted marketing emails affect consumer search on a retailer's website.[7] Building on these papers, we design and implement an experiment in which we can cleanly identify the causal effects of ads on search by randomizing both ad exposure and content.

Finally, our paper complements the prior work on measuring consumer search in controlled laboratory experiments (Gabaix et al. 2006, Reutskaja et al. 2011, Shi et al. 2013, Ursu et al. 2024b). Inspired by this work, we create our own bookstore where we experimentally manipulate ads and collect more detailed search data than are usually available to advertising researchers. Our bookstore can be accessed from any device with an Internet connection, which enables us to recruit thousands of participants. Further, the realism of our store increases the external validity of the experimental results.[8] We showcase this approach and illustrate how one can design an incentive-compatible experiment in which products are electronically delivered to participants. By doing so, we hope to provide a blueprint for other researchers interested in adopting a similar methodology in their work.[9]

## 2. Advertising Content Effects and Consumer Search

### 2.1. Theoretical Framework

A consumer with unit demand chooses among $J$ books available in the bookstore. The utility consumer $i$ derives from purchasing book $j$ equals $u_{ij} = -\alpha_i p_j + \gamma_i g_j + \varepsilon_{ij}$, where $p_j$ is book $j$'s price; $g_j \in \{0,1\}$ is its genre; and $\alpha_i$ and $\gamma_i$ are the consumer's price sensitivity and genre taste.[10] We assume the heterogeneous price sensitivities $\alpha_i$ are positive and distributed with the CDF $F_\alpha(\cdot)$ and the heterogeneous genre tastes $\gamma_i$ are distributed with the CDF $F_\gamma(\cdot)$. Thus, price $p_j$ is a *vertical attribute* in the sense that, other things equal, all consumers prefer to pay less. By contrast, genre $g_j$ is a *horizontal attribute* that may be liked by some consumers and disliked by others. Finally, $\varepsilon_{ij}$ captures other horizontal attributes that determine book $j$'s match value such as its detailed plot description. There is no outside option, so each consumer must choose a book.

Following Greminger (2022), we assume consumers learn about books via the following process of search and discovery, which closely approximates how consumers search in our bookstore. Upon visiting the store, the consumer observes $n_d$ books on the front page, which form the initial awareness set, $S_0$. The consumer learns the prices $p_j$ of these books but not their genres $g_j$ or attributes $\varepsilon_{ij}$. We make this assumption because in our bookstore consumers see prices on product list pages, but they need to click on books to learn their genres and other attributes.

After seeing the initial set of books $S_0$, the consumer sequentially decides whether to discover additional books, search a previously discovered book, or purchase a previously searched book. The consumer can discover additional books by navigating to the next product list page, which adds $n_d$ books to the awareness set and reveals their prices. To discover books from page $l$, the consumer must pay the discovery cost $c_d^l > 0$. Alternatively, the consumer can search an already discovered book by navigating to its product detail page. To search a book, the consumer must pay the search cost $c_s > 0$. Searching a book reveals all its attributes, thus revealing the entire utility $u_{ij}$. The consumer keeps making sequential search and discovery decisions until they make a purchase or exhaust all search opportunities.

We assume the consumer expects that prices are drawn from a distribution with CDF $F_p(\cdot)$ with mean $\overline{p}$ and support $[0, p^{max}]$, that genre is $g_j = 1$ with probability $q$, and that attributes $\varepsilon_{ij}$ are drawn from the distribution with CDF $F_\varepsilon(\varepsilon)$. To simplify exposition, we assume prices $p_j$, genres $g_j$, and attributes $\varepsilon_{ij}$ are independently distributed so that the consumer cannot use the attributes they already know to infer the ones they have not yet learned.[11]

### 2.2. Ad Content Effects

Our goal is to study the effects of ad content over and above any effect of being exposed to an ad. To this end,

we first establish a benchmark for measuring ad content effects. Consider a "plain ad" for book $k \notin S_0$ of genre $g_j = 1$ whose organic listing resides on page $l(k) > 1$ and suppose this ad does not reveal the book's genre or price. We assume a plain ad moves the book into the consumer's default awareness set $S_0$, reducing its discovery cost to zero. Because the ad does not reveal genre or price, the consumer needs to pay a search cost $c_s$ to reveal these attributes.[12] Proposition 1 shows that the plain ad increases the search and purchase probabilities of the advertised book $k$, assuming this book's initial discovery cost is sufficiently high. We relegate all proofs of this section to Appendix A.

**Proposition 1** (Exposure Effects). *A plain ad increases the average search and purchase probabilities of the advertised book as long as its original discovery cost $c_d^{l(k)}$ is sufficiently high.*

One can interpret Proposition 1 as saying that plain ads make consumers aware of the advertised book, as in Honka et al. (2017) and Ursu et al. (2024a), or that they reduce the effective cost of searching the advertised book.[13] Alternatively, plain ads may signal to consumers that the advertised book is of high quality.[14] Both mechanisms predict that a plain ad should increase searches and purchases of the advertised book. Because separating these explanations is not our main focus, we remain agnostic about the mechanisms behind exposure effects and instead turn to modeling the incremental effects of ad content.

Consider an ad that reveals a horizontal attribute, the book's genre. We assume a genre ad generates the same exposure effects as a plain ad, but it additionally reveals the book's genre to consumers. Revealing genre $g_k$ sends consumers a noisy signal of utility $u_{ik}$, but they still need to pay the search cost $c_s$ to learn the price $p_k$ and attributes $\varepsilon_{ik}$. Proposition 2 shows that relative to plain ads, genre ads may increase or decrease demand depending on the share of consumers who value the revealed genre $g_k$.[15]

**Proposition 2** (Content Effects: Revealing Genre). (a) *Relative to a plain ad, a genre ad increases the search and purchase probabilities for consumers who like the revealed genre ($\gamma_i > 0$), decreases them for consumers who dislike the revealed genre ($\gamma_i < 0$), and does not change them for indifferent consumers ($\gamma_i = 0$).*

(b) *Relative to a plain ad, a genre ad increases the average search and purchase probabilities of the advertised book if there is a sufficient share of consumers who like this book's genre. On the other hand, a genre ad decreases the average search and purchase probabilities if there is a sufficient share of consumers who dislike the genre.*

To gain intuition, suppose a publisher of the book *The Shadow of the Gods* by John Gwynne advertises the book as a fantasy story about mages and dragons. After seeing this ad, fantasy lovers may become more interested in inspecting this book, as they have just learned that it matches their tastes well. By contrast, readers who dislike fantasy may conclude that this book is not for them. Learning its genre from the ad has convinced them that they should reject the book without searching. As Proposition 2a shows, advertising should then increase searches and purchases of this book among fantasy lovers and reduce them among consumers who prefer other genres, leading to polarized decisions. In turn, Proposition 2b implies that the net impact of these effects is ambiguous. In fact, the total demand for the advertised book may decrease if the negative response from consumers who dislike fantasy outweighs the positive response from fantasy aficionados.

