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Skippable Ads and Viewer Attention

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1. Introduction

An advertisement is successful only if the consumer devotes attention to it. But most commercial messages are unsolicited and interspersed among segments of non-commercial content (e.g. news). Marketers clearly understand the challenge of having their ads viewed. They try to make them worthy of attention through the use of non-informational cues, such as entertainment, and the careful timing of product and brand information. The consumption of advertising, therefore, is the result of joint decisions about advertising content and viewer attention. The strategic interaction of these decisions is the focus of our research.

A better understanding of ad consumption is particularly relevant in the information age. Not only do consumers have more distractions given the ubiquity of digital devices, but marketers have multiple advertising formats with which to reach them.[1] Many ads, for instance, arrive in a *non-skippable* format (e.g. television and radio) and have the property that, even though a viewer is free to tune out an ad, say by switching channels or checking email on her phone, she cannot skip directly to the intended content. Alternatively, ads often arrive in a *skippable* format, which allows the viewer to skip a portion of the ad and jump directly to the intended content. Ads in the skippable format appear, for example, in print media (e.g. magazines), because, once she sees an ad, the reader can turn the page to next bit of content. The skippable ad format also applies widely to digital media (e.g. YouTube's TrueView ads). Skippable ads on digital media often possess the added feature that an advertiser knows when the ad is skipped. We refer to this feature as *payment attribution*, because advertisers typically do not pay for skipped ads. Table 1 provides an overview of these ad formats with examples of their occurrences. (All Tables and Figures appear at the end of the report.) Each format implies different incentives for the viewer's attention and, correspondingly, may affect how the marketer uses ad content to induce that attention. The above discussion leads to the following questions: *How is ad content structured to induce viewer attention?* And *How does ad format moderate decisions on viewer attention and ad content?*

[1] By many accounts, competition for a consumer's attention is increasing. Boik, Greenstein, and Price (2016) find that, between 2008 and 2013, U.S. households' supply of attention online did not increase despite the proliferation of internet offerings and the increased ownership of viewing devices.

Because decisions on viewer attention and ad content are strategically intertwined, their interaction can be explored from an equilibrium perspective. In this vein, we study ad consumption as the outcome of a game between advertiser and viewer. The main contribution of this game-theoretic exercise is to dissect the fundamental incentives of these two agents and to put in place a microeconomic foundation for the consumption of advertising. Our analysis generates insights about various advertising content strategies seen in practice.

The viewer's objective is to allocate her attention optimally between ad viewing and some other non-ad-viewing activity (e.g. texting a friend or skipping to content). The advertiser's objective is a *viewer conversion*. A viewer is converted if she takes an action that has value to the advertiser. By defining conversion in this way, we permit a wide set of interpretations that include a purchase, a favorable impression, or even activating word-of-mouth. In conjunction with the viewer's engagement with an ad, we allow for two different degrees of conversion. A *weak conversion* represents a small payoff to the advertiser and can be achieved even when the consumer does not attend to the entire ad. Though a consumer might not watch an entire ad, she could have become aware or been reminded of the advertiser. A number of interpretations are possible for a weak conversion. For instance, brand awareness or follow-on search[2] offer indirect returns that do not directly lead to substantial viewer benefits. Such a modest objective is often valuable for advertisers who, for example, are new on the market. By contrast, a *strong conversion* gives bigger returns to the advertiser, but requires additional viewer engagement with the ad. We interpret a strong conversion as possibly a purchase or something that returns significant value to the viewer herself as well.

Our study indicates that entertainment can be utilized to counter viewers' tendencies to avoid or skip part of an advertisement. Entertaining content is less valuable for skippable ads than for non-skippable ads. In digital media, for which there is payment attribution, skippable ads have an even lower return on investing in entertaining content relative to non-skippable. This result may fuel the notion that digital ads are generally of lower copy quality relative to ads on traditional print and broadcast media (O'Guinn et al. 2009, p225). The model also explains how the advertiser can structure its informational content to combat viewer inattention by inducing

[2] Joo et al. (2014) show how ad viewing on television can lead to subsequent online search, as measured by the Google metric "Follow-on Search" (Pashkevich et al. 2012).

viewer curiosity. Viewer curiosity is induced by structuring the content so that the viewer obtains the highest expected benefit from continued ad viewing by way of a strong conversion. An extreme example of this practice is clickbait advertising, by which a small set of consumers succumb to temptation, click on the ad, and generate web traffic on the advertised site.

It is important to clarify the differential effects of entertainment and curiosity. Entertainment is more effective than curiosity when the advertiser believes the viewer is not inherently interested in the message. A retailer, for example, rebuilding a tattered brand may need an inspiring narrative and imagery to keep the viewer's attention in order to deliver the brand's message. By contrast, curiosity takes advantage of the viewer's inherent interest in learning about the product. A new version of a popular product can exploit the curiosity motive by saving the new features toward the end of the ad so that the viewer remains engaged throughout.

Finally, our model suggests that, whenever entertainment and curiosity are less effective, the advertiser structures its content for short attention spans by aiming for a weak conversion. A practical interpretation of this result is the use of skippable ads for modest marketing goals, such as raising brand awareness and is consistent with how YouTube and Facebook market their skippable video ads.[3]

2. A Theoretical Framework

We present a game-theoretic model to explore the interaction of the viewer's attention decision and the advertiser's decision about content. Mathematical details and formal proofs of all results are available in our companion paper "Advertising Content and Viewer Attention: The Role of Ad Formats" available at SSRN (https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3679335). Our model consists of two agents, a consumer and an advertiser. The consumer, sometimes also referred to as the viewer, interacts with an advertisement over two periods, $t = 1,2$. An advertiser has two types of signals which are both binary. They represent differential dimensions of information for the consumer. For convenience, we will interpret one of the signal types as the

[3] For example, Google promotes YouTube's skippable ads as being useful for building brand awareness: https://support.google.com/youtube/answer/2375464?hl=en

identifier and the other the *relevance indicator*.[4] The *identifier* (I) can be viewed as identifying the advertiser without giving immediate benefit to the viewer. Upon seeing this signal, the viewer identifies positively with the advertiser ($I = 1$) with probability $\rho_I \in [0,1]$. Otherwise, the viewer does not identify with the advertiser ($I = 0$). The *relevance indicator* (R), by contrast, can generate benefit to the viewer, but only if a favorable identification also occurs ($I = 1$). Upon seeing the relevance indicator, the viewer finds the advertiser relevant ($R = 1$) with probability $\rho_R \in [0,1]$. Otherwise, the advertiser is not relevant ($R = 0$). If the identifying and relevance indicator signals are jointly successful ($I = 1$ and $R = 1$, in either order), then the viewer obtains a direct benefit $u_s > 0$, stemming from a purchase or call to action. Thus, upon viewing both signals, the viewer receives benefit with probability $\rho_I \rho_R$. Otherwise, the viewer receives no benefit from the advertiser. She may still receive a benefit from the advertisement itself, in the form of entertainment, which we will introduce later.

