tvScientific

Multi-Touch Attribution in the Connected TV (CTV) Environment

An analysis of the impact of ad timing, frequency of ad exposure, and ad environments on conversion on the tvScientific platform

Contents

Introduction

Since the first TV commercial aired 80 years ago, marketers have relied on the power of TV advertisements to build brands and drive sales. Why, then, has TV increasingly lost share in the marketing mix? The simple answer is that the digital revolution, the rise of smartphones, and pandemic-related budget pressures have pushed marketers to digital channels. But the story goes even deeper.

Historically, marketers bought TV advertising at a highly aggregated level, effectively paying for impressions across a broad demographic target. Under this model, it would take months of complex analysis to understand the return of multimillion-dollar investments.

Contrast this with modern digital marketing. Performance pricing and precision targeting are par for the course across all major platforms. In-flight optimization can take place at the second or sub-second level. It's easy to see why CMOs spend 72.2% of their marketing budgets on pureplay digital channels, according to **research from Gartner.**

TV advertising still has the **same narrative power and impact** on the consumer psyche. But until recently, digital channels proved more cost-effective and scalable thanks to their precision targeting and superior measurement. However, the modern digital paradigm is constantly shifting.

The Rise of Performance TV

While it may appear that TV advertising is on the back foot, the technology undergirding it is advancing. Meanwhile, marketing mainstays like Google and Facebook no longer drive the same ROI. We've observed three dynamics that are putting TV back into the ascendancy:

1 Not all impressions are equal

In the advertising industry, there is increasing recognition that different media deliver different qualities of impressions. Marketers increasingly consider qualitative metrics like attention — a measure of an advertisement's effectiveness in arousing interest in a viewer. New studies demonstrate that some media drives much higher attention than others, and link increased attention to **larger sales lifts.** Research also suggests that attentive audiences demonstrate **higher brand recall,** and **remember the ads themselves** for longer. In her **November 2020 paper,** Professor Karen Nelson-Field of Amplified Intelligence concludes that "TV, regardless of device, drives more sales uplift than any other platform," ahead of social media and other digital channels.

2 Connected TV makes TV media addressable

Connected TV (CTV) uses an internet connection to stream over-the-top content on TV glass. Connected TV effectively transforms TV into a digital channel but with the superior ability to capture attention. Connected TVs have an integrated internet connection to enable the streaming of videos and music. They also have an associated IP address which makes it possible to track advertisement exposure. As with any other digital platform, marketers can link Connected TV ads to their desired next action such as website visits, app installs, or purchases. The result? TV ads can now receive credit for driving outcomes directly, rather than relying on highly aggregated probabilistic models.

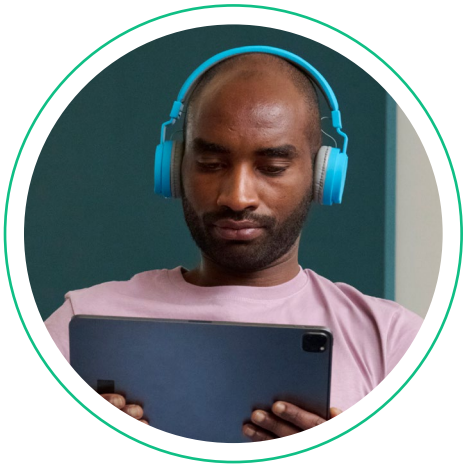
Connected TV also revolutionizes the way that advertising takes place. Unlike linear TV advertising, which depends on broad demographics, advertisers can now bid on individual ad slots on a user's TV. This shift gives addressable Connected TV advertising two advantages over its linear cousin: Advertisers can precisely target audiences with specific behavioral or demographic profiles and manage campaigns with greater agility, adjusting bidding as the campaign unfolds.

3 Analytical advancements empower decision-making

In the Connected TV environment, advertisers can access granular campaign data. Combined with analytical advancements, this data makes it possible to apply a multi-touch attribution model to television campaigns. Multi-touch marketing attribution reveals the true impact of each ad exposure on a consumer's path to purchase.

These advancements also empower advertisers to make data-driven decisions throughout a campaign flight. They can confidently assess the optimal frequency of ad exposure and bid more aggressively on slots that drive greater performance. They can also apply this data to bidding engines to optimize campaigns the second the first ad "airs."