Now consider an ad that reveals a vertical attribute—the book's price. As with genre ads, a price ad generates the same exposure effects as a plain ad but additionally reveals the book's price to consumers. Revealing price sends consumers a noisy signal of utility, but consumers still need to pay the search cost $c_s$ to learn the remaining attributes $g_k$ and $\varepsilon_{ik}$. Proposition 3 posits how consumers should react to price ads:

**Proposition 3** (Content Effects: Revealing Price). *The following two results hold if the advertised book is sufficiently inexpensive:*

(a) *Relative to a plain ad, a price ad increases the search and purchase probabilities of individual consumers regardless of their genre tastes $\gamma_i$.*

(b) *Relative to a plain ad, a price ad increases the average search and purchase probabilities of the advertised book.*

When the ad reveals that book $k$ is unusually cheap, as is the case in our experiment, all consumers view the revealed price as a positive signal of utility and thus become more likely to search the book. Although they still do not know this book's other attributes, the book now looks more appealing than it did before they saw the ad (Proposition 3a). This positive effect on search translates into additional purchases, thus increasing the average purchase probability of the advertised book relative to that under the plain ad (Proposition 3b).

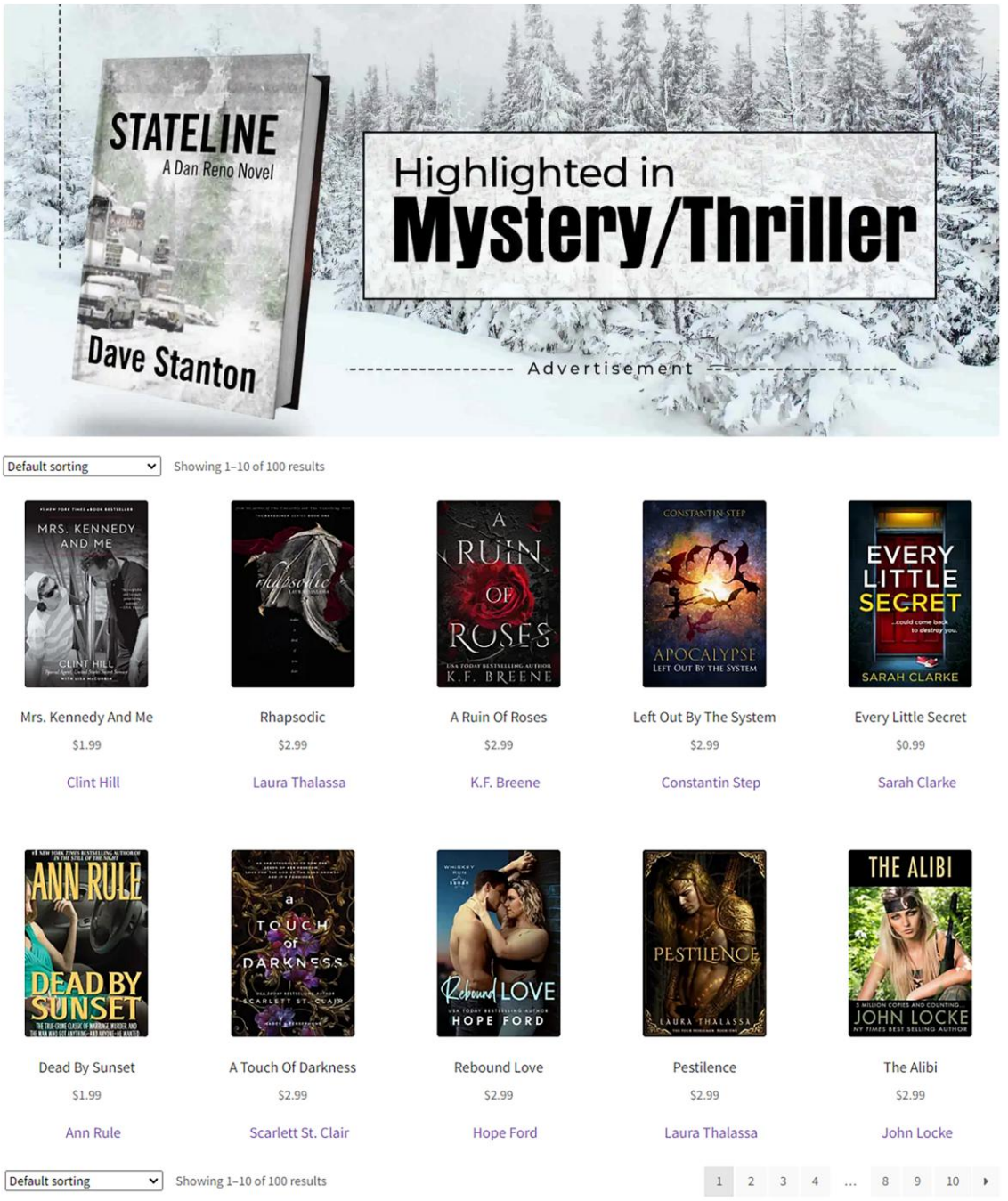
## 3. Store Design and Advertisements

### 3.1. Bookstore Design

We create a realistic online bookstore using open-source website development software and populate it with a custom assortment of books. We use several plug-ins to serve display ads, and we collect detailed search data from all store visitors using advanced consumer-tracking software (see details in Appendix B.1). This software tracks everything consumers do in the store, including how many product list pages they visit, which books they click on, and whether they use filters, sorting tools, or search queries.

The store offers only one product category: electronic books. We chose this category because e-books can be electronically sent to participants, making it feasible to conduct a large-scale incentive-compatible study. The typical product list page displays books in two rows with five books in each row (see Figure 1). The store has 10 product list pages, and all consumers initially land on the first page. Consumers can navigate to other product list pages by clicking on buttons at the bottom of each product list page. Following the standard layout of online bookstores, such as Amazon or Barnes & Noble, we design product list pages so that they reveal basic information about books including the title, author, price, and cover image. Throughout our experiment, we keep books' prices and rankings the same for all consumers. Clicking on a book in the product list directs the consumer to the product page, which additionally reveals the genre of the book and a detailed description of its plot (see Appendix Figure A.7).

**Figure 1.** (Color online) A Display Advertisement on the First Product List Page



The bookstore offers several search tools. Consumers can enter a search query or sort books by price (low to high or high to low). Each product page also shows nonpersonalized book recommendations, which feature three randomly selected books of the same genre (see Appendix Figure A.8). From a product page, consumers can go back to the product list, navigate to the genre subcategory by clicking on genre tags, or click on a recommended product. To purchase a book, consumers can add it to the cart and complete the check-out process (see Appendix Figures A.9–A.10).

### 3.2. Book Selection

We populate our bookstore with an assortment of 100 books. To create a meaningful search task for consumers, we include books from five different genres: biography/memoir, fantasy, mystery/thriller, romance, and science fiction. We select inexpensive but high-quality books because we want to interest consumers in making a purchase, while also minimizing the expected cost of the experiment. To achieve this, we take books from Amazon bestseller lists and select 20 books of each genre that are priced under $3. We set the books' prices equal to the current Amazon prices, which range between $0.99 and $2.99, and we set the prices of the advertised books to $0.99 for reasons explained in Section 3.3. See Appendix B.2 for additional details on book selection.