The advertiser benefits from ad consumption from an event we call *conversion*, of which there are two types. A *weak conversion* gives the advertiser $V_w \geq 0$ and requires only that the consumer identifies the advertiser ($I = 1$). The viewer receives no benefit ($u_W = 0$). A *strong conversion* gives the advertiser $V_S > V_w$ and requires that *both* signals are successful – a favorable identification that is also relevant – (with probability $\rho_I \rho_R$). See Table 2 for a summary of the configurations of signals, conversions, and payoffs.[5] By construction, the advertiser's payoff from conversions are differentially aligned with the consumer's. This serves two purposes in our model. First, it generates strategic interaction between the advertiser in his choice of signal order and the viewer's choice to pay attention to the second part of the advertisement. Second, this payoff structure has flexible interpretations relating to different goals of advertising. For example, a strong conversion can be interpreted as a purchase or some other consumer action

[4] The labeling of these signals is merely for the convenience of nomenclature and should not be interpreted as the advertisement's explicit content. To help fix ideas, one can interpret the signals as follows. The identifier reveals whether the viewer views the advertiser favorably ($I = 1$) or unfavorably ($I = 0$), while the relevance indicator reveals whether or not the viewer is in the market for the product being advertised ($R = 1$ or $R = 0$, respectively). A favorable impression with the viewer in the market generates a strong conversion (e.g., purchase), but a favorable impression for a viewer not in the market generates only a weak conversion (e.g. a favorable impression).

[5] We assume that the viewer has a smaller weak-to-strong benefit ratio relative to the advertiser: $u_W/u_S \leq V_W/V_S$. The simplest case of this condition is $u_W = 0$. Further, it maintains the desired property of contrasting incentive alignments among strong and weak conversions. Specifically, viewer and advertiser incentives are aligned in a strong conversion, but a weak conversion benefits only the advertiser (incentives misaligned).

that mutually benefits the consumer and advertiser. Alternatively, one can interpret a weak conversion as the advertiser achieving an increased brand awareness or building customer-based brand equity. In such cases, the viewer receives no immediate benefit from the advertisement while the advertiser does.

Viewers are assumed to have differential attention costs across periods. Specifically, we normalize the attention cost in the first period to zero so that all viewers consume the first signal in period $t = 1$ and have positive attention costs for attending to the second signal in period $t = 2$. This setup mimics a situation in which, for example, viewers are shown the first part of an ad before realizing it is actually an advertisement. Based on the realization of the first signal (successful or unsuccessful), the consumer decides whether to attend to the second one. Receiving the second signal costs the consumer $c > 0$ and reflects her effort in paying attention to and concentrating on an ad. Consumers are distributed by their attention costs, $c \sim U[0, \bar{c}]$. The upper end of the support, $\bar{c} > 0$ represents the consumer whose attention cost is so high that she never engages with the second part of the ad.[6] (See Assumption 1.) The role of this variable, however, allows us to consider changes in viewing environment beyond media or formats. For instance, watching television at a sports bar with friends may have a higher value of $\bar{c}$ than television viewing alone at home. All viewers anticipate content after the advertisement, which gives a utility of $w > 0$, if viewed in period $t = 2$. In some cases, the viewer does not consume content until after period 2, in which case her content utility is discounted by a factor of $\delta > 0$. Viewers also receive direct utility $e \geq 0$ from watching the ad in period 2 in the form of entertainment. In Subsection 4.2 we consider the advertiser's choice of e, but for now it is considered fixed.

We consider two types of ad formats. The *non-skippable* ad format (N) defines that the viewer must wait until after period 2 to consume content, which delivers a discounted utility of δw. By not attending to the second message (period $t = 2$), the viewer saves her attention cost c

[6] An alternative specification is to suppose that viewers face a positive cost $c_1 \sim U(0, \bar{c})$ to view the first part of the ad. Viewers' decisions to pay attention would be based on a common expected benefit, b, from ad viewing. Then all viewers for whom $c_1 < b$ would initiate ad viewing. One can interpret $\bar{c}$ as this first period threshold b, which suggests that this specification is qualitatively similar to the specification maintained throughout the model.

and receives a utility of zero from the ad. Alternatively, in the *skippable* ad format (S), the viewer can skip the second period's signal and enjoy the undiscounted utility of content.

Within the skippable ad format, two types of payment structures are possible. With *payment attribution*, publishers can charge advertisers conditional on the viewer sitting for the duration of the ad. Such structures are employed in digital ads, such as TrueView ads on YouTube, ThruPlay video ads on Facebook, as well as pop-ups on content sites. Otherwise, without payment attribution, the advertiser pays for placing the ad regardless of whether the viewer attended to the entire ad. This latter payment structure is seen in display ads and in conventional print media. (See again Table 1.)

2.1 Viewer Attention

We start with the non-skippable format and assume the advertiser leads with I. Because the first signal is costless for the viewer to acquire, all viewers are exposed to it. A positive signal I (i.e., $I = 1$) is delivered with a probability ρ_I. The viewer's decision tree with both agents' payoffs are given Figure 1. If the viewer pays attention $c > 0$ in the second period, then she can expect a utility of

$$U_I^N(c) = \begin{cases} \rho_R u_s + (e - c) & \text{if } I = 1 \\ e - c & \text{otherwise,} \end{cases} \tag{1}$$

for a fixed level of entertainment $e \geq 0$. If the viewer does not pay attention in the second part of the ad, her utility is normalized to zero. Thus, we can define an attention cost threshold $\hat{c}_I^N$ such that any viewer with $c < \hat{c}_I^N$ attends to the second signal, which is successful (i.e., $R = 1$) with probability ρ_R. Specifically, setting (1) to zero gives two thresholds, $\hat{c}_I^N = \rho_R u_s + e$, if the first signal was successful, and $\tilde{c}_I^N = e$, otherwise. (We use the notations $\hat{c}$ and $\tilde{c}$ to generally denote the threshold when the first signal is successful and unsuccessful, respectively.) Note that if $I = 0$, then any conversion is impossible. Hence, the latter threshold is irrelevant to any equilibrium outcome and hence is ignored. The threshold $\hat{c}_I^N$ increases in e, so that more entertainment induces more viewers to attend to the second part of the ad. For the case of $\hat{c}_I^N$, the viewer is further motivated to pay attention from the value of product information, which is the expected value of a strong conversion, $\rho_R u_s$.

If the advertiser leads with R in the non-skippable format, her utility is

$$U_R^N(c) = \begin{cases} \rho_I u_s + (e - c) & \text{if } R = 1 \\ e - c & \text{otherwise,} \end{cases} \quad (2)$$

which defines thresholds $\hat{c}_R^N = \rho_I u_s + e$, if the first signal is successful (i.e., $R = 1$), and $\tilde{c}_R^N = e$ otherwise. The decision tree for this scenario is given in Figure 2. If $R = 0$, then the advertiser may still benefit from a weak conversion if the viewer attends to the second part of the ad and the second signal is successful ($I = 1$).