How Connected TV powers multi-touch attribution



Given the industry's emphasis on data science and machine learning — not to mention the wealth of detailed data available from digital platforms — it's surprising that advertisers still rely on antiquated methods to understand performance. In particular, first touch and last touch attribution models remain prevalent. However, only multi-touch attribution paints a holistic picture of ad effectiveness by using all the data available. First and last touch models fall short by contrast because they consider a small subset of data, which often leads to arbitrary conclusions.

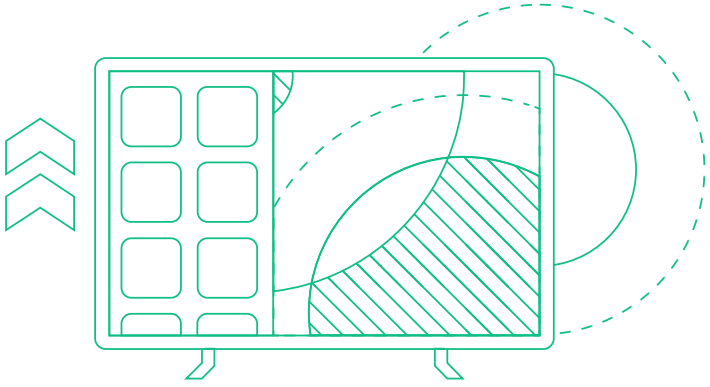
Attribution Model	Description
First Touch	Assigns all the credit for a conversion to the advertisement where the user was first exposed to the campaign.
Last Touch	Assigns all the credit for a conversion to the last exposure to the advertisement before the conversion
Time Decay	Credit is distributed between all exposures. More credit is given to exposures nearer to the conversion. The rules for attributing the effects are typically arbitrary.
Data-Driven	No assumptions about "what works" are made. Advanced machine learning methods are used to assess each advertisement element of the advert is assigned part of the conversion credit depending on how much it contributed to driving the conversion.

First and last touch attribution methods disregard the valuable data of all the other ad exposures. This poses a significant problem because other exposure points could have played a greater role in driving conversions. Similarly, the time decay method arbitrarily weights each exposure. Multitouch attribution is the only model that uses data to give these exposures their true weights. Throughout the industry, multi-touch is gradually subverting these antiquated models. Indeed, in September 2021, **Google announced** that the default attribution customers will be provided with will be their data-driven model. As they put it:

> Google
>
> "As the industry continues to evolve, lastclick attribution will increasingly fall short of advertisers' needs. The most successful marketers will switch to a data-driven approach."

Here at tvScientific, we use a cutting-edge multi-touch attribution approach to empower CTV marketers to make data-driven decisions. Our methodology allows advertisers to understand the trends, patterns, and processes underlying campaign data sets. By recording data such as IP addresses, we track every instance an ad is viewed, along with the time, date, and other metadata. We can also glean insights into marketing outcomes such as website visits, app downloads, purchases, etc., and link conversions to instances of ad exposure. Advertisers can understand Connected TV's relative impact in driving conversions and assess the cost-per-action from Connected TV campaigns. This information can then feed back into the bidding process to maximize campaign performance.

Our leading-edge machine learning enables more granular questions to be asked of Connected TV data than were historically possible.



Multi-touch & the Shapely Value

A number of different data-driven models may be applied to achieve multi-touch attribution. One such model uses the Shapley Value, a solution concept derived from game theory. The Shapely Value is the **average of the marginal contributions to all possible coalitions.** In the context of advertising, an algorithm based on the Shapley Value assigns fair credit to each point of ad exposure along the path to conversion.

While other solutions exist (e.g. **Markov Chains**), the Shapley value has two key benefits: It is not overly sensitive to input data, and it is "internally consistent." For example, if you were to run Shapley for four individual weeks and then over a four week period, the addition of the individual four weeks would be identical to the four-week aggregate. Other algorithms do not necessarily achieve the same stability and consistency. In the context of TV viewing, factors such as time of day, frequency of exposure, time since last exposure, advertising medium, and so on are included in the model to assign each feature its fair credit to conversion.

To understand the Shapley value, consider an ad campaign using digital display and two Connected TV channels to promote their online music retail store.

Digital Display	CTV Channel 1	CTV Channel 2	Unique conversions	Total claimed by coalition
Yes			16k	171k
	Yes		23k	187k
		Yes	27k	206k
Yes	Yes		35k	253k
	Yes	Yes	58k	264k
Yes		Yes	51k	257k
Yes	Yes	Yes	70k	280k

Yes refers to instances of ad exposure*

The campaign sees a total of 280K subscription signups, but the CMO now seeks to attribute these conversions to their individual channels.