### 3.3. Display Advertisements

The front page of the store displays a salient advertising banner (see Figure 1), similar to how major book retailers such as Barnes & Noble display ads on their websites (see Appendix Figure A.11 for an example). Clicking on the banner in our store redirects consumers to the product page of the advertised book. The advertising banner is only shown on the front page of the store.

When choosing which books to advertise, we select books for which demand is likely to respond to advertising. Advertising an unappealing book would have little effect on choices, which would not give us sufficient power to precisely measure ad content effects. To avoid this issue, we select the mystery book *Stateline* by Dave Stanton and the romance novel *The Lost Girls of Ireland* (henceforth *Lost Girls)* by Susanne O'Leary. Both books are relatively popular within their genre subcategories on Amazon (e.g., customer ratings 4.2 and 4.3 out of 5 on Amazon). To enhance the appeal of these books, we reduce their prices from the original $2.99 on Amazon to $0.99, thus making them among the cheapest books in our store. We also choose these books because they have nondescript titles and covers that do not obviously reveal the book's genre, which helps us isolate the incremental effect of revealing genre in the ads. We place both books on the second page of the default product list to ensure we are not advertising options that are already salient. This placement also matches our theoretical setting in Section 2, where we assume that consumers do not observe the price or genre of the advertised book at the time of ad exposure.

In our main experiment, detailed in Section 4, we randomize participants into seven advertising conditions: a control condition and six treatment conditions corresponding to six different ad copies.[16] In the control condition, we hide the advertising banner from the front page and shift the organic book listings to the top.

Figure 2 shows the six professionally designed ad copies that we use for the main experiment. We first randomize participants into seeing advertisements for one of the two books, *Stateline* or *Lost Girls*. For each book, we further randomize participants into seeing one of the three advertising banners: (1) a banner with the generic text, "Highlighted This Month," that does not reveal any attributes other than the title and cover image ("plain ad"), (2) a banner that reveals the book's genre with the text "Highlighted in Mystery/Thriller" or "Highlighted in Romance" ("genre ad"), or (3) a banner that reveals the book's low price with the text, "Highlighted This Month: Grab Your Copy for $0.99" ("price ad"). Based on the power calculations conducted in a pretest, we set the assignment probabilities to 4% for the control condition and 16% for each of the six treatment conditions. In Appendix B.5, we describe how we implemented randomization.

## 4. Amazon Mechanical Turk Experiment

### 4.1. General Timeline and Sample Size Selection

We recruited participants from Amazon Mechanical Turk (MTurk). We first conducted two pretests based on which we selected a compensation scheme and conducted power calculations. Then, we preregistered our main experiment and ran it between May 19, 2022, and August 3, 2022. Based on the pretest data, we calculated that we would need at least 12,500 participants to measure the effects of advertising exposure and content. Because our budget was determined by an external grant, we committed to running the study until we exhausted this budget. In the end, we collected survey responses from $n = 16{,}088$ participants before we exhausted our budget, out of which $n = 11{,}498$ participants had complete browsing and purchase data. We provide further details on subject recruitment and attrition in Appendices B.3 and C.

### 4.2. Incentive Compatibility

We made the experiment incentive-compatible by fulfilling participants' orders. We gave each participant a budget of $3, which is sufficient to purchase any book in the store. We told participants that we would conduct a lottery that gives each participant a 50% chance of having their order fulfilled. In addition to their baseline

**Figure 2.** (Color online) Advertising Copies Used in the Main Experiment


*Note.* These ad copies were created by a professional graphic designer we hired on Fiverr.com, an online marketplace for freelance services.

compensation of $1.50, participants who won the lottery received their selected e-book and the remainder of their $3 budget as a cash bonus. Participants who did not win received only the baseline compensation of $1.50. Conducting a lottery helped us reduce the expected experiment cost while still incentivizing participants to select books they truly like.[17]

After the experiment, we conducted the lottery, manually bought books from Amazon, and sent personalized bonuses and book redemption links to the lottery winners. Participants could redeem and read their e-book using a free Amazon Kindle app on their e-book reader, browser, or phone. Because the purchased e-books could only be redeemed from the United States, we only recruited participants who reside in the United States.

### 4.3. Pre- and Post-Experiment Surveys

Participants were told that the study investigates their preferences for e-books. They first filled out a Qualtrics survey in which they reported their demographics and were asked to rank five book genres from their most preferred to their least preferred. We then informed participants about the incentive structure, explained that their choices would have real consequences, and asked them a comprehension question to ensure they understood their incentives.[18] Participants who passed the comprehension question were given a link to the bookstore and were asked to visit it, select their preferred e-book, and complete the check-out process.

After checking out, participants returned to the Qualtrics survey, and we asked them what they would prefer to do if they won our lottery: receive their selected book and the remainder of their $3 budget or forfeit the book and keep the entire $3 budget. The purpose of this question was to assess whether participants were genuinely interested in reading the books they selected.[19] To make the study fully incentive-compatible we implemented their decision on whether to keep the book or the money. We then also asked some general questions: what they thought the purpose of the study was,

whether they remembered seeing advertising, how important genre and price were to their choice, and how much they would be willing to pay for *Lost Girls* and *Stateline*.[20]

## 5. Experiment Results

### 5.1. Experimental Data and Estimation

Our main sample includes participants who passed the comprehension checks, purchased a book in our store, and returned to the Qualtrics survey after completing the checkout process. Despite our instructions to use a standard browser, approximately 18% of the participants either used ad blockers or privacy-enhancing browsers that made it impossible for us to track their actions. We exclude these participants from the sample. Because participants are unlikely to change their browser privacy settings in response to seeing ads in our bookstore, we assume that this selection criterion is orthogonal to the experimental assignment. We further tested whether there was differential attrition across experimental conditions but found no evidence of such imbalances (joint $F = 1.64$ with $p = 0.132$). Our final sample includes $n = 11{,}498$ participants for whom we have complete browsing and purchase data. Appendices B and C provide further details on attrition, sample construction, and participants' demographics. Our data are available in a public GitHub repository, which researchers can use to replicate and extend our work.[21]

To understand whether we have generated realistic search and purchase behavior, we conduct several validation analyses (see Appendix D for details). First, we show that consumers engage in meaningful search: the average consumer spends 3.7 minutes in the store, opens 4.0 product list pages, and searches 1.9 unique books (see Figure A.3). This search behavior is broadly consistent with the search behavior of actual consumers shopping for books online (see Figure A.5), which we document using an external data set from Comscore. Second, we show that consumers' book choices align with their self-reported genre preferences (see Figure A.4). Third, we document that consumers do not exclusively purchase the cheapest books on the website to maximize their cash bonus (see Table A.4). Finally, more than 60% of all participants decided they would keep their book if they won our lottery, and 27% of those who received a link redeemed their books, suggesting they truly liked the books they selected. Based on these results, we conclude that our experiment elicits meaningful search behavior and induces consumers to make choices that align with their book preferences.

