Modeling Out of Home Media

Best Practices for
Marketing Mix and Attribution Models

October 2021

Introduction

Measuring the in-market performance of Out of Home media (OOH) exposures on marketplace outcomes offers a few unique challenges. It is also subject to the same requirements as modeling other media. Both buyers and sellers of OOH are best served by models and data that are accurate and actionable. This guide sets out a few key principles that, if observed in practice, will help both parties achieve those ends.

OOH Data Inputs for Marketing Mix Models

Accurate and precise data inputs enable model outputs that are accurate and precise. More granular inputs enable more granular models and more actionable insights. These two universal principles translate into the following best practices for OOH.

- Generating OOH data inputs must begin with the actual OOH inventory, as posted, with Geopath IDs and posting and take-down dates for each unit.

- Next, weekly Geopath GRP or impressions data is assigned to each audited unit for each week. Geopath data is used to provide a common measure across campaigns and from planning to buying to posting to outcome measurement.

- Using unit level data for a marketing mix model would be difficult because all the data for all the marketing and marketplace factors must be aggregated, by format, to the same level of geography. Although there are some exceptions, the most accurate read of the contribution of OOH will be achieved by a model at the finest level of geography possible. This might be store trading-areas, zip codes, or metro areas. Areas with a consistent level of OOH campaign presence are preferable. Data should never be aggregated into geographic units larger than DMAs. The larger the unit of geography, the more the presence of OOH is averaged across areas with and without OOH. And the greater the suppression of the model's ability to detect OOH's contribution.

- Depending on the level of investment, weekly, format-level GRP/impressions data may need to be aggregated into format groups or types to provide data

stability and to achieve readability thresholds. The trade-off is a loss of actionability. More granular data inputs enable modeling OOH at a more granular level, providing estimates of the contribution and ROI by format or type, rather than OOH as a whole. This provides substantially greater insight and ability to optimize OOH plans going forward. The cost vs. value of data at this level needs to be considered in light of the use case.

- In the data aggregation process, keeping different campaigns and even individual creative executions separate should be prioritized. Creative has been recognized to be responsible for at least 50%, and as much as 80%, of a campaign's contribution to marketplace performance. Model-based insights enabling under-performing creative to be culled, or strong-performing creative to be spread further, represent the greatest opportunity for improving OOH contribution and ROI.

- Standardized ad identifiers (Ad-ID) should be adopted to ensure consistency of reporting. Ad-ID is a naming system for advertising assets. It attaches a universal identifier to each individual piece of ad creative, and will be an indispensable tool for attribution studies. A standard code per OOH execution would allow for accurate, granular unit-level creative tracking and optimization.

OOH Analytics for Marketing Mix Models

Loading the best possible OOH data into a marketing mix model is the first and most essential best practice. Less accurate and granular data will suppress the model's estimate of OOH contribution. But there are a number of model-building best practices related to, or extending, those data input best practices.

- The marketplace outcome variable must align with the role of OOH in the campaign. For example, if OOH is charged with driving brand awareness or consideration, it should not be evaluated on its performance driving short-term sales. In some cases, this might require modeling at two levels (for example, OOH's contribution to store traffic and store traffic's contribution to sales.)

- Modeling at the finest level of geography the data permits will provide the best estimate of OOH's contribution and ROI.

- Modeling creative executions at the most granular level permitted by the data and investment levels can provide measures of the relative performance of different creative. Together with frequent model reads and fast reporting turn-around this would enable optimization of campaigns by culling under-performing ads and doubling-down on strong performers. This potential may be constrained by the limited flexibility of some OOH media.

- Modeling OOH formats at the most granular level the data and the levels of investment allow, will afford similar opportunities. This potential needs to be weighed against the flexibility of the media for in-flight allocation changes.

- Where more granular measurement of OOH formats or creative is not possible with an MMM, but the potential for campaign optimization is material, test and learns (experiments) are advisable.

- If the OOH campaign is tied to external events, such as weather, it will be important to capture the interaction between the two.

OOH Data Inputs for Attribution Models

The data needs for attribution are not as well standardized as for marketing mix models. These are still days of experimentation and development and there are many data sources. Best practices are still emerging. OAAA has issued [DOOH Exposure Methodology Guidelines](#) that provide a helpful framework, and we can identify foundational principles and highlight key issues in attribution.

Ad Occurrences
The OOH ads themselves are the starting point for OOH inputs for attribution models.

- Generating OOH data inputs must begin with all of the actual audited OOH units in the buy, as posted with posting and take-down dates for each unit as well as the metadata necessary to determine the unit's viewshed.

- For digital units, playlogs (the timestamp indicating when the ad plays) are required to determine exposure to the specific creative running at the time of exposure. This process would be improved by standardizing formats and reporting latency, as well as the assurance that playlog ad display timing and mobile device clocks are precisely synchronized.

- Standardized ad identifiers (Ad-ID) should be adopted to ensure consistency of reporting. Ad-ID is a naming system for advertising assets. It attaches a universal identifier to each individual piece of ad creative, and will be an indispensable tool for attribution studies. A standard code per OOH execution would allow for accurate, granular unit-level creative tracking and optimization.