To calculate the Shapley Value, we create coalitions containing the different media for each combination of media. Each coalition claims the total amount from each combination involving a player in the coalition. Digital display claims a total value of 171K conversions because that's the value of all of the combinations that include digital display (16K+35K+51K+70K). At a total level, we see that the digital display campaign influenced 171K conversions, CTV Channel #1 influenced 187K conversions, and CTV Channel #2 influenced 206K conversions. But this isn't a complete picture because the sum of these values exceeds the total number of conversions (280K).

Digital Display	CTV Channel 1	CTV Channel 2	Unique conversions	Total claimed by coalition	Digital Contribution
Yes			16k	171k	171k
	Yes		23k	187k	
		Yes	27k	206k	
Yes	Yes		35k	253k	253-187= 66k
	Yes		58k	264k	
Yes			51k	257k	257-206= 51k
Yes	Yes		70k	280k	280-264= 16k

Yes refers to instances of ad exposure*

We then compare each coalition's value against every other coalition's value to get each player's incremental contribution to the coalition. In this example, the contribution of digital to the digital/linear coalition is 66K because the total claimed by that coalition, 253K, is 66K more than the sum claimed by the linear coalition (187K):

We calculate this for all coalitions and multiply by the Shapley scaling factor to get the Shapley value. The scaling factor ensures that the Shapley value always adds up to the total amount of each combination's unique conversions. In our example, the Shapley value has split the actual number of conversions (280K) between each channel proportionally to their value.

Digital Display	CTV Channel 1	CTV Channel 2	Unique conver-sions	Total claimed by coalition	Digital Contribu-tion	CTV Channel 1 Contrubu-tion	CTV Channel 2 Contrubu-tion	Shapley Scaling Factor
Yes			16k	171k	171k			0.33
	Yes		23k	187k		187k		0.33
		Yes	27k	206k			206k	0.33
Yes	Yes		35k	253k	66k	82k		0.17
	Yes		58k	264k		58k	78k	0.17
Yes			51k	257k	51k		86k	0.17
Yes	Yes		70k	280k	16k	23k	27k	0.33
				Total Contribution:	**303k**	**350k**	**396k**	
				Shapley Value:	**81.6k**	**93.3k**	**104.9k**	**280k**

Yes refers to instances of ad exposure*

Analysis

Study methodology

To demonstrate the power of this approach in the context of Connected TV advertising, tvScientific has analyzed how various feature values impact campaign performance. The specific features we've considered are the frequency and recency of ad exposure, the time and day of the week, and the ad environment. We performed this analysis across the following advertising categories:

Advertising Category	Definition
App Install - Gaming	Any advertiser whose outcome is to install gaming apps
App Install - Streaming Media	Any advertiser whose outcome is to install gaming apps
Retail DTC - Low Ticket	Any advertiser whose outcome is to complete a purchase, where the price point of the product is below $250
Retail DTC - High Ticket	Any advertiser whose outcome is to complete a purchase, where the price point of the product is above $250
Lottery	Those advertisers who are promoting sweepstakes or contests.
Events	Any company advertising events, e.g. concerts.

Average campaign performance by frequency of exposure

Marketers often ask this key question: What frequency of ad exposure maximizes the chance of conversion?

Too many instances of exposure, and you risk your audience tuning out. You'll waste ad dollars trying to reach people that no longer want to listen. Too few exposures and your audience may not have fully absorbed the campaign's messaging. Thanks to the advent of Connected TV, which brought digital ad tracking to the realm of television, marketers can now answer this question precisely. They can understand how many ads a user has seen, and understand how each incremental exposure impacts the likelihood of conversion.