Having validated our experimental data, we use them to estimate how consumers respond to ad exposure and ad content. In all analyses, we estimate ad effects using a linear regression model

$$y_i = \delta + \sum_{j=1}^{6} \beta_j \cdot T_i^j + \varepsilon_i$$

where $y_i$ is the outcome variable, $\delta$ is the mean in the no advertising condition, $\beta_j$ are ad effects, and $T_i^j$ is an indicator that participant $i$ is assigned to ad copy $j$. In Appendix C, we report randomization checks that use demographic variables and self-reported book preferences. While in some analyses the ATE estimates $\hat{\beta}_j$ are of direct interest, we study ad content effects by computing the differences (e.g., $\hat{\beta}_{genre} - \hat{\beta}_{plain}$), thus estimating the incremental effect of ad content relative to the effect of plain ads. We report robust standard errors in all analyses (Imbens 2010).[22]

### 5.2. Exposure Effects

We start by estimating the effects of ads that do not explicitly reveal any attribute information. To this end, we estimate consumers' responses to plain ads relative to the control condition with no ads. The effects of plain ads establish a benchmark against which we measure the effects of ad content.

Appendix Table A.5 reports the estimated advertising effects for *Lost Girls* in Panel A and *Stateline* in Panel B. Consistent with Proposition 1, we find that showing a plain ad significantly increases the search and purchase probabilities of the advertised books. Advertising *Lost Girls* makes the consumer $0.071/0.052 \approx 137\%$ ($p < 0.001$) more likely to search this book by visiting its product page and $0.037/0.028 \approx 132\%$ ($p < 0.001$) more likely to purchase it. We find even stronger advertising effects for *Stateline*. Showing a plain ad for this book makes consumers $0.072/0.050 \approx 144\%$ ($p < 0.001$) more likely to search it and $0.057/0.017 \approx 335\%$ ($p < 0.001$) more likely to purchase it. These exposure effects are primarily driven by clicks on the ad banner itself, rather than clicks on the organic product listing or product recommendations.[23]

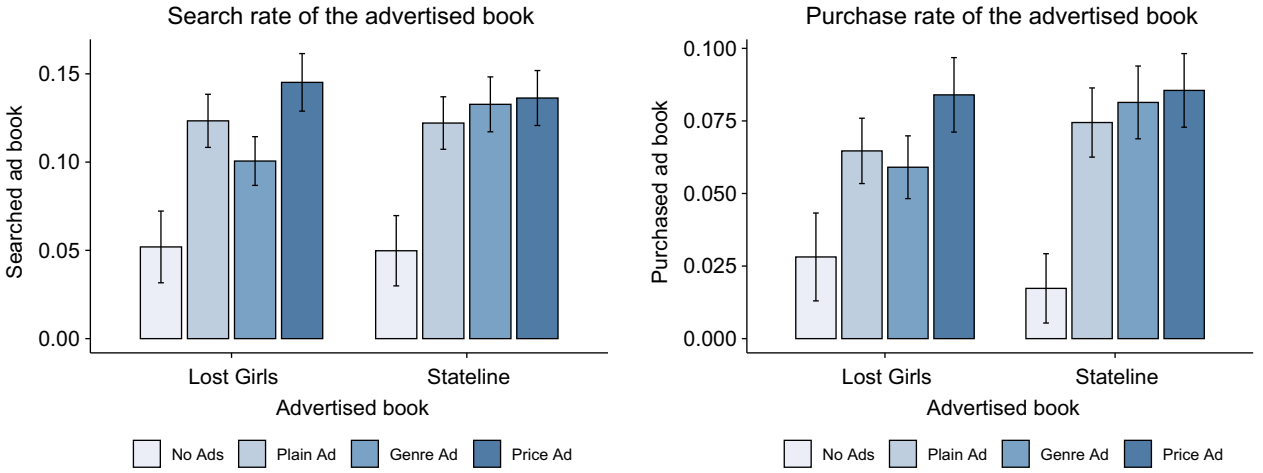
Overall, these results illustrate that plain ads strongly increase demand for the advertised book. As discussed in Section 2, these exposure effects could arise because plain ads make consumers aware of a book, reduce its search costs, or signal its high quality. Testing these mechanisms is outside the scope of this paper. Instead, we now turn to discussing the incremental effects of ad content.

### 5.3. Content Effects

To visualize the effects of ad content, in Figure 3 we plot the average search and purchase probabilities of the advertised books across all conditions. In Table 1, we report the corresponding ATE estimates, their robust standard errors and $p$-values, and the $p$-values of pairwise $t$-tests.

We find substantial evidence of content effects. Revealing genre makes the ad for *Lost Girls* 31% less effective at increasing searches ($\hat{\beta}_{genre} - \hat{\beta}_{plain} = -0.023$

**Figure 3.** (Color online) Estimated Advertising Effects on Searches and Purchases




*Notes.* The figure visualizes the average search probabilities (left graph) and purchase probabilities (right graph) for each ad condition. The results of all pairwise *t*-tests for the equality of means are reported in Table 1.

with $p = 0.029$), whereas it makes the ad for *Stateline* directionally 15% more effective at increasing searches ($\hat{\beta}_{genre} - \hat{\beta}_{plain} = 0.011$ with $p = 0.334$). The effects on purchase probabilities are directionally the same but not statistically significant. By contrast, revealing price makes the ad more effective for both books. For *Lost Girls*, the price ad is 31% more effective at increasing searches ($\hat{\beta}_{price} - \hat{\beta}_{plain} = 0.022$ with $p = 0.054$) and 51% more effective at increasing purchases ($\hat{\beta}_{price} - \hat{\beta}_{plain} = 0.019$ with $p = 0.027$) than the plain ad. We find similar effects for *Stateline*, albeit with relatively high *p*-values. As these estimates suggest, revealing different book attributes in ads may substantially strengthen or weaken ad effects.

To understand the mechanisms behind these content effects, we turn to our theoretical predictions in Section 2. Consider first the effects of revealing genre. Our model rests on the assumption that consumers cannot infer genre from the book's title and cover art, and thus the genre ad reveals new information relative to the plain ad. To test whether this assumption holds, we look for evidence of differential search patterns in the plain ads

**Table 1.** Estimated Advertising Effects on Searches and Purchases

| | Prob. Searched Advertised Book | | | Prob. Purchased Advertised Book | | |
|---|---|---|---|---|---|---|
| | Estimate | S.E. | *p*-value | Estimate | S.E. | *p*-value |
| Panel A. Advertising for Lost Girls | | | | | | |
| ATE regression estimates (Lost Girls) | | | | | | |
| $\beta$ Plain ad | 0.071 | 0.013 | 0.000 | 0.037 | 0.010 | 0.000 |
| $\beta$ Genre ad | 0.049 | 0.012 | 0.000 | 0.031 | 0.009 | 0.001 |
| $\beta$ Price ad | 0.093 | 0.013 | 0.000 | 0.056 | 0.010 | 0.000 |
| Implied ATE differences | | | | | | |
| $\beta$ Genre − $\beta$ Plain | −0.023 | 0.010 | 0.029 | −0.006 | 0.008 | 0.480 |
| $\beta$ Price − $\beta$ Plain | 0.022 | 0.011 | 0.054 | 0.019 | 0.009 | 0.027 |
| $\beta$ Price − $\beta$ Genre | 0.045 | 0.011 | 0.000 | 0.025 | 0.009 | 0.004 |
| Panel B. Advertising for Stateline | | | | | | |
| ATE regression estimates (Stateline) | | | | | | |
| $\beta$ Plain ad | 0.072 | 0.013 | 0.000 | 0.057 | 0.009 | 0.000 |
| $\beta$ Genre ad | 0.083 | 0.013 | 0.000 | 0.064 | 0.009 | 0.000 |
| $\beta$ Price ad | 0.087 | 0.013 | 0.000 | 0.068 | 0.009 | 0.000 |
| Implied ATE differences | | | | | | |
| $\beta$ Genre − $\beta$ Plain | 0.011 | 0.011 | 0.334 | 0.007 | 0.009 | 0.432 |
| $\beta$ Price − $\beta$ Plain | 0.014 | 0.011 | 0.197 | 0.011 | 0.009 | 0.213 |
| $\beta$ Price − $\beta$ Genre | 0.004 | 0.011 | 0.750 | 0.004 | 0.009 | 0.649 |