With the skippable format, the viewer's cost of pursuing a second signal is $c + \hat{w}$, where $\hat{w} \equiv (1 - \delta)w$ is the loss of utility due to not skipping the second part of the ad and in turn delaying the consumption of desired content. We interpret this as the viewer suffering attention cost c in addition to her delayed content. Decision trees for each of the I and R scenarios under the skippable format can be obtained by replacing δw in both "Ignore" branches with w in Figure 1 and 2, respectively. The determination of viewers' attention choices follows the same process as with the non-skippable ad format and we relegate the derivations to the Appendix with the corresponding thresholds in Lemma 1.

In order to ensure interior solutions, we make the following assumption:

Assumption 1 Let $e \geq 0$.

(i) For non-skippable ads (N): $\rho_{R/I} u_S + e < \bar{c}$.

(ii) For skippable ads (S): $0 \leq \rho_{R/I} u_S + e - \hat{w} < \bar{c}$.

This assumption is equivalent to the condition that thresholds $\hat{c}_I^f, \hat{c}_R^f, f \in \{N, S\}$ and $\tilde{c}_R^N$ reside in the interval $(0, \bar{c})$ so that some proper portion of the viewers do not attend to the second part of an ad.

Lemma 1 *Assume $e < \hat{w}$. The viewer's optimal attention decisions and conversion probabilities are summarized in Table 3. Under Assumption 1 all attention thresholds reside in $(0, \bar{c})$.*

The first interpretation from Lemma 1 is that continued viewing, as measured by the attention threshold, is increasing in $\rho_{I/R}u_S$ and e. The first term captures the informational incentive to attend to the ad, while the second captures non-informational benefits. These incentives are traded-off against attention cost $c > 0$ and lost content $\widehat{w}$ utility. Whenever the first signal is 0 (either I or R), there is no informational incentive. Only entertainment from the ad can inspire attention. Generally, the advertiser can obtain no benefit from consumer attention when the first signal is 0, except for one possibility. This is indicated in Table 3 by the conversion probabilities of zero when the first signal is 0, except in the non-skippable format with $R = 0$. In that case, $\tilde{c}_R^N/\bar{c}$ portion of consumers stick around purely for entertainment giving the advertiser a weak conversion with a probability of ρ_I. When $R = 0$ in the skippable format, all viewers skip to content by the lemma's assumption $\widehat{w} > e$, which guarantees that any advertisement is not preferable to the intended content on the medium.[7]

2.2. Advertiser's Content Decisions

The advertiser decides how to structure informational ad content by choosing the order of signals. In addition, the advertiser can also add an entertainment element. Thus, at the start of the game, the advertiser has two strategic decisions that can affect a viewer's allocation of attention and the likelihood of a conversion. Denote by $e \geq 0$, the "level" of entertainment chosen by the advertiser. Recall that e is the viewer's additional utility from the ad in period 2. Entertaining content gives the advertiser the ability to combat viewer inattention as well as the temptation to skip the ad under the skippable format. We interpret the choice of e as designing content that is more enjoyable to watch, say, by adding humor or telling a compelling story. Such content is assumed to be costly at an increasing rate and impossible to outdo inherent content. For convenience, we assume a quadratic cost function ke^2, $k > 0$. For now, we fix $e \geq 0$ and consider the advertiser's decision on entertaining content in Subsection 4.2.

Our formulation of content induces consumer attention in two dimensions: product information and pure viewing benefit. The differential roles of signals, I and R, allow the advertiser to structure product information in a way that can incentivize the viewer to expend effort attending to an ad because of the product benefit offered by the advertiser. By contrast, the

[7] This condition is formally implemented in terms of exogenous variables by Assumption 3.

entertainment e is a means for the advertiser to simply give the consumer a reward for sticking through the entire ad before watching the intended content.

Let $r \geq 0$ be the price the advertiser pays for an ad. Under the non-skippable format, the advertiser pays r regardless of whether the viewer attends to the entire ad. By contrast, under the skippable format with the payment attribution property, the advertiser pays r only if the viewer attends to the entire ad. For the immediate analysis, we ignore the skippable format without payment attribution. Skippable ads *without* payment attribution can be considered a specific case of this model, as explained later in Section 5.

The profit for the advertiser under the non-skippable format, as a function of content:

$$\pi_I^N = \rho_I\{\hat{c}_I^N[\rho_R \cdot V_S + (1-\rho_R)\cdot V_W] + (\bar{c} - \hat{c}_I^N)\cdot V_W\}/\bar{c} - r - ke^2; \quad (3)$$

$$\pi_R^N = [\rho_R\rho_I\hat{c}_R^N \cdot V_S + (1-\rho_R)\rho_I\tilde{c}_R^N \cdot V_W]/\bar{c} - r - ke^2. \quad (4)$$

In the above equations, the portion of consumers that watch in the second period is increasing in e. Thus, the advertiser's trade-off is the induction of more second period viewing relative to the cost of entertaining content.

For skippable ads, the advertiser's profit is similarly expressed, except that the advertiser does not pay when the consumer skips.

$$\pi_I^S = \rho_I\{\hat{c}_I^S[\rho_R \cdot V_S + (1-\rho_R)\cdot V_W] + (\bar{c} - \hat{c}_I^S)\cdot V_W\}/\bar{c} - r\,\frac{\hat{c}_I^S}{\bar{c}} - ke^2; \quad (5)$$

$$\pi_R^S = \rho_R(\rho_I V_S - r)\hat{c}_R^S/\bar{c} - ke^2. \quad (6)$$

2.2.1 Informational Content

To gain an understanding of the advertiser's ability to induce viewing through informational incentives, we start with the case of $e \geq 0$ and fixed. Define $\Delta^f \equiv \pi_I^f - \pi_R^f, f \in \{N, S\}$, as the incremental profit from leading with I. Then equations (3)-(6) imply

$$\Delta^N = \pi_I^N - \pi_R^N = \frac{\rho_I}{\bar{c}}[\rho_R u_s(\rho_R - \rho_I)V_S + (\bar{c} - \rho_R^2 u_S - e)V_W];$$

$$\Delta^S = \pi_I^S - \pi_R^S = \frac{1}{\bar{c}}\{(\rho_R\rho_I u_S V_S - r\widehat{w})(\rho_R - \rho_I) + \rho_I[\bar{c} - \rho_R(\rho_R u_S - \widehat{w} + e)]V_W\}.$$

In order to analyze the optimal informational content, we need only the following conditions:

$$\Delta^N > 0 \Leftrightarrow \rho_R u_s V_S(\rho_R - \rho_I) + (\bar{c} - \rho_R^2 u_S - e)V_W > 0; \quad (7)$$

$$\Delta^S > 0 \Leftrightarrow (\rho_R \rho_I u_S V_S - r\widehat{w})(\rho_R - \rho_I) + \rho_I[\bar{c} - \rho_R(\rho_R u_S - \widehat{w} + e)]V_W > 0. \quad (8)$$

The above conditions reveal two distinct drivers of the advertiser's informational content decision. These two drivers are active in both formats and can be identified in both (7) and (8). The first terms in each condition indicate the incremental profit from a strong conversion when going from R to I. The second terms define the incremental profit from a weak conversion. We study each of these two drivers in isolation. In what follows, we first shut down the second driver by setting $V_W = 0$, which implies that all advertiser profits come from a strong conversion and requires the viewer to watch the entire ad. Then we study the second driver by shutting down the first one by setting $\rho_R = \rho_I$ and allow $V_W > 0$.