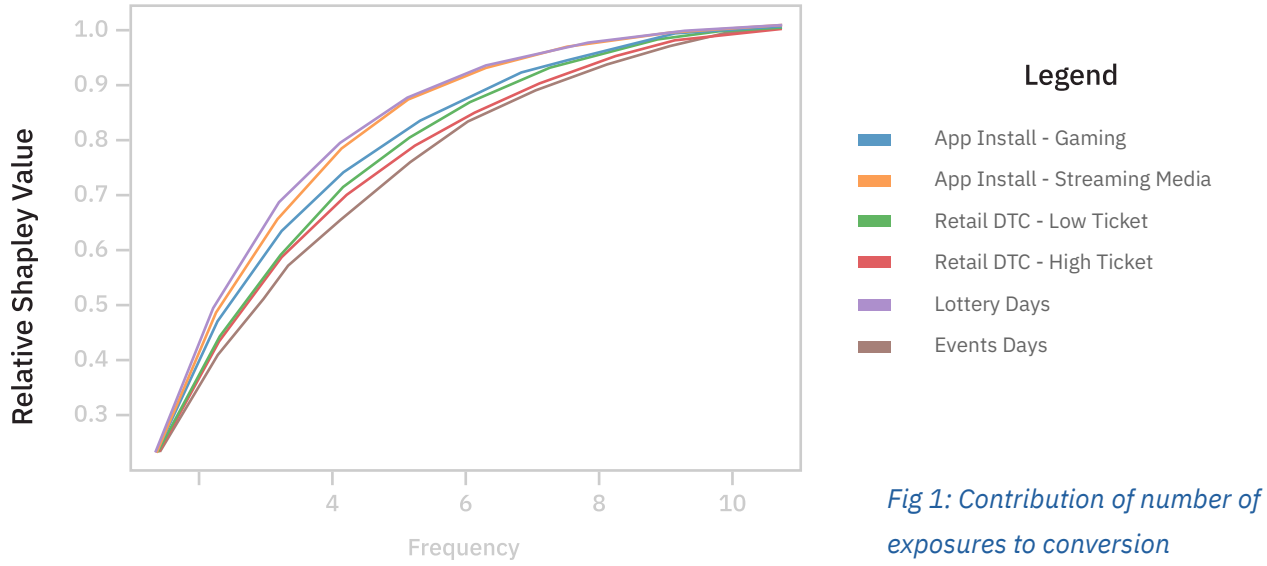


Fig 1: Contribution of number of exposures to conversion

Our analysis showed that campaigns see clearly diminishing returns as the number of exposures increases, though the effect varies considerably by category. For the lottery category, the diminishing returns are significantly more aggressive than for the events category, for example. The high-level takeaway is that marketers should be cautious of excessive ad exposure. A single exposure contributes between 25% to 42% to conversion. By the time a campaign drives four exposures, 76% to 89% of the total possible return has already been achieved.

Time decay between ad exposure and conversion

Another question marketers ask is how recency affects conversions. Marketers want to understand the window of time over which ad exposure influences purchase decisions.

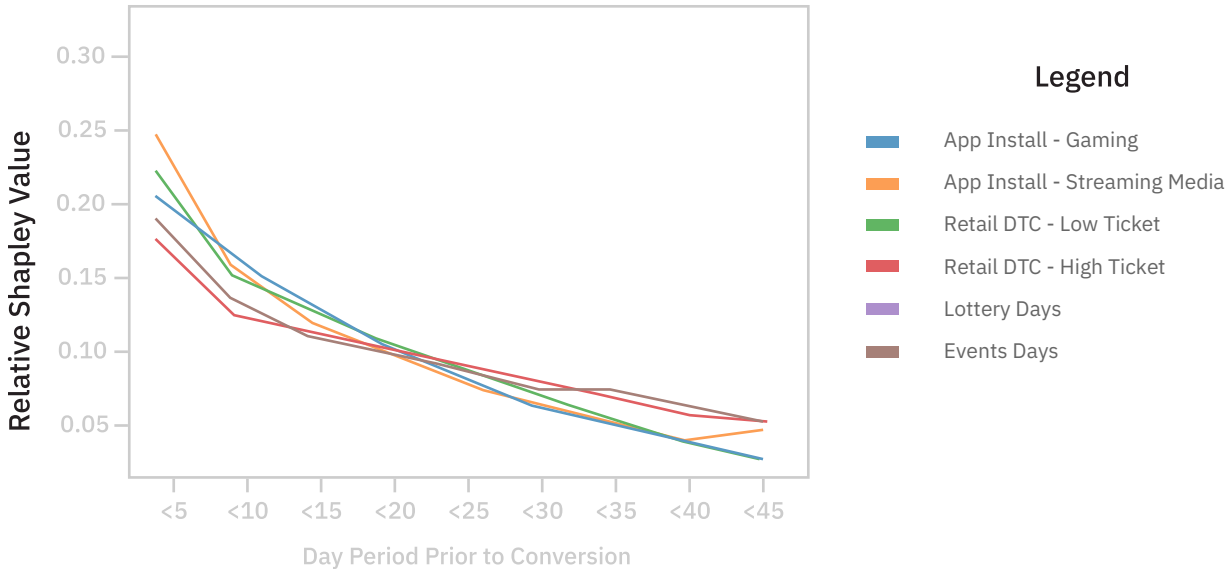


Figure 2: This figure shows the relative Shapley weight of each 5-day period during a 45-day attribution window for each advertising category. The 5-day periods go from 0 to 5 shown as <5, then 5 to 10 shown as <10 etc.