*Notes.* The table reports ATE estimates on the search probability (columns 1–3) and purchase probability (columns 4–6) of the advertised book. For each outcome, we report the treatment effect estimates $\hat{\beta}_j$, robust standard errors, and *p*-values. The top panel reports the results for *Lost Girls*, in which rows 1–3 present the estimates $\hat{\beta}_{plain}$, $\hat{\beta}_{genre}$, and $\hat{\beta}_{price}$, and rows 4–6 report results from the pairwise t-tests of coefficients $\hat{\beta}$ where the null hypothesis assumes the two effects are equal. The bottom panel reproduces the same results for *Stateline*.

**Table 2.** Match Value Effect of Genre Advertising

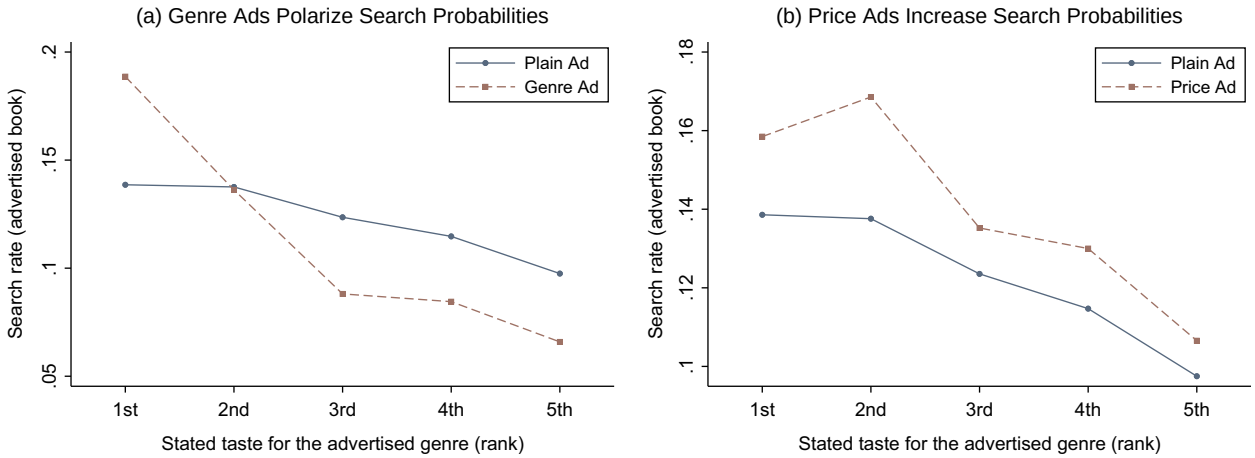
| | Plain ad | Genre ad | $\hat{\beta}$ | S.E. | $p$-value |
|---|---|---|---|---|---|
| Panel A. Advertising for Lost Girls | | | | | |
| Probability of searching Lost Girls: | | | | | |
| Consumers who ranked romance 1st | 0.108 | 0.140 | 0.032 | 0.026 | 0.212 |
| Consumers who ranked romance 2nd–5th | 0.127 | 0.092 | −0.035 | 0.011 | 0.002 |
| Probability of purchasing Lost Girls: | | | | | |
| Consumers who ranked romance 1st | 0.079 | 0.102 | 0.023 | 0.022 | 0.311 |
| Consumers who ranked romance 2nd–5th | 0.062 | 0.049 | −0.013 | 0.008 | 0.133 |
| Panel B. Advertising for Stateline | | | | | |
| Probability of searching Stateline: | | | | | |
| Consumers who ranked mystery 1st | 0.157 | 0.220 | 0.063 | 0.024 | 0.009 |
| Consumers who ranked mystery 2nd–5th | 0.108 | 0.097 | −0.012 | 0.012 | 0.312 |
| Probability of buying Stateline: | | | | | |
| Consumers who ranked mystery 1st | 0.100 | 0.125 | 0.025 | 0.019 | 0.195 |
| Consumers who ranked mystery 2nd–5th | 0.065 | 0.063 | −0.001 | 0.010 | 0.890 |
| Panel C. Pooling both books | | | | | |
| Probability of searching the advertised book: | | | | | |
| Consumers who ranked ad genre 1st | 0.139 | 0.189 | 0.050 | 0.018 | 0.005 |
| Consumers who ranked ad genre 2nd–5th | 0.118 | 0.094 | −0.024 | 0.008 | 0.003 |
| Probability of purchasing the advertised book: | | | | | |
| Consumers who ranked ad genre 1st | 0.092 | 0.116 | 0.024 | 0.015 | 0.104 |
| Consumers who ranked ad genre 2nd–5th | 0.063 | 0.056 | −0.007 | 0.006 | 0.245 |

*Notes.* The table reports our tests of the match value effect for *Lost Girls* (top panel), for *Stateline* (middle panel), and for both books with data pooled across all conditions (bottom panel). Each panel reports the means of the outcome variable in the two experimental conditions (columns 1–2), the estimated effect of revealing genre information relative to plain ads (column 3), and robust standard errors and $p$-values (columns 4–5). We split participants into two groups based on their stated genre preferences: participants who ranked the advertised genre first and all other participants.

condition. If consumers exposed to a plain ad can infer the advertised book's genre, then those who favor that genre should search the book more frequently than others. Column 1 in Table 2 shows mixed evidence. After being exposed to a plain ad for *Lost Girls*, consumers who favor romance novels have a lower baseline search rate than others. However, after exposure to a plain ad for *Stateline*, consumers who prefer the mystery genre have a higher baseline search rate, suggesting they can partially infer this book's genre. Although this partial inference can weaken our experimental manipulation for *Stateline*, genre ads should still polarize consumers' search decisions as long as some consumers cannot infer genres from titles and book covers.

