Observed Reach & Frequency
Product Documentation
Motionworks 07 Oct 2022

Introduction

Motionworks **Observed Reach and Frequency** provides the percentage of the population reached by an advertisement and frequency of ad exposure across a set of out-of-home (OOH) displays over a specific period of time. The data provided crosses all OOH formats and key demographics. It is available nationally and for the top 50 markets. The data include:

- frequency
- reach
- effective reach (penetration of individuals who are exposed at a defined effective frequency or more)

Purpose

To maximize the potential of every dollar a brand invests in advertising, agencies often rely on **media mix allocation** solutions such as Nielsen's Commspoint.

Media mix software optimizes how much of a brand's campaign budget should go to each marketing channel in order to achieve campaign objectives.

Major drivers influencing the output of these allocation models are the **reach curves** associated with each channel. When the reach of a channel begins to plateau, the model recommends shifting the next incremental dollar to a different channel where that dollar's impact will drive a higher reach.

Prior to the recent release of the new Geopath measurement system, the organization relied upon information from surveys and other available inputs to generate national reach curves for the channel. The methodologies used to calculate these curves could not capture the nuanced travel patterns that modern location data inputs can identify.

As a result, the legacy reach curves escalated rapidly as target rating points (TRPs) increased. This means that the incremental value OOH provided to a campaign appeared as if it would plateau with minimal spend. The allocation models would stop recommending additional budget be dedicated to the channel. Simply put, this is one of the main reasons the channel has had approximately 4-5% of ad spend year after year.

The new reach curves produced by Motionworks are incredibly sensitive to the nuanced mobility behavior of the total population. With these new reach curves, a more significant investment in the channel is required to hit the plateau point. As a result, the media mix allocation models will recommend additional

investment in OOH, growing the share of the budget allocation and increasing the overall revenue for the channel. Additionally, cross-media campaigns including OOH will be more impactful, resulting in more effective advertising for agencies and brands across the country.

Approach

Motionworks' core solutions identify the movement of the total population every hour of every day on all roadways, pedestrian pathways, and inside of every venue. This inherently quantifies if, when, and how often individuals are in a specific location within a specific period. The outputs of this solution are used in a variety of industries, including urban planning, transportation, government, retail, real estate, and tourism.

This population intelligence solution naturally lends itself to use within the media space. Harnessing the power of this methodology, Motionworks repurposed the outputs to focus on exposure to OOH advertising.

Motionworks utilized millions of actual and hypothetical OOH media plans to feed the solution, quantifying the reach and frequency for each incremental TRP added to the plan. The majority of these plans were real packages built by the buying community. Motionworks supplemented these plans with modeled packages to test the extremes of the model. Based on the outputs, National and Regional models were produced for every format Geopath measures.

Methodology

Panel and Weighting

The Motionworks panel is a statistically significant, representative set of qualified devices. For a device to be included in the panel on a weekly basis, it must be visible for the majority of waking hours in the week. Due to the high device visibility with this requirement, Motionworks is confident that the general movement of these panel devices represents cohorts[1] and their behaviors well.

For Observed Reach and Frequency specifically, the panel for a single reach and frequency analysis is the set of devices consistently present in the panel throughout the duration of the time specified in the request.

For each device in the panel, its representativeness is determined over the time specified using three main components:

- its home block group
- the proportion of cohorts present in its home block group, and
- the total number of persons in the county in each of the cohorts that the home block group belongs to.

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[1] Motionworks currently uses the Claritas PRIZM Premier segmentation system in the US to define cohorts. There are 68 cohorts.

First, a home block group[2] is assigned each week to each panel device based on residential areas where the device is seen most in the current week plus the previous five on a rolling basis. Next, a portion of each device is assigned to each cohort that exists in the device's home block group(s).

To scale up the behavioral observations of the panel devices to represent the total population, each home block group and cohort combination is considered in the context of the cohort totals at the county level[3]. The overall sample weight applied to each device's home block group and cohort combinations can also be considered a "contribution" that is summed whenever this device is counted in an analysis. To prevent unreasonable results, a number of sampling rate heuristics are employed to prevent over or under sampling of each home block group and cohort combination. Generally, sampling rates are limited to the average weight plus two standard deviations of the weight for the cohort. The average and the standard deviations are calculated based on the state of home block group[4].