As you would expect, advertisements across all categories show a general time decay. Exposures nearest the point of conversion have the most impact in driving these conversions. As more days pass, the exposures have less and less impact. The lottery category shows an interesting result once again: The five-day window proceeding conversion is the most impactful window between all categories. This pattern highlights the impulse-based nature of taking part in the lottery. Other categories enjoy greater longevity. Retail DTC and event advertising types are far less dependent on recency to drive conversion. In these categories, flights that extend over the duration of a campaign, but then pause off for a week, for example, will yield a greater ROI than heavy loading into a concentrated period of time.

One notable feature of the chart is how crucial the first five days are in terms of conversion. Exploring this effect in more detail for gaming and streaming media app install campaigns, we see that the first five hours are particularly important. For streaming media app campaigns, the likelihood of conversion falls sharply after 45 hours. Indeed, for this category, a window of fewer than 90 minutes disproportionately drives conversions.

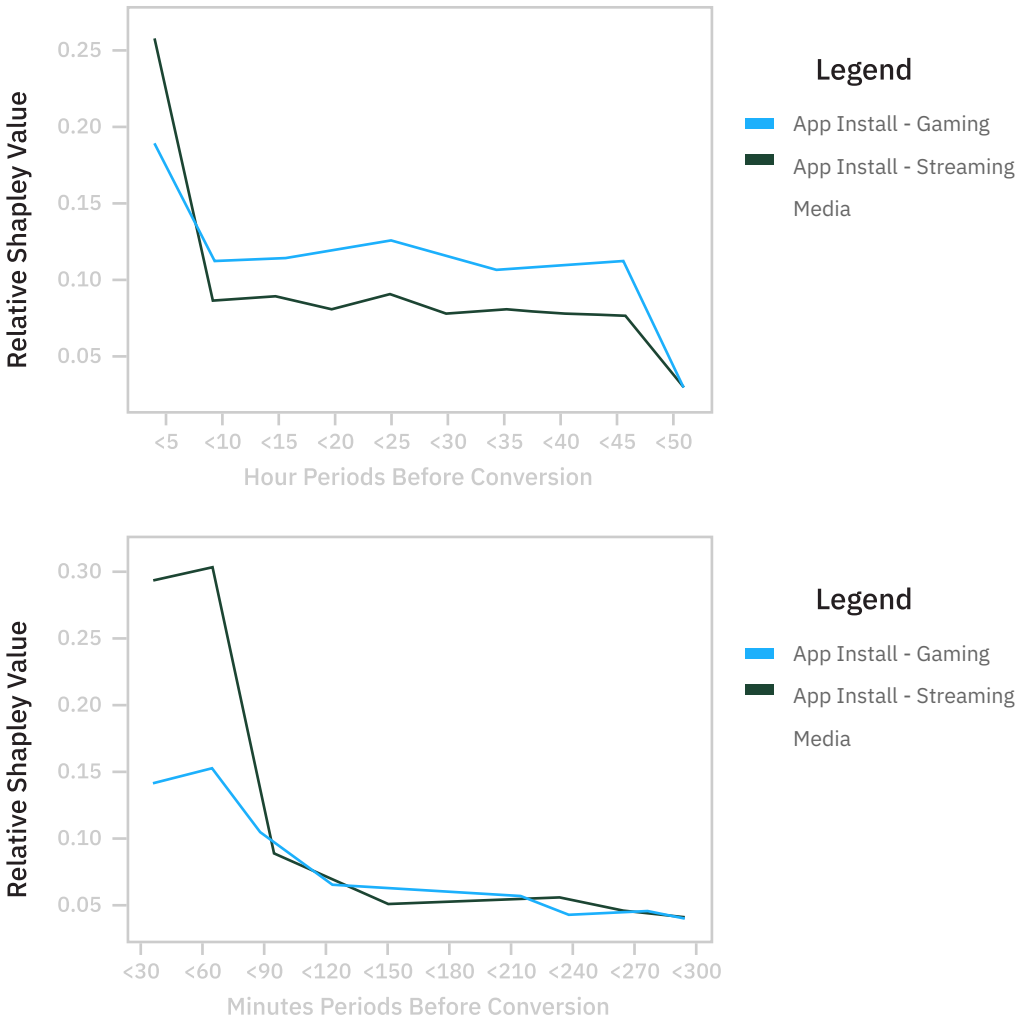


Figure 2: This figure shows the relative Shapley weight of each 5-day period during a 45-day attribution window for each advertising category. The 5-day periods go from 0 to 5 shown as <5, then 5 to 10 shown as <10 etc.