Proposition 2a predicts that genre ads may polarize consumers' search decisions relative to plain ads. Figure

**Figure 4.** (Color online) The Effects of Genre and Price Ads on the Search Rate of the Advertised Book



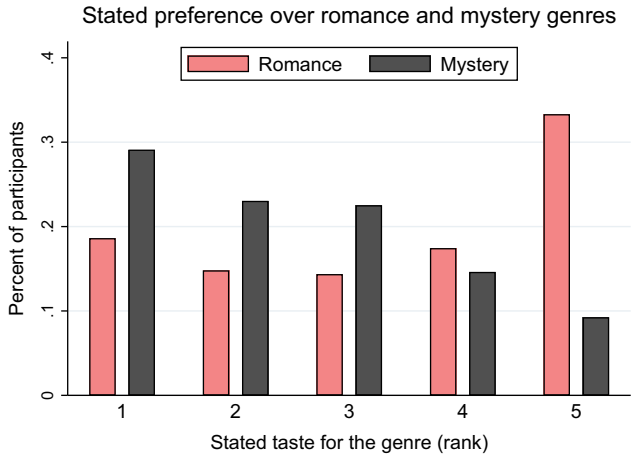

*Notes.* The left graph show the average search and purchase probabilities under genre ads and price ads. The right graph show the same probabilities but for price ads relative to plain ads. The effects are shown for five groups of consumers based on their self-reported preference for the genre of the book they saw advertised (i.e., either romance or mystery genre depending on whether they saw an ad for *Lost Girls* or *Stateline*). 1st is the most preferred genre and 5th is the least preferred. Both graphs pool data across the two books.

4(a) provides a direct test of this proposition. The figure visualizes the average search rate of the advertised book under genre ads (red dashed line) and plain ads (blue solid line) for five groups of consumers who differ by their stated preference for the advertised genre. Consistent with the proposition, revealing genre increases the search probability among consumers who favor this genre, has little effect on consumers who ranked this genre second, and substantially decreases the search probability among all other consumers.

We formally test these effects in Table 2 by estimating the ATE of genre ads on search and purchase probabilities relative to plain ads. To maximize statistical power, we pool consumers into two groups: those who ranked the advertised book's genre as their most preferred genre and everyone else. Panels A and B present results separately for each book, and in Panel C we pool data from both books. Focusing on the pooled estimates, we find that revealing genre significantly increases the search probability of the advertised book for consumers who favor its genre by $0.050/0.139 \approx 36\%$ ($p = 0.005$) and significantly decreases it by $0.024/0.118 \approx 20\%$ ($p = 0.003$) for all other consumers. We also show suggestive evidence that these effects translate into purchases: revealing genre increases the advertised book's purchase rate by $0.024/0.092 \approx 26\%$ ($p = 0.104$) for consumers who favor the advertised genre and decreases the purchase rate by $0.007/0.063 \approx 11\%$ among all others ($p = 0.245$).

This polarization result explains why revealing genre in *Stateline* ads increases the aggregate search probability but revealing genre in *Lost Girls* ads decreases it. As Proposition 2b shows, because revealing genre polarizes consumers' responses, the overall effectiveness of a genre ad depends on the share of consumers who favor the advertised genre. In our sample, consumers rank the mystery genre much higher on average than the romance genre (see Figure 5). For this reason, revealing the genre of a mystery book generates strong positive effects on searches that offset the negative effects on consumers who dislike the genre. By contrast, revealing the genre of a romance book generates mostly negative effects on search, which overpower the positive effects among the smaller group of consumers who like romance novels.

**Figure 5.** (Color online) Distribution of Genre Preferences for Romance and Mystery Novels




*Notes*. The graph shows the percent of respondents that assign a given rank to each genre. Rank 1 is the most preferred and rank 5 is the least preferred.

Next, to explain why price ads appear to be the most effective at driving searches and purchases, we turn to Proposition 3. Specifically, Proposition 3a posits that revealing price should increase the search and purchase probabilities of the advertised book for all consumers regardless of their genre preferences, assuming the revealed price is sufficiently appealing. The latter assumption holds in our experiment because price ads reveal the advertised book to be one of the cheapest options in the store.

To test this prediction, in Figure 4(b) we visualize the average search rate of the advertised book under price ads (red dashed line) and plain ads (blue solid line) for the same five consumer groups based on their stated genre preferences. Relative to plain ads, price ads increase the search probabilities in all consumer groups. We analyze these differences formally in Appendix Table A.6. Consistent with Proposition 3a, the price ad directionally increases the search rate by $0.020/0.139 \approx 14\%$ ($p = 0.244$) among consumers who ranked the advertised genre first and by $0.017/0.118 \approx 14\%$ ($p = 0.059$) among all other consumers. Once again, these effects on search translate into purchases: revealing price directionally increases purchases among consumers who rate the advertised genre first $0.005/0.092 \approx 5\%$ ($p = 0.717$) and significantly increases purchases by $0.018/0.063 \approx 28\%$ ($p = 0.010$) among all other consumers.

These uniform responses explain why price ads are highly effective in our experiment. Consistent with Proposition 3a, a low price ad induces positive responses among all consumers regardless of their genre preferences, thus increasing the average search and purchase probabilities of the advertised book (Proposition 3b).

Put together, our experimental results show that ad content plays a substantial role in shaping advertising effects, and our theoretical model clarifies the mechanisms behind these content effects. When an ad reveals a favorable vertical attribute, such as a low price, the effects of ad content are positive across consumers with different genre preferences because all consumers positively update their beliefs about the book. By contrast, revealing a horizontal attribute, such as the book's genre, attracts some consumers while discouraging others from searching the book. Importantly, revealing a niche genre that few consumers like but many dislike significantly reduces searches and directionally reduces purchases of the advertised book.

### 5.4. Spillover Effects

We have so far discussed how ad content influences searches and purchases of the advertised book. In practice, advertising content effects might also spill over to nonadvertised books. Although our search model does not directly predict these spillovers, the prior empirical literature has presented evidence that ad exposure increases demand for products that are similar to the advertised option (Lewis and Nguyen 2015, Sahni 2016, Shapiro 2018).[24] In the case of ad content, revealing an attribute in ads could make it more salient to consumers (Mackenzie 1986), which may lead them to focus on other books with this attribute. Genre ads may then encourage consumers to seek other books of the same genre, and price ads may lead them to examine other cheap books offered in the store.

Both advertisers and platforms could benefit from knowing whether such spillovers occur. An advertiser, for example, may have little interest in revealing attributes in ads if it knows that doing so will increase demand for similar products sold by competitors. Further, a platform might want to understand whether price ads for individual products can make consumers more price-sensitive, thus changing the platform's pricing incentives.

In Table 3, we test for spillover effects using several outcome variables. First, if a price ad induces consumers to search other inexpensive books, consumers may sort books by price to locate other cheap options. In the same vein, if a genre ad encourages consumers to seek other books of the same genre, they may use filters to navigate to the relevant genre subcategory. We find null effects in both cases ($p$-values between 0.108 and 0.986). Second, even without inducing consumers to use different search tools, ad content could still make them more likely to click on the organic listings of similar books. We test for this effect but find little evidence that price ads increase the search or purchase probabilities of other inexpensive books priced below \$1 ($p$-values 0.599 and 0.723), or that genre ads induce consumers to search or purchase nonadvertised books of the same genre ($p$-values 0.581 and 0.304). Lastly, consumers do not report ascribing more importance to price or genre after being exposed to ads that advertise these attributes ($p$-values 0.694 and 0.601).