First suppose $V_W = 0$. Under this condition, the advertiser obtains benefit from an ad only from a strong conversion. Noting that a strong conversion also gives benefit to the viewer, the advertiser's incentive is aligned with the viewer's. As such, the advertiser can induce continued viewing by maximizing the viewer's expected benefit from conversion. This is seen directly from the condition (7) when $V_W = 0$ from the fact that $\Delta^N > 0$ if and only if $\rho_R > \rho_I$. The advertiser leads with the weaker signal so that the viewer who has had a successful signal in the first period, has a larger expected benefit for attending to the second part of the ad. This motive capitalizes on the viewer's incentive to acquire more information in the second signal. Therefore, we refer to the advertiser's motive to exploit the viewer's desire for more information as the *curiosity-inducing motive*. The curiosity-inducing motive relies on the viewer's desire for a strong conversion and applies uniquely to that advertiser goal.

The curiosity-inducing motive is active under the skippable ad format as well, as long as $\rho_R \rho_I V_S > r\left(\frac{\widehat{w}}{u_S}\right)$. The term on the left-hand side reflects the advertiser's expected benefit from the viewer's pursuit of the second signal. The term on the right-hand side of this condition relates to the expected savings for the advertiser when the viewer skips the second part of the ad, which is clearly proportional to the price of a fully viewed ad, $r > 0$, and the viewer's trade-off from pursuing the ad, as reflected by the term $\widehat{w}/u_S$. Thus, the condition means that the payment

attribution incentive of the advertiser is inferior to that of a strong conversion. Otherwise, when $\rho_R\rho_I V_S < r\left(\frac{\hat{w}}{u_S}\right)$, the advertiser will lead with the stronger signal in order to reduce ad costs by discouraging the viewer from paying attention. Because this latter situation is uninteresting, we shall henceforth assume the following.

Assumption 2 $\rho_R\rho_I V_S > r\left(\frac{\hat{w}}{u_S}\right)$.

The above discussion establishes part (i) of Proposition 1 below.

Next we allow $V_W > 0$ and examine the second driver of the advertiser's informational content decision, which relates to the motive of the advertiser to obtain a weak conversion. This is isolated by the condition $\rho_R = \rho_I$, which shuts down the curiosity-inducing motive discussed above. It immediately follows from (7) and (8) that $\Delta^f > 0$. The advertiser in both formats unambiguously prefers to lead with I because it increases the possibility of a weak conversion. Leading with I means that a weak conversion can occur regardless of how much attention the viewer pays to the remainder of the ad. As such, we refer to this as the *short-attention-span motive* for the advertiser's goal of a weak conversion in the first part of the ad, which has the maximal audience. The above arguments are formally summarized in the next proposition.

Proposition 1 Suppose $e < \hat{w}$ and e is fixed.

(i) *Let* $V_W = 0$. $\pi_I^f > (<)\pi_R^f, f = N, S$, *if and only if* $\rho_I < (>)\rho_R$. *(Curiosity-Inducing)*

(ii) *Let* $V_W > 0$. *If* $\rho_R = \rho_I$ *then* $\pi_I^f > \pi_R^f, f = N, S$. *(Short-Attention Span)*

Though not explicitly shown in part (ii), the short-attention-span motive is stronger for skippable ads than non-skippable. That is, the relative attractiveness of I over R, as measured by $\Delta^S - \Delta^N$, is stronger for skippable ads. According to (7) and (8), $\Delta^S - \Delta^N > 0$ if (i) $V_W > 0$ and (ii) $r(\rho_I - \rho_R) > 0$.[8] In the former condition, the advertiser cares about a weak conversion, as

[8] Equations (7) and (8) imply that $\Delta^S - \Delta^N = \frac{r\hat{w}}{\bar{c}}(\rho_I - \rho_R) + \frac{\rho_I}{\bar{c}}[\rho_R\hat{w} + (1-\rho_R)e]V_W$, which is positive if $r(\rho_I - \rho_R) > 0$ and $V_W > 0$.

per the short-attention span motive. The second condition furthers the advertiser's incentive to lead with I to capitalize on the payment attribution property of skippable ads. When the viewer skips the ad, the advertiser saves ad costs if $r > 0$. Leading with I when $\rho_R < \rho_I$, encourages this cost savings because the viewer is less pursuant of the second signal, R.

Given the stronger incentive for I under skippable ads, we can also ask: *Does a format change ever induce the advertiser to revise signal order, all else equal?* Specifically, does a switch from the non-skippable to skippable ever induce the advertiser to switch from leading with R to leading with I? To understand the answer to this question, we study the conditions that lead to the condition $\Delta^N < 0 < \Delta^S$. We look at this question through a constrictive lens that relates purely to conversions. In particular, we ignore the payment attribution ($r > 0$) effect, which always encourages I for the skippable format. Therefore, in Proposition 2, we characterize the motivations for an order switch that are independent from avoiding the cost of advertising.[9]

Proposition 2 *Let $e < \hat{w}$ be fixed and $r = 0$. Further suppose $\rho_R < \rho_I$ and $V_W > 0$. A change in ad formats from N to S induces the advertiser to switch signal order from R to I, (i.e., $\Delta^N < 0 < \Delta^S$), if and only if* $\frac{\bar{c}-\rho_R^2 u_S - e}{\rho_R(\rho_I-\rho_R)u_S} < \frac{V_S}{V_W} < \frac{\bar{c}-\rho_R^2 u_S + \rho_R(\hat{w}-e)}{\rho_R(\rho_I-\rho_R)u_S}$.