Average campaign performance by day of week

Another question marketers ask is how recency affects conversions. Marketers want to understand the window of time over which ad exposure influences purchase decisions.

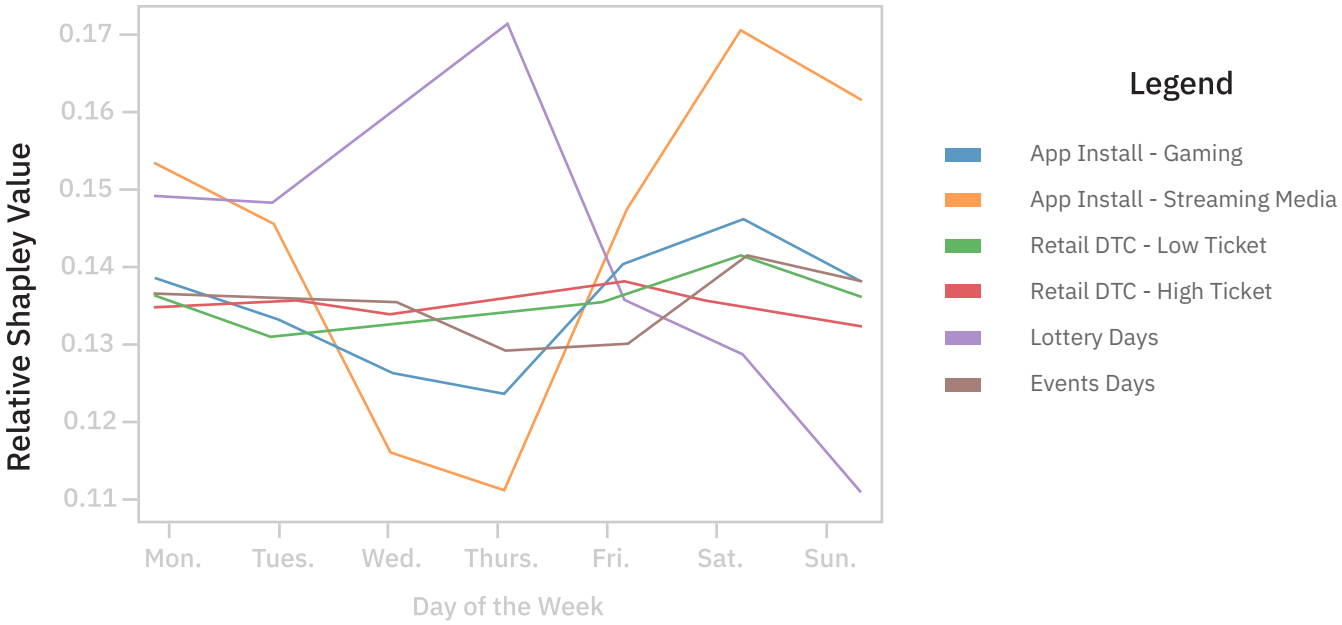


Figure 4: This figure shows the relative Shapley weights for an advertisement resulting in a conversion for each day of the week split by advertising category

Most categories generally perform best on the weekend. This is particularly true of streaming media app install campaigns that hit a trough in effectiveness mid-week. This trend does not hold true in the high-ticket DTC retail and lottery categories. For high-ticket DTC retail, each day of the week is as effective as any other. Meanwhile, the lottery category shows a great increase in effectiveness on Wednesday and Thursday. It is not surprising that these two days are the most effective, with winners announced on a Wednesday.

Average campaign performance by time of day

Another question marketers ask is how recency affects conversions. Marketers want to understand the window of time over which ad exposure influences purchase decisions. The time of day an ad is shown also affects the likelihood of conversion. Historically, 'Prime Time' has always carried a cost premium to advertisers. Here we see this is justified, thanks to the slot's ability to drive conversions across all categories.