Although we find no evidence of spillovers in the attribute space, we do find evidence of spatial spillovers.[25] As shown in Appendix Figure A.6, advertising draws consumers' attention to books located near the advertising banner (the front page layout is shown in Figure 1). Ads reduce the purchase rates of the two books in the leftmost column (*Mrs. Kennedy and Me* and *Dead by Sunset*) and increase the purchase rates of several books located immediately under the advertising banner. These spatial spillovers arise consistently for all ad copies.[26] We speculate that consumers examine the product list page from top to bottom and from left to right, which generates natural position effects. The ad banner then disrupts the normal flow of search and weakens these position effects. This may explain why the two books in the leftmost column become less popular—these books would normally be the most salient. The advertising banner might draw attention away from these books and toward books that are located near the banner itself. Appendix E discusses these results in more detail.

### 5.5. Effects on Search Intensity and Choice Satisfaction

Our results shed light on how ads with varied content influence consumers' search and purchase decisions. So far, however, we have been silent on whether any of these effects benefit consumers. Ads could save

**Table 3.** Advertising Spillovers to Similar Nonadvertised Books

| | Plain ad | Attribute ad | $\hat{\beta}$ | S.E. | $p$-value |
|---|---|---|---|---|---|
| Panel A. Spillovers from price ads | | | | | |
| Sorted by price low-to-high | 0.233 | 0.230 | −0.004 | 0.010 | 0.716 |
| Sorted by price high-to-low | 0.033 | 0.028 | −0.005 | 0.004 | 0.205 |
| Searched other cheap books | 0.514 | 0.507 | −0.006 | 0.012 | 0.599 |
| Bought another cheap book | 0.419 | 0.424 | 0.004 | 0.012 | 0.723 |
| Self-reported price importance | 3.029 | 3.042 | 0.013 | 0.032 | 0.694 |
| Panel B. Spillovers from genre ads | | | | | |
| Filtered to advertised genre | 0.017 | 0.017 | −0.000 | 0.003 | 0.986 |
| Filtered to any genre | 0.060 | 0.070 | 0.009 | 0.006 | 0.108 |
| Searched other books of advertised genre | 0.282 | 0.287 | 0.006 | 0.011 | 0.581 |
| Bought another book of advertised genre | 0.199 | 0.208 | 0.010 | 0.009 | 0.304 |
| Self-reported genre importance | 4.011 | 3.998 | −0.013 | 0.024 | 0.601 |

*Notes.* Each panel reports the estimated ATE of revealing an attribute (price in Panel A and genre in Panel B) on measures of attribute-oriented search and the search and purchase probabilities of books similar to the advertised option. The table compares consumer behavior under plain ads to that under attribute ads (either genre or price ads, depending on the panel). Each panel reports the means of the outcome variables in the plain ads condition and in either the genre or price ad condition (columns 1–2), the estimated effect of attribute ads relative to the plain ads condition (column 3), and robust standard errors and $p$-values (columns 4–5). The estimates are pooled across both books to maximize statistical power. Cheap books are defined as books priced below \$1.

consumers time by reducing the number of books they need to examine before finding a good match, or they could divert consumers' search toward a low quality option and increase the amount of time needed to find a good book. The welfare effects of ads will also depend on whether the books consumers choose after seeing ads match their preferences better or worse than the books they would choose without ads. Understanding these effects might be of particular interest for platforms that want to know whether showing ads on their websites can improve the shopping experience and increase customer retention.

Although a complete welfare analysis is outside the scope of this paper, here we explore the effects of ads on several proxies for consumer welfare. Appendix Figure A.12 visualizes the effects of different ads on measures of overall search effort. Relative to no ads, a plain ad leads consumers to search 10% fewer books (from 2.14 to 1.92, $p = 0.059$), reduces the probability of opening more than one product list page by 9% (from 0.712 to 0.646, $p = 0.003$), and directionally reduces shopping time by 2.3% (from 3.88 to 3.79 minutes, $p = 0.570$).[27] These results suggest that plain ads induce consumers to search less. As long as this reduction in search does not lead to decreased customer satisfaction, it could be welfare-enhancing.

Next, we test whether consumers exposed to plain ads are more or less satisfied with their final choices than those in the no ad condition. If consumers exposed to plain ads are more satisfied with their purchases, they should be more likely to keep their selected book instead of choosing the cash after the experiment. We find that exposure to a plain ad does not significantly change the probability that consumers keep their selected book (from 0.615 to 0.614, $p = 0.966$). Thus, although plain ads help consumers make their choices with less search, they do not necessarily improve the quality of these choices.

Ad content may amplify both of these effects. Genre ads, for instance, may help consumers quickly find a book with a high match value, reducing the time they need to spend on search. Our data do not support this conjecture: relative to plain ads, attribute ads do not generate incremental effects on the number of searched books, number of opened product list pages, shopping time, or the probability of keeping the book (see Appendix Figure A.12). These findings suggest that revealing product attributes in ad creatives does not save consumers time and does not change how satisfied consumers are with their final choices. We acknowledge, however, that the estimates presented in this section are noisy and that the decision of whether to keep the book after the study may not capture all facets of consumer satisfaction.[28]

## 6. Discussion

One takeaway from our experimental results is that advertisers should carefully choose which product attributes to reveal in ad copies. Our experiment shows that advertising the right attributes can get consumers interested to learn the remaining attributes, but highlighting the wrong ones can convince consumers that the product is not even worth examining. Therefore, it might be a good idea to avoid advertising attributes that are likely to induce polarized responses from consumers.

Managers may also benefit from jointly optimizing the content of their ads and the scope of their advertising campaigns. A manager designing a mass advertising campaign might want to focus on advertising vertical attributes and avoid revealing niche product attributes that appeal to few consumers but repel many others. Alternatively, the manager can design a targeted campaign that selectively reveals a horizontal attribute. Our analysis suggests that the gains from such targeting can be sizable. For example, based on our estimates, showing the genre ad to consumers who favor mystery novels and the price ad to everyone else could increase the search probability of *Stateline* by 14% relative to showing the price ad to everyone. More generally, by highlighting the aspects of the product each consumer finds the most appealing, personalized ads could minimize negative ad content effects, thus increasing the ROI of advertising. The literature has documented that many firms successfully use consumer data for ad targeting (Johnson et al. 2017, Sahni et al. 2019, Wernerfelt et al. 2024). Our results suggest that firms might find it valuable to use such data for personalizing ad content as well.

We conjecture that ad content may also affect demand elasticities and thus have downstream consequences for firms' pricing decisions. Price ads allow consumers to screen the advertised book on price and may thus *rotate the book's demand curve counter-clockwise*, incentivizing the advertiser to charge a lower price (Robert and Stahl 1993, Kaul and Wittink 1995). By contrast, genre ads allow consumers to screen the advertised book based on how much they like the revealed genre, which may *rotate the book's demand curve clockwise* (Johnson and Myatt 2006) and incentivize the advertiser to charge a higher price (Meurer and Stahl II 1994). Our results show that consumers' responses to ad content are consistent with the theoretical predictions that lead to these demand rotations. A promising direction for future research would be to explicitly test for these rotations using data with exogenous variation in both ad content and prices.