Ad Exposures
Exposures to occurrences are determined in several steps:

- Mobile location data is the raw material for exposures. It is generally aggregated from a variety of sources to provide sufficient scale and coverage. These sources must be deduplicated and the remaining devices balanced for representivity on multiple dimensions including geography, device characteristics (e.g., OS), and demographics. Deprecation of Mobile Ad IDs and SDKs threaten data scale and coverage and their impact on data quality should be tracked regularly.

  - Scale is essential for the attribution model to produce statistically significant estimates of OOH's contribution to the marketplace outcome. There is no single number or rule of thumb to determine sufficiency of scale. Each case is different. The net exposures measured after filtering the mobile location data for quality control, qualifying those for ad

exposure and then matching each of those to the outcome are the essential ingredient for attribution. There have to be enough of them to provide a statistically significant read.

- Complete coverage of the campaign geography is essential. Some areas may differ in terms of: likelihood to see a campaign ad, conversion propensity, brand awareness, consideration and preference, exposure to other brand advertising or promotion, access to retail locations, socio-economic, cultural, or other marketplace factors. If coverage is not complete, the area covered must be representative of the entire campaign geography and, at the attribution step, any coverage deficiencies must be remedied by weighting and projecting.

- The precision of the location data (latitude/longitude) must be sufficient to determine presence inside a viewshed, the area in line-of-sight with the OOH ads. In practice this usually means the data must be collected via GPS, Wi-Fi SSID identification or Bluetooth Beacons.

- Different mobile apps on specific mobile phones provide differing levels of measurement persistence/consistency (the rate at which they provide location signals.) Perfect persistence is too high a standard to be expected. The absence of signals leaves gaps in the data and also bias the data toward non-detection of exposures, as well as outcomes. There is currently no standard threshold for persistence, but that would be useful. In the absence of a standard, levels of persistence are another factor that must be addressed in the attribution step.

- Industry standards for mobile location data for OOH measurement would be greatly beneficial. Any difference between data scale, coverage (and how it is weighted and projected), precision and persistence will result in different exposure counts.

- Mobile signals or "locates" inside a unit's viewshed qualify as an exposure to that unit. The locates that just happen to be close to the unit are filtered out, leaving only individuals with a real opportunity to see the unit. The [OAAA DOOH Exposure Methodology Guidelines](#) identify six factors that define each viewshed:

  - Location of frame (intersection to vehicular & pedestrian reads)
  - Proximity of frame (distance) to read
  - Orientation to read (facing)
  - Size of frame – (screen size needs to matter)
  - Loop (# of spots) and Spot length - specifically if Digital
  - Dwell time
  - Sunrise/Sunset for illumination or artificial illumination for frames on 24 hours

  Data comparability among providers would be greatly advanced if a standard set of metadata were used and standard minimum requirements for qualifying an opportunity to see were established. The OAAA Exposure Methodology Guidelines are a strong start, but do not address data persistence, playlogs and

viewshed. This is important because any differences in viewshed specifications will result in different exposures counts.

Device level exposure data could be validated and calibrated to Geopath data. This would align the exposures being used for outcome measurement with the currency used for audience delivery and buying and selling. It would also bolster confidence in device-level exposure data.

- Mobile location data, obviously, is extracted from mobile devices. A single individual may have multiple devices and often, many devices are found in a household. The choice of resolution to a person or a household depends on the nature of the outcome data. For example, store or website visits tends to be a personal outcome; grocery purchases captured with loyalty card data tends to be a household outcome. Conceptually, this is the last step for exposures measurement, but in practice, it will be conducted later, by the identity resolution providers.

Matching Outcome Measures to OOH exposures

Attribution is about attributing the contribution of exposures to incremental marketplace outcomes valued by the advertiser.

- Outcome data should be selected to accurately reflect the performance of OOH against its designated strategic role in the media plan, in the geographic area the OOH campaign has been executed. An example of this is if the objective of OOH was to drive retail traffic, it should not be held accountable for driving sales. Typical outcome data include: sales (online and/or offline), prescription sales, visits, web visits, brand metrics lift, app downloads, and the like.

  - Retail visit data are best provided by the same mobile location data provider employed for exposures data. That avoids the need for matching two data sets as well as any potential coverage or bias issues that could result. The retail location (point of interest or POI) data may be provided by 3rd party or the client. These data should be drawn from a highly credible, client-accepted provider who can accurately and precisely geo-fence the retail locations with fresh data reflecting any recent changes in store closings and openings.

  - Other outcome data should be sourced from trusted industry standard third parties. Their data must be representative of the coverage area of the OOH campaign. First, make sure the data covers the geographic area of the OOH campaign. Then, does it capture data from all locations? These concepts apply to both offline and online. Then check if the data itself is representative. The simplest way to check this is by comparing some key metrics, in aggregate, with the advertiser's reference data or an independent authoritative benchmark. For example, for sales data, ask the data provider for a table including weekly category and brand penetration, category dollars spent per household and brand shares. The advertiser can quickly scan such a table to check if the data accurately represents their category.