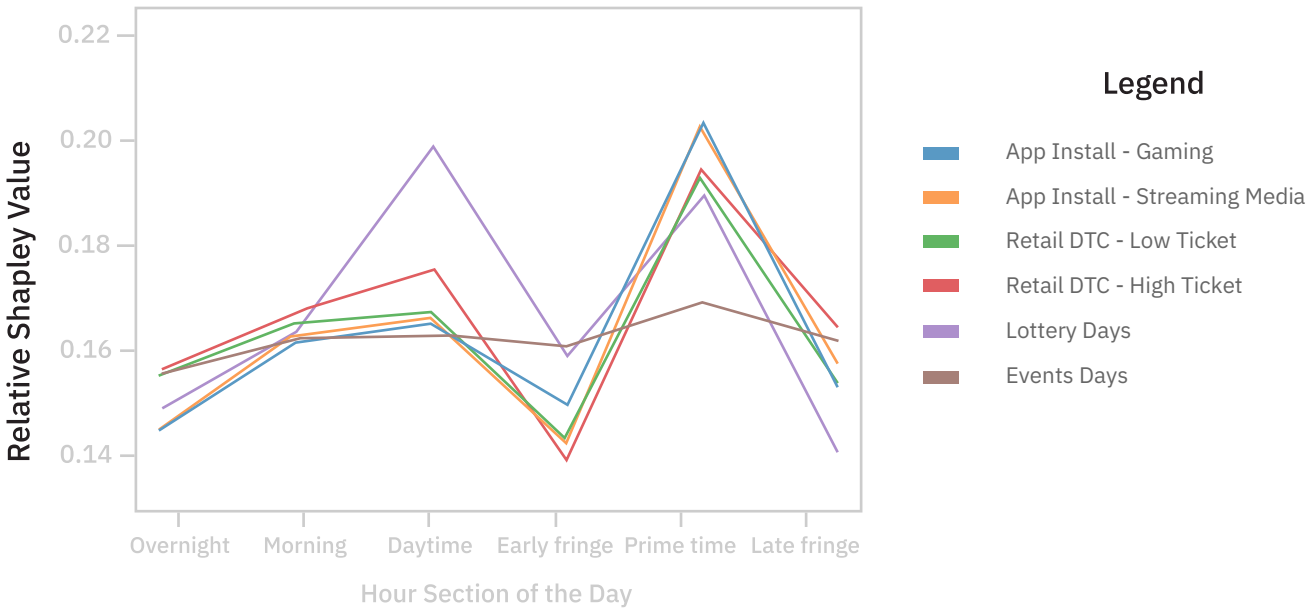


Figure 6: This figure shows the relative Shapley weight of seeing an ad by day-part. The times are in 4-hour blocks. The label overnight means between 3 am and 7 am, the label morning means between 7 am and 11 am, and so on.

Another interesting facet of this data is that the Daytime slot drives a high volume of conversions for the lottery category.

Average campaign performance by advertising environment

When planning a campaign marketers want to ensure they are using the most effective environment to maximize conversions. Here we apply the Shapely Value across various channels to understand their relative contribution to performance.