Necessary for $\Delta^N < 0 < \Delta^S$ is that the advertiser has more of an incentive for I under the skippable format relative to the non-skippable ($\Delta^S - \Delta^N > 0$), as discussed above. This requires the proposition's conditions $\rho_R < \rho_I$ and $V_W > 0$. The conclusion of Proposition 2, therefore, specifies exactly when a switch in ad formats, from non-skippable to skippable, forces an equilibrium change from R to I ($\Delta^N < 0 < \Delta^S$). When V_S/V_W is too small, then I is more profitable under both ad formats because of the relatively high value of a weak conversion. Conversely, when this ratio is very large, the advertiser invokes the curiosity-inducing motive under both formats by leading with the signal with the lower probability, R. Additional insight from Proposition 2 is found by studying the difference in the bounds on this ratio (focusing on

[9] In other words, the restriction to $r = 0$ is the most restrictive condition on the set of parameter values that lead to a switch in order.

the numerators), which is $\rho_R(\hat{w} - e) + e > 0$. Holding all else constant (including e), an increase in $\rho_R(\hat{w} - e)$ reduces the chance a viewer watches the second part of the ad under the skippable format but does not change anything in the non-skippable format. Thus, from the advertiser's perspective, an increase in $\rho_R(\hat{w} - e)$ makes leading with I even more attractive under skippable but does not alter the incentives under non-skippable. An increase in e alone (holding $\rho_R(\hat{w} - e)$ constant) works in support of R under the non-skippable format by encouraging viewers to watch the second part of the ad and generate a strong conversion for the advertiser.

The general lesson from Proposition 2 is that the short-attention span motive (to lead with I) is more acute for skippable ads than for non-skippable ads. The proposition's conditions assure us that, even when the curiosity-inducing motive is active, there are situations in which the short-attention-span motive dominates exclusively for the skippable format. The presence of payment attribution only accentuates the incentive to lead with I. In what follows, we see how the advertiser's endogenous choice of entertainment interacts with these two motives for informational content.

2.2.2 Entertaining Content

Entertaining content provides *non-informational* benefit for consumers to attend to the second part of the ad. We now introduce the advertiser's strategy to combat viewer distractions by choosing an amount of entertaining content (e), which we assume is costly (ke^2). The viewer can infer the value of e before making attention decision in period 2, and attention is needed for the viewer to enjoy the benefit of e. For example, the viewer can infer e based on the plot/setup (in the first part of the ad) but can enjoy the benefit only after finishing the whole story (the whole ad). In order to ensure that the advertiser in our model cannot fully offset the cost of delayed content ($\hat{w}$), we make the following assumption, which is equivalent to the condition $\hat{w} > e$ for all scenarios

Assumption 3: Entertainment cost parameter satisfies
$k > \underline{k} \equiv \frac{\rho_I}{2\bar{c}\hat{w}}[\rho_R V_S + (1 - \rho_R)V_W]$.

Optimizing profits in (3)-(6) with respect to e leads to the following.

Lemma 2 *The advertiser's optimal entertainment levels are given in Table 4.*

(i) *If* $V_W = 0$, *then* $e_I^N = e_R^N$.

(ii) *If* $V_W \geq 0$, *then* $e_{I/R}^N > e_{I/R}^S$.

(iii) *If* $V_W > 0$, *then* $e_R^f > e_I^f$, $f = N, S$.

Part (i) simply confirms that, for non-skippable ads when $V_W = 0$, the order of signals does not affect the amount of entertainment. Because the sole source of advertiser profit is from a strong conversion, the marginal return to entertainment is equal to $\rho_R \rho_I V_S / \bar{c}$ for either informational content strategy. This is an intermediate result that will aid us in interpreting the results in Propositions 3 and 4.

Part (ii) establishes the general property in equilibrium that there is less entertainment in the skippable format than in the non-skippable format. The case of $e_I^N > e_I^S$ is due to the payment attribution aspect of skippable ads. In particular, whenever $r > 0$, the advertiser obtains a cost savings when the viewer skips. While this same force is at work in the case of R, the result of $e_R^N > e_R^S$ is also driven by the fact that the advertiser uses entertainment for a weak conversion in period 2 under the non-skippable format, but not under the skippable format. Part (iii) shows how the short-attention-span motive interacts with the advertiser's return on entertainment. Recall from Proposition 1, that this motive is active only if the advertiser obtains positive benefit from a weak conversion, $V_W > 0$. In this case, the advertiser has a greater incentive for entertainment under R than under I. Even if $R = 0$ in the first ad period, entertainment can encourage a weak conversion by having the viewer stick around for the second period. However, if $I = 0$ in the first period, then the advertiser gains no benefit from the viewer's continued viewing in the second period. Thus, the short-attention-span motive, which favors leading with I, comes with a lower return on investing in entertainment.

Finally, we derive several insights from the comparative statics implied by expressions in Table 4. Entertainment levels are uniformly increasing in $\rho_R \rho_I V_S$, the expected benefit of a strong conversion. An increase in this benefit directly raises the return to entertainment. Entertainment levels are (weakly) decreasing in V_W. Generally, entertainment levels decrease in

V_W because a higher benefit from a first-period weak conversion makes a strong conversion incrementally less valuable for the advertiser. An exception to this rule is e_R^N. This exception follows because the advertiser can hope to obtain a weak conversion even when $R = 0$. In this case, if the viewer is induced to watch the second signal when the first signal is unsuccessful (with probability $1 - \rho_R$), then the advertiser still has a chance at a weak conversion. Assumption 3 implies this incentive is not present under the skippable format. Finally, entertainment levels are uniformly decreasing in $\bar{c}$. An increase in exogenous attention costs reduces the portion of viewers continuing to the second part of the ad, thereby reducing the marginal return of entertainment.

We now turn to the advertiser's optimal order of signals. We start with the simple case of $V_W = 0$, which was considered in Proposition 1(i) for a fixed level of entertainment $e \geq 0$. The same result applies for endogenous e in the non-skippable format because $e_I^N = e_R^N$ when $V_W = 0$ (Lemma 2 (i)). Under the skippable format, the same result applies if we assume $|\rho_R - \rho_I|$ is small enough. The latter condition, assures that the difference $|e_I^S - e_R^S|$ is not so big that the advertiser's decision on signal order is dominated by the differential costs in entertainment. Generally, therefore, when there is no value from a weak conversion, the curiosity-inducing motive is the main driver of the advertiser's signal order decision. That is, the advertiser leads with the weaker signal to drive more attention from the fewer consumers who have a greater chance for a strong conversion. For example, if $\rho_I < \rho_R$, then by leading with I, the set of $\rho_I \hat{c}$ viewers obtain expected benefit $\rho_R u_s$ from continuing the ad. That is, the advertiser is able to exploit consumer's desire for a strong conversion to induce attention to the second part of the ad.

The case of $V_W > 0$ is analytically more involved. To evaluate this case analytically, we examine the advertiser's indifference curve in (ρ_I, ρ_R)-space in the neighborhood $V_W \in (0, \bar{V})$, where the existence of $\bar{V} > 0$ is specified in the Appendix. For each $f = N, S$, let $\Gamma^f(\rho_I, V_W)$ be the value of ρ_R that equates profits for the advertiser using either I or R. It is immediate from Proposition 1 that for $V_W = 0$, we have $\Gamma^f(\rho_I, 0) = \rho_I$, the 45° line in Figure 3. The general case for $V_W > 0$ is given here.