- The outcome data must then be matched to the ad exposures data at the device or household level, including exposed and unexposed persons or households. There are a number of reputable identity resolution companies that can provide this service in a privacy compliant manner. No match ever includes 100% of the source data. As a result, there are three questions to ask at this point in the process.
  - Did the matching process leave enough data for a statistically significant attribution analysis?
  - Does the matched data set still adequately cover the geographic area of the OOH campaign?
  - Is the matched data set still representative of the advertiser's category?

At this point all the data inputs are ready for attribution. The result is a set of persons/households exposed to the campaign and all other persons/households in the outcome data that were not exposed.

OOH Analytics for Attribution

The process of attribution answers the question, of all those consumers who performed the desired outcome (bought the product, visited the store, etc.,) how many were truly incremental to those who would have done so in the absence of any exposure to an ad campaign. Most attribution for OOH uses a test vs. control methodology, so this document will focus on that approach. Other attribution approaches that include OOH among other media, and even other marketing factors, tend to use true modeling methods, not test/control. The key to the test vs. control methodology is that the control group must consist entirely of persons/households unexposed to the campaign, and in every other respect, be the *mirror image* of the test group which consists entirely of persons/households that were exposed. Exposure to the OOH campaign should be the only difference between the two groups.

- The Control group must never just be the entire set of unexposed persons/households. This group will fall mainly outside of the campaign's target audience and have a lower probability of performing the desired outcome.

- The control group must match the test group on propensity to perform the desired outcome, i.e., to buy the brand, visit the store, or download the app. When the campaign is intended to bring in new consumers, it will also be important that the control group match the test group on the characteristics used to target those ads, which might be demographics, or some other marker of consumers' propensity to consider the brand or find it relevant, etc.

- Test and control groups must also match well on data reporting frequency (persistence) and precision (precise latitude/longitude). Infrequently reported data is more likely to undercount both exposures and outcomes, resulting in generally lower conversion rates. If this bias is equal in the test and control groups, it will not affect the attribution. Similarly, lower precision data may overstate retail visit outcomes. This bias must also be balanced between test and control groups.

- Advertising has a lingering effect on consumers long after the actual exposure. A campaign's impact on the desired outcome will continue to manifest after the campaign ends. This lingering effect is captured by the attribution window, a period of time during which outcomes are still counted, after the campaign ended. The attribution window varies by outcome variable and should reflect a reasonable time for the consumer to have the opportunity to act on the advertising message. Thirty days is a typical attribution window, although 90 days is more typical for automotive. Shorter windows can be used to drive mid-campaign optimization, but know that more memorable, longer-lasting advertising may be undervalued versus more immediate call to action ads.

- Most commonly, the incremental lift in the desired outcome produced by the OOH campaign is determined by subtracting the incidence of that behavior among the control group from that same incidence among the test group.

- A better practice, often observed, is to also consider a pre-campaign period of the same duration for both test and control groups. If the matching of those groups has been done well, the pre-period should reveal the same incidence of the desired outcome between the two. If there is a big difference, the two groups have not been properly matched for propensity and that balance must be revisited. If there is a small difference, it can be accommodated by calculating each group's post-pre period difference and then taking the *difference* of those two differences.

- If the data used for attribution did not reflect the total coverage area of the campaign, the attribution results need to be projected to provide an estimate of the campaign's total impact. This is a simple multiplication to scale-up the impact in terms of *counts* of purchases, visitors, etc. Obviously, *percent* lifts require no scaling. If the data used for attribution was not fully representative of product and consumer characteristics of the campaign's total coverage area, the attribution results should be weighted to bring them more into line, e.g., if the data used for attribution skewed younger than the population in the campaign coverage area, it should be weighted. Propensity to engage in the outcome will always be the most important weighting factor.

- Attribution results should be broken out as granularly as possible by creative and OOH format. This sheds light on strong versus weak contributors to campaign effectiveness. Insights about creative and OOH formats can lead to increasingly more effective OOH campaigns, and eventually guide mid-campaign optimization. In the long term, it can also inform in real-time buying through programmatic platforms, or other processes. This appears to be quite a way off for OOH, but should remain a goal.

- Attribution is blind to the impact of other factors that could be in a campaign, like other media, or marketing factors such as trade and consumer promotion. It may misattribute the impact of these factors to OOH. If the test and control groups each had equal exposure to the other media and marketing factors in play, this wouldn't be a problem. But current attribution methodologies aren't there yet. Despite this limitation, attribution can still do a good job discerning the relative contribution of different elements (creative and formats) of the OOH campaign.

Appendix

Typical Data Inputs for Marketing Mix Models

Weekly data by DMA or lower
- Sales
- Distribution/Trade
- Promotion
- Seasonality/holidays
- Macro-economic variables (GDP, unemployment, inflation, etc.)
- Weather
- Brand metrics
- Paid/owned/earned media impressions (or GRPs)
- Other Events/Sponsorships
- Competition

Typical Data Inputs for Attribution

- Media schedule (occurrences)
  - Geography
  - Campaign, Ad format
- Ad Exposures
  - Mobile location data + POI data
- Outcome data: visits, sales, offline/online behavior, brand metrics