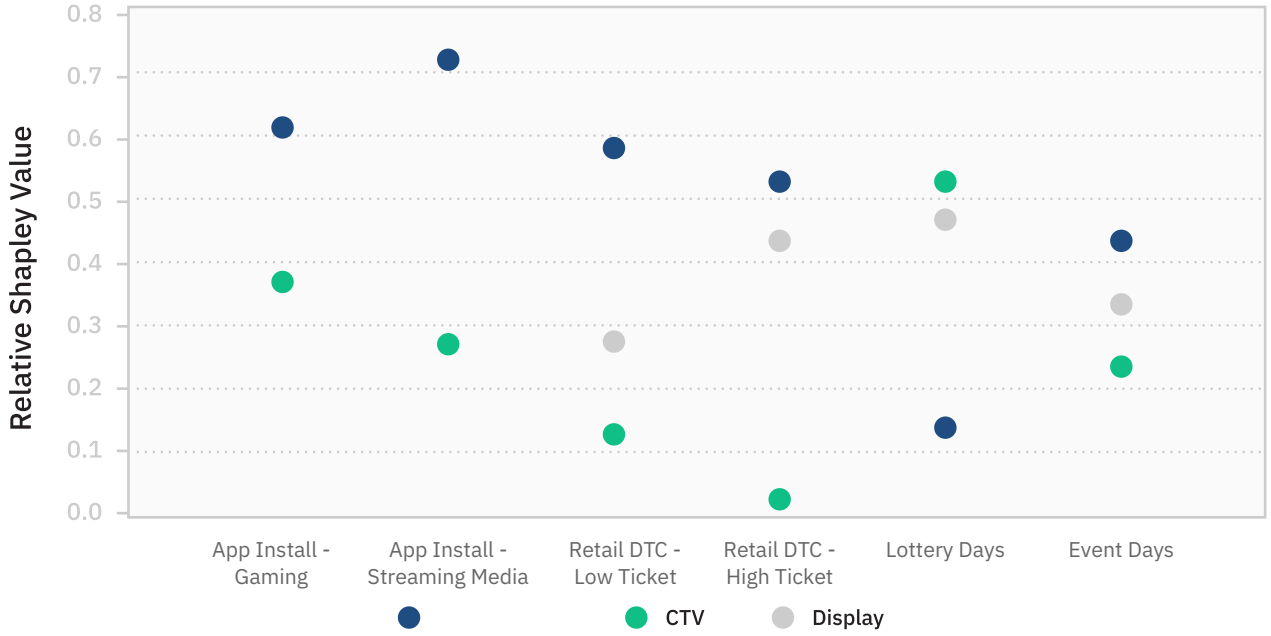


Figure 5: This figure shows the relative Shapley Values of the different environments an advertisement is watched on leading to a conversion.

Here we see some considerable variation in the contribution that each advertising environment delivers across categories. While the general theme is that OTT outperforms Connected TV and display, the reverse is true for the lottery category where both Connected TV and display drive considerable contributions to conversion. This implies that impulse categories benefit from the lack of friction that Connected TV and display ads provide in terms of ease of conversion. Display has virtually no contribution to conversion for gaming and streaming media app install campaigns. While OTT drives significant conversion for retail and events, display is also an important component in the mix for these categories.

Conclusion

The advent of Connected TV has revolutionized television advertising. With this new technology — and the wealth of data it delivers — come new possibilities for advertisers. However, it is critical that marketers move away from arbitrary attribution methods to a true understanding of what works using data-driven techniques.

When viewed through the lens of proper multi-touch attribution, every impression's contribution is weighted in accordance with its delivery to the outcome — the "last touch" does not receive all the credit. Indeed, approaches that don't use data to drive the weights in multi-touch attribution are not properly assessing performance.

The methods we have described here are the same as those used in data-driven attribution models assessing the impact of paid search, organic, affiliates, display, etc. In other words, it is entirely possible to determine the credit a Connected TV ad should receive when it drives conversion higher up the path to purchase than the last click.

While the contributions we have described here provide marketers with valuable insight into what is driving conversion, the greater opportunity is to use this data algorithmically.

Rather than rely on planners to try and allocate an optimal campaign, these weights can be incorporated into a bidding optimization engine to ensure that every bid placed is utilizing the latest knowledge of what is most effective in driving conversion, delivering closed-loop optimization. The introduction of Connected TVs has made the power of TV advertising more accessible than ever. Data-driven attribution puts these ad campaigns into overdrive. Now is the time for every business to invest in Connected TV advertising.

About tvScientific

tvScientific is the most sophisticated performance advertising platform built for connected TV. The tvScientific platform makes TV advertising accessible and measurable for brands and apps of all sizes. tvScientific offers a self-managed solution custom built for performance marketers, that simplifies and automates TV buying and optimization, leveraging massive data to prove the actual value of TV advertising.

The platform reaches 95% of AVOD inventory using proprietary, deterministic ID technology to measure ad exposure to outcome in an approachable, radically transparent and scalable way.

An Idealab company, tvScientific was co-founded by senior executives with deep roots in programmatic advertising, digital media, and ad verification. The company is headquartered in Pasadena, California.

For more information, visit **https://www.tvscientific.com**

63M
HOUSEHOLDS REACHED

268M
TRACKED DEVICES

2.2B
IMPRESSIONS DELIVERED

12B
CONVERSIONS TRACKED

tvScientific

The first performance platform for Connected TV.

Performance that combines the power of television + the precision and measurability of digital marketing.

For more information, visit https://www.tvscientific.com