Proposition 3 *For some* $\bar{V} > 0$ *and for each* $f \in \{N, S\}$*, there exists* $\Gamma^f : [0,1] \times [0, \bar{V}) \to \mathbb{R}$ *such that* $\Delta^f = 0$ *whenever* $\rho_R = \Gamma^f(\rho_I, V_W)$*. Furthermore, for* $\rho_I \in [0,1]$ *there exists* $\xi > 0$*, such that whenever* $V_W \in (0, \bar{V})$ *and* $\left|\rho_R - \Gamma^f(\rho_I, V_W)\right| < \xi$*,* $\Gamma^f(\rho_I, V_W)$ *has the following properties.*

(i) $\pi_R^f < (>)\pi_I^f$ *if and only if* $\rho_R > (<)\Gamma^f(\rho_I, V_W)$.

(ii) $\Gamma^f(\rho_I, V_W)$ *is strictly increasing in* ρ_I *with* $\Gamma^f(0, V_W) = 0$.

(iii) There exists a value k^f *such that* $\Gamma^f(\rho_I, V_W)$ *is increasing (decreasing) in* V_W *whenever* $k < (>)k^f$.

$k^N = \frac{\rho_I \rho_R V_S}{2\bar{c}(\bar{c} - \rho_R^2 u_S)}$ *and* $k^S = \frac{\rho_I \rho_R (\rho_R V_S - r)}{2\bar{c}[\bar{c} - \rho_R(\rho_R u_S - \hat{w})]}$.

Part (i) permits the generalization of Proposition 1 for endogenous e. Part (ii) confirms the role of the curiosity-inducing motive in determining the optimal order of signals. That is, increases in either ρ_I and ρ_R favor leading with R or I, respectively. More formally, as seen in the proof, Δ^f increases ρ_R with but decreases with ρ_I. Finally, part (iii) describes how the cost of entertainment affects the optimal signal order and how the ad format affects that optimum differently. Large values of k imply that a change in informational content order does not have drastic effects on the optimal entertainment. As indicated in Lemma 2, as $k \uparrow$, the difference $|e_I^f - e_R^f|$ decreases. Therefore, when $k > k^f$, the advertiser's trade-off between I and R is driven more by the short-attention-span motive than from changes in entertainment costs. This makes leading with I relatively more attractive than leading with R when V_W increases, and the threshold ρ_R value (i.e., $\Gamma^f(\rho_I, V_W)$) goes down. That is, the indifference curve shifts downward as the advertiser's value of weak conversion increases.

Conversely, when $k < k^f$ the advertiser's decision on signal order takes more into account the role of entertainment for enticing continued viewing. In this way, lower entertainment costs helps the advertiser augment the curiosity-inducing motive by providing more incentive for viewers to continue with the ad. Consider the case of $V_W = 0$, which has the indifference curve at the 45°-line in Figure 3. As V_W increases, there is a greater return to entertainment when leading with R because there is a larger payoff from a weak conversion in

the second part of the ad. This can be seen formally from Lemma 2's characterization of the advertiser's optimal entertainment levels, $\partial\left(e_R^f - e_I^f\right)/\partial V_W > 0$. This raises the indifference curve $\Gamma^f(\rho_I, V_W)$ above the 45°-line. Thus, even though $\rho_R = \rho_I$, or even slightly $\rho_R > \rho_I$, the advertiser prefers to lead with R.

The comparative statics on the cost thresholds are also meaningful. For each format, k^f is increasing in ρ_I, ρ_R, and u_s. An increase in any of these variables induces more information seeking by the consumer's incentive for a strong conversion. This makes leading with R relatively more attractive for the advertiser. Similarly, an increase in V_S makes R more attractive directly because the advertiser more ambitiously shoots for a strong conversion. Uniquely under the skippable format, an increase in r means that the advertiser incurs higher costs whenever the consumer pursues the second signal. An early weak conversion is relatively more attractive and occurs only when starting with I than with R. This also means the advertiser is less inclined to invest in entertainment when r increases, as revealed by Lemma 2. Similarly, when $\widehat{w}$ increases, the consumer is less inclined to wait for the second signal, thereby encouraging the advertiser to aim for a weak conversion ($V_W > 0$) by leading with I and cutting entertainment costs (short-attention-span motive).

Proposition 4 *The thresholds from Proposition 3 satisfy, $k^N > k^S$. Therefore, for any $\rho_I > 0$ and $V_W \in (0, \bar{V})$, the interval $(k^S, k^N) \neq \emptyset$. Furthermore, for any $k \in (k^S, k^N)$*

(i) $\pi_I^f > \pi_R^f$, *for* $f = N, S$, *whenever* $\rho_R > \Gamma^N(\rho_I, V_W)$;

(ii) $\pi_I^f < \pi_R^f$, *for* $f = N, S$, *whenever* $\rho_R < \Gamma^S(\rho_I, V_W)$; *and*

(iii) $\pi_I^N < \pi_R^N$ *but* $\pi_I^S > \pi_R^S$, *whenever* $\Gamma^S(\rho_I, V_W) < \rho_R < \Gamma^N(\rho_I, V_W)$.

Figure 3 graphically depicts the results in Proposition 4. Conditions (i) and (ii) imply that the curiosity-inducing motive is dominant. The advertiser, in both formats, prefers to lead with I whenever $\rho_I \ll \rho_R$ and R whenever $\rho_I \gg \rho_R$. The proposition also tells precisely when a switch from the non-skippable format to the skippable causes the advertiser to change its informational

content order. The condition in (iii) means that the curiosity-inducing motive is weakened because the effectiveness of the two signal types are relatively equal. But, unlike the fixed e case of Proposition 1 (ii), the curiosity-inducing effect is not absent and can be augmented by additional entertainment. For intermediate values of ρ_R, the advertiser prefers to lead with R under the non-skippable format because it is relatively beneficial to induce the consumer to pursue a strong conversion on the merits of both product information and additional entertainment. By contrast, under the skippable format, the advertiser must contend with the attractiveness of the non-advertising content and, when $r > 0$, the payment attribution benefit. With skippable ads, therefore, the short-attention-span motive drives the advertiser to shoot for a weak conversion to avoid entertainment costs and an ad payment.

3. Interpreting the Results

The formal results presented above have a number of interpretations, which we summarize in this section. The objective is to draw insights from our model and connect the technical results with practical observations.