Finally, we show that ad exposure reduces the total amount of search without affecting customers' satisfaction with their chosen book. This finding suggests an intriguing possibility that showing display ads on a platform might make shopping more efficient, which could potentially improve customer retention. Because we do not observe repeat store visits in our data, we leave testing this conjecture to future work.

## 7. Conclusions

In this paper, we create a simulated shopping environment in which consumers need to choose from an assortment of e-books while being exposed to display advertisements with varied content. Using data from an incentive-compatible experiment, we estimate how ad content causally influences consumer search and choice.

Although there are benefits to creating a simulated store, this approach is not without limitations. Relative to major online bookstores, our store lacks customer ratings and reviews, which could serve as an alternative source of information about products and thus reduce the effects of ad content. Further, our limited book assortment and forced-choice design could lead to larger than normal ad effects in our setting. For this reason, we caution against interpreting our results as capturing realistic magnitudes of ad effects in online retail.

Despite these limitations, we believe the methodology of creating a simulated online store holds promise. As our results show, it is possible to create a store where consumers make realistic search and purchase decisions and respond to ads. We have also demonstrated that one can conduct a large-scale laboratory experiment with thousands of participants by choosing a product that can be delivered online. Researchers can apply this methodology to other marketing problems, not necessarily related to ad content effects. Having created a simulated store, researchers can freely manipulate how the store presents information about products. Through such experiments, researchers could study how online retailers and platforms ought to optimally design the information environment in which consumers conduct their search. We would be excited to see future work in this area.

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## Endnotes

[1] Nielsen Catalina reports that almost 50% of the sales lift from advertising can be attributed to ad creatives (Nielsen 2022). Similarly, a 2022 study from Meta shows that following their recommended practices for making ad creatives can increase short-term sales 1.2 to 7.4 times and long-term sales 1.2 to 2.7 times (Meta 2017).

[2] For example, the creative management platform Confect explains that product attributes highlight "what makes your product different, unique from the rest" and are "typically the deciding factors" driving consumer choices. They claim that, based on their analysis, ads showing attributes perform 44% better than ads that do not describe the product (https://confect.io/blog/custom-labels-dynamic-product-ads). Meanwhile, The Ecomm Manager newsletter recommends that marketers "list the product attributes that will matter most to your prospective buyer."

[3] A few studies that do not observe ad content present indirect evidence suggesting that consumers learn product attributes from ads. For example, Anand and Shachar (2011) document that consumers make choices that seem more aligned with their tastes after being exposed to ads, and Ackerberg (2001) shows that advertising primarily affects consumers who have little experience with the advertised brand.

[4] Johnson and Myatt (2006) show that this polarized response may rotate the demand curve clockwise. Anderson and Renault (2006) find a similar effect in their model. The attention model of Gossner et al. (2021) also predicts polarized responses and demand rotations. In their model, advertising can generate negative effects when it helps consumers eliminate an unappealing option that does not match their tastes.

[5] Early papers in this literature document the prevalence of informative ad content (Resnik and Stern 1977, Stern and Resnik 1991, Abernethy and Franke 1996), but they do not study the effects of ad content on consumers' choices.

[6] A few papers study ad content effects in randomized experiments but do not manipulate attributes revealed in ads. Sudhir et al. (2016) randomize advertising content in a field experiment on charity ads but focus on measuring consumers' behavioral responses to ad content that is unrelated to attributes. Xu et al. (2014) randomize the source of a price ad in a laboratory experiment and find that participants respond more positively to price ads run by dealers than those run by manufacturers.

[7] Fong (2017) estimates the causal effect of ad exposures, whereas we focus on advertising content. Kalyanam and Kim (2024) implement a field experiment on a B2B company's website to study how revealing information about assortment breadth and quality affects search by influencing consumers' beliefs about search benefits.

[8] In a parallel effort, Dang et al. (2023) also create a simulated shopping platform to gather search data, but they focus on understanding the reasons behind search revisits rather than measuring ad effects.

[9] We created a written tutorial that provides detailed instructions on how to create an online store and conduct experiments within the store. Researchers can access the tutorial at https://github.com/ilyamorozov/adContent.

[10] We use two genres for illustration. It would be straightforward to extend this model to an arbitrary number of genres.

[11] In principle, consumers may believe that books' prices correlate with unobserved quality or match values. Because the range of prices in our store is fairly narrow, it is unlikely that such correlations play an important role.

[12] In our experiment, we only advertise books whose names and covers are relatively nondescript. Therefore, it makes sense to assume that consumers cannot infer other book attributes from the plain ads.

[13] Several theoretical consumer search papers view ads as reducing search costs (Arbatskaya 2007, Janssen and Non 2008, Armstrong et al. 2009, Haan and Moraga-González 2011).

[14] For example, see Nelson (1974) and Milgrom and Roberts (1986).

[15] The theoretical literature on match value advertisements discusses similar results (Grossman and Shapiro 1984, Meurer and Stahl II 1994).

[16] A participant always sees the same ad regardless of the number of times they return to the front page.

[17] In our pre-test, participants in the 50% fulfillment condition behaved similarly to those in the 100% fulfillment condition. Participants searched less and were less responsive to ads in conditions with lower fulfillment probabilities (0% and 10%), indicating that in these conditions, they were not sufficiently incentivized to conduct search.

[18] About 75% of the participants who attempted the study passed the comprehension checks.

[19] If we had given participants a "no choice" option during their shopping task, we would have lost data on the preferences of participants who chose the outside option. We borrowed our two-stage design from the literature on "dual response" conjoint surveys (Wlömert and Eggers 2016).

[20] When asked about the purpose of the study, only 0.2% of participants mentioned anything about ads.

[21] The experimental data and replication codes can be accessed at github.com/ilyamorozov/adContent.

[22] Following best practices, in the Appendix, we also report the results while controlling for pre-treatment covariates (Duflo et al. 2007, Bruhn and McKenzie 2009). Our results are robust to including these controls.

[23] In Appendix Table A.5, we also report the effects of plain ads on other outcome variables measured during different stages of the decision-making process (e.g., organic listing views, add-to-cart events, and book redemptions).

[24] The literature on modeling cross-product spillovers in consumer search is still in its infancy (Malladi 2022, Hodgson and Lewis 2023), and we are not aware of any theoretical search model that micro-founds the advertising content spillovers we study.

[25] This analysis, as well as our analysis of how ads affect consumer's satisfaction with their selected books (see Section 5.5), are the only analyses we did not anticipate in the study preregistration.

[26] Seiler and Yao (2017) hypothesize that newspaper feature ads could generate spillovers to other categories that are nearby in the physical store, but they report precisely estimated null effects. Bairathi et al. (2022) hypothesize that adding an endorsement badge to a service on an online platform could generate spillovers to unendorsed services. In their experiment, they find negative spillovers for proximate listings and positive spillovers to listings located further from the sponsored listing. Simonov et al. (2023) document attention spillovers from news articles to ads embedded in the news article. By contrast, we show spillovers going in the opposite direction, from ads to website content.

[27] Fong (2017) similarly finds that targeted offers for an online store reduce the total search activity on the retailer's website.

[28] We tested whether the average effects mask heterogeneity across consumers with different genre preferences but did not find significant differences in the total number of searches or propensities to keep the book after the study.

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