Clickbait. An ad in our model induces more viewer attention when the consumer wants more information about the advertiser. This mechanism, which defines the curiosity-inducing motive, is most active when there is no benefit from a weak conversion ($V_W = 0$). From Proposition 1 part (i), we know that the optimal signal order is opposite the ordering of ρ_I and ρ_R. Consider, for instance the practice of *clickbait* used to generate website traffic. Clickbait ads are banner ads that generate no advertiser value from their viewing. They typically have an attention grabbing photo and a puzzling statement (e.g. "These eleven celebrities read *JMR*…") to entice a small set of curious viewers to click. Typically, the first cues of the clickbait ad specifically appeal to the niche in order to invoke strong interest ($\max\{\rho_I, \rho_R\}$) from a small percentage of viewers ($\min\{\rho_I, \rho_R\}$) who ultimately generate visits to the advertiser's website (V_S). In this way, clickbait can be explained by the curiosity-inducing motive.

Brand Awareness. When $V_W > 0$, the short-attention-span motive now acts alongside the curiosity-inducing motive.[10] And, as Proposition 2 shows, this is particularly relevant for

[10] See Proposition 1 (ii) and Proposition 4 (iii).

skippable ads where there is a strong attraction of content to compete with viewer's attention. Consider a *magazine ad*, which features an attractive display featuring the brand name and logo. The reader quickly processes the logo, considers it an ad, and is free to skip to the next page of content without reading product details written in the ad. Therefore, despite the reader not pursuing the ad, the advertiser gains an exposure of its brand ($V_W > 0$). This reasoning applies as well to skippable ads on digital media. For instance, YouTube claims that its skippable *TrueView* ads generate high recognition of the advertiser even when the viewer skips the ad.[11]

Role of Payment Attribution. To study the impact of payment attribution on ad content strategy, we take an analytical shortcut made possible by the fact that, without payment attribution, the advertiser pays the rate r irrespective of whether the viewer skipped the ad or not. Therefore, the cost of advertising is the same for both informational content strategies, I and R. Formally, the profit difference Δ^S in (8) with $r = 0$ captures the advertiser's incremental profit when there is no payment attribution. Thus, the impact of payment attribution can be assessed in our model by simply looking at the comparative statics between $r > 0$ (with payment attribution) and $r = 0$ (without).

Payment attribution has implications for both types of content. First consider the impact on entertaining content by looking at the impact of r in Lemma 2. It shows that payment attribution reduces entertainment levels. Entertainment encourages continued viewing, which increases the probability of payment. This incentive also undermines the curiosity-inducing motive with respect to informational content order. From Proposition 3, we see that k^S is decreasing in r, which means that payment attribution tends to favor leading with I over R. With payment attribution, all else equal, a weak conversion becomes relatively more attractive to the advertiser because it is possibly costless. Otherwise, leading with R means that the viewer's continuation with ad is necessary for a conversion of any kind. In general, payment attribution encourages the advertiser's short-attention-span motive.

[11] See the April 2011 YouTube Skippable Pre-Roll Ads Research Study, "Effect of Consumer Choice on Advertiser Effectiveness" (p.7).

Ad Quality. Within the context of our model, we can operationalize ad quality as the portion of consumers who watch the entire ad. We can then ask: *How does ad quality depend on the ad format?* From Lemmas 1 and 2 we immediately have

$$e_{I/R}^{N} > e_{I/R}^{S} \text{ and } \hat{c}_{I/R}^{N} > \hat{c}_{I/R}^{S},$$

which indicates that, in general, ad quality is lower in the skippable format relative to the non-skippable format. This follows from the condition that platform content is inherently more attractive to the viewer than any advertisement can be. Thus, advertisers face a lower return to entertainment in the skippable format than in the non-skippable format. This finding provides some credence to the claim (empirically unverified) that digital ads are of poorer copy quality relative to traditional, non-skippable, television ads (O'Guinn et al. 2009).

For digital content platforms that sell skippable ads with payment attribution, better quality ads increase ad revenue by having more viewers attend to the entire ad. In addition, better quality ads make the platform generally a more attractive medium. This regularity could explain why such digital content platforms help and encourage advertisers to make skippable ads compelling to continue watching (i.e. make e bigger).[12] In other words, these platforms try to counteract the advertiser's reduced incentives for ad quality.

4. Conclusion and Managerial Implications

Consumers attend to ads only if there are benefits to do so. To ensure these benefits are sufficient, an advertiser constructs the ad to be enticing. We studied two means by which the advertiser affects viewer benefits from the ad. First, the advertiser can structure ad information so that it is most relevant for viewer learning. Second, the advertiser can add entertaining content to directly reward the viewer for her attention. This perspective suggests ad viewing as a game-theoretic interaction between viewer attention and the ad content. Conceptualizing ad viewing in this fundamental way is the broad contribution of this research. Furthermore, it allowed us to posit how ad content will differ across the various ad formats seen in practice.

[12] Facebook, for instance, provides online courses on improving video ads to make them more watchable (https://www.facebook.com/business/ads/video-ad-format). Similarly, YouTube helps advertiser create video ads to improve their quality (https://www.youtube.com/ads/making-a-video-ad).

This exercise generated three lessons for marketers who communicate to consumers facing digital and non-digital distractions. First, curiosity and entertainment are complementary tools for the advertiser to combat viewer inattention. Curiosity is most effective when viewers might obtain personal benefits from knowing more about the advertised product, such as purchase information. Entertaining content is particularly valuable when the advertiser has more ambitious goals and values a full viewing of the ad to obtain benefits (i.e. strong conversion). For example, an emotional story or fulfilling music can help an advertiser wishing to demonstrate its commitment to a worthy social movement. The viewer is not inherently interested in knowing this, so the advertiser cannot rely on the curiosity motive.

Second, ad quality is expected to be lower for skippable ads relative to non-skippable ads. Skippable ads provide more temptation for the viewer to avoid the entire ad. Therefore, costly entertainment has lower return on investment with the skippable format. Finally, under the skippable format, advertisers are better off designing the ad with less ambitious goals, such as brand awareness (i.e. weak conversion). This motive is accentuated for digital formats in which the platform can implement payment attribution. To save on ad costs, the advertiser can hope for brand awareness or reminders in the early part of the ad without paying for the viewer's extended viewing of the ad.

An important caveat to our study is the fact that we have treated ad content exclusively in terms of costs and benefits of attention. This permitted us to specify a viewer's utility and assess decisions in the framework of utility maximization. However, advertisers develop ads with other factors in mind, particularly as it relates to emotional appeals, sensory stimulation, or other affective elements seen in advertising copy. Therefore, our framework is unable to answer many questions about ad design. Nevertheless, our modest intention with this work is provoke the idea that ad viewing can be viewed as an equilibrium outcome governed by the costs and benefits thereof.

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Tables and Figures

Table 1: Ad Medium Formats

Format	Non-Skippable (N)	Skippable (S)	
Payment Attribution	No	No	Yes
Examples	Television, Radio, Non-Skippable Pre-Roll	Print Media, Outdoor, Display Ads	Skippable Video, Overlay, Pop-Up

Table 2: Configurations of Signals, Conversions, and Payoffs

Conversion Type	**Signal Type (1= Successful, 0 = Unsuccessful)**		**Payoff**	
	Identity	**Relevance**	**Advertiser**	**Viewer**
Strong	1	1	V_S	u_S
Weak	1	0	V_W	0
None	0	0 / 1	0	0

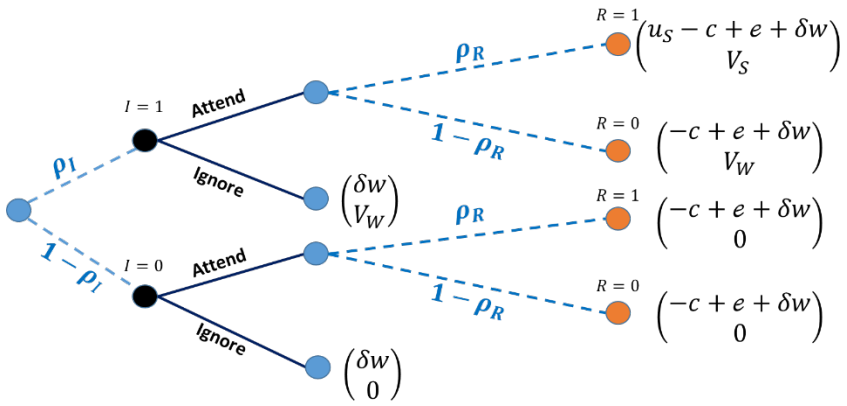

Figure 1: Decision Tree with Payoffs $\begin{pmatrix} \text{Viewer} \\ \text{Advertiser} \end{pmatrix}$ when I is First Signal

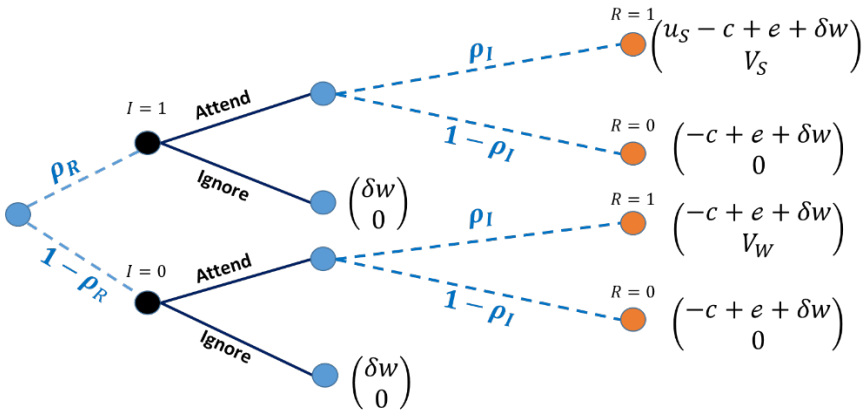

Figure 2: Decision Tree with Payoffs $\begin{pmatrix} \text{Viewer} \\ \text{Advertiser} \end{pmatrix}$ when R is First Signal

Table 3: Attention Decisions and Conversion Probabilities

Ad Format	First Signal		Attention Threshold for $c \in (0, \bar{c})$	Conversion Probability	
	Type	Success Probability		Strong Conversion	Weak Conversion
Non-Skippable	I	ρ_I	$\hat{c}_I^N = \rho_R u_S + e$	$\rho_I \rho_R \hat{c}_I^N / \bar{c}$	$\rho_I[(1-\rho_R)\hat{c}_I^N + (1-\hat{c}_I^N)]/\bar{c}$
		$1-\rho_I$	Irrelevant	0	0
	R	ρ_R	$\hat{c}_R^N = \rho_I u_s + e$	$\rho_I \rho_R \hat{c}_R^N / \bar{c}$	0
		$1-\rho_R$	$\tilde{c}_R^N = e$	0	$\rho_I(1-\rho_R)\tilde{c}_R^N / \bar{c}$
Skippable	I	ρ_I	$\hat{c}_I^S = \rho_R u_S + e - \hat{w}$	$\rho_I \rho_R \hat{c}_I^S / \bar{c}$	$\rho_I[(1-\rho_I)\hat{c}_I^S + (1-\hat{c}_I^S)]/\bar{c}$
		$1-\rho_I$	All Skip	0	0
	R	ρ_R	$\hat{c}_R^S = \rho_I u_S + e - \hat{w}$	$\rho_I \rho_R \hat{c}_R^S / \bar{c}$	0
		$1-\rho_R$	All Skip	0	0

Table 4: Optimal Entertainment Levels under Each Format and Signal Order

Ad Format	Optimal Entertainment Level	
	I	R
Non-Skippable	$e_I^N = \frac{\rho_I \rho_R}{2\bar{c}k}(V_S - V_W)$	$e_R^N = \frac{\rho_I}{2\bar{c}k}[\rho_R V_S + (1-\rho_R)V_W]$
Skippable	$e_I^S = \frac{\rho_I}{2\bar{c}k}[\rho_R(V_S - V_W) - r]$	$e_R^S = \frac{\rho_R}{2\bar{c}k}(\rho_I V_S - r)$

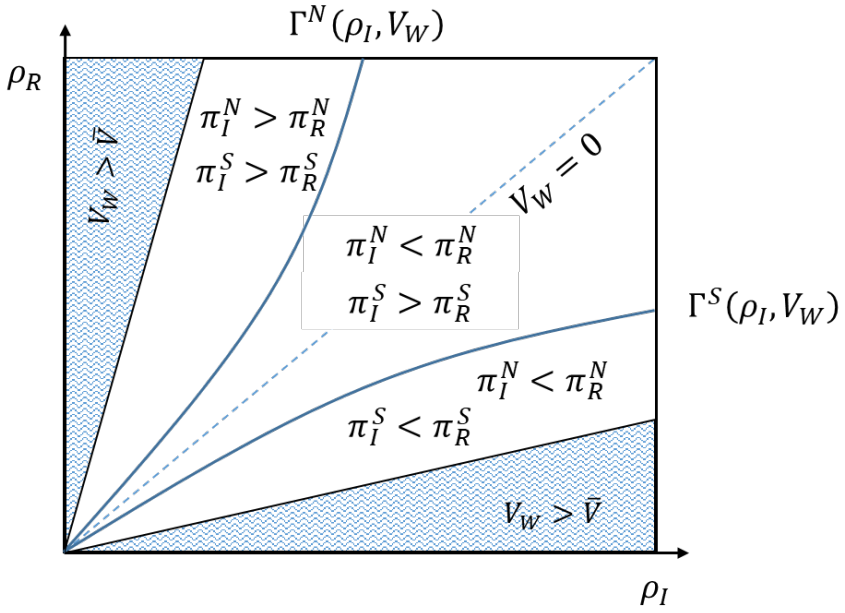

Figure 3: Relative Profitability of Content Order