Trip Identification

Once the panel is curated, all the trips made by each of these panel devices throughout the course of the analysis period are identified. It is well-established that mobile GPS data are noisy, at times sparse, and inconsistent in sighting density over time. In fact, a stationary device at home may continue developing sightings while an active device may generate a fewer number of sightings, or vice versa, depending on several factors, including the applications in use. The Motionworks trip identification methodology confidently isolates the episodes involving a device in motion and filters out the stationary activities or locations. One of the key concepts in the Motionworks trip identification methodology is that a device must leave its origin H3 cell flower (the cell itself and its six neighboring cells) at resolution 9 for a trip to be initiated and travel more than a quarter a mile. The Motionworks data demonstrates that post-COVID, each device in the panel makes, on average, approximately two routable trips per day, ignoring short trips like walking the dog.

For the frequency analysis, only local trips shorter than 150 miles are considered. This eliminates the inclusion of air travel or longer infrequent long-distance trips. The trips included in the analysis either start, end, or travel through the target market and were completed by the devices living in the market. Each trip records the beginning and end location and time of the trip. The purpose or activity (home, work, and other) of the trip-ends are determined, and therefore a trip is designated by its specific purpose, such as commute or errand. More importantly, the device pings throughout each trip give insight on the approximate route toward the destination.

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[2] or block group equivalent in countries where block groups do not exist

[3] or county equivalent in countries where counties do not exist

[4] or state equivalent in countries where states do not exist

Network Map Matching

Motionworks snaps each trip to the transportation network using a customized version of the Open Street Routing Machine (OSRM) and its Map Matching service with the available timestamps, longitudes, and latitudes captured during the complete course of travel. The Map Matching algorithm finds the most probable route taken by the device to the destination via the observed waypoints.

For Observed Reach and Frequency, the HERE Map street network is used to represent the transportation network. From the Map Matching service results and the network representation, Motionworks conceptually observes the gaps between device sightings while the device is in motion. Before panel device sightings are map-matched, Motionworks removes noise observed in the original device pings caused by jumps (while in motion) or wandering locations (while waiting in traffic).

The network map matchings produced a set of timestamped HERE Map intersection identifiers that were traversed. Specifically, the identifiers are node identifiers in the network graph that are conceptually intersections in the real world.

Enumeration

For the set of OOH inventory (roadside, transit, place-based, etc.) that were specified in the Observed Reach and Frequency request, Motionworks enumerates the panel behaviors by summing the device weights at each intersection with the set of inventory. For this, roadside inventory are converted to a set of transportation network link identifiers (i.e., path) by a geographic overlay of the inventory's polygon with the transportation network. Metrics like the number of total visitors, number of unique visitors, the frequency distribution of visitors, and effective reach (visitors as a percentage of the population) are computed from these enumerations.

Schema

The Motionworks Observed Reach and Frequency product is supported by an API. Responses can also be delivered via Snowflake in batches. The following sections describe the basic schemas of requests and their responses.

Request

The following parameters are submitted as part of a request:

- **start_date** Start date of the analysis is formatted as yyyy-mm-dd.
- **end_date** End date of the analysis is formatted as yyyy-mm-dd.
- **base_segment** Motionworks population segment ID that represents the denominator in reach calculations.
- **target_segment** Motionworks population segment ID that represents the numerator in reach calculations.
- **target_geo** Motionworks geography type that gives the geographic area in the analysis where global, county, and DMA are supported (default: global).
- **place_set** List of Motionworks place IDs in the set.

Request schema.

Column Name	Type	Example
start_date	yyyy-mm-dd	2021-04-26
end_date	yyyy-mm-dd	2021-05-02
base_segment	String	9330
target_segment	String	9330
target_geo	String	global
place_set	Array of Strings	["351760", "31090438", …]

Response

The following describes the response:

- **request_id** Unique string representing the request.
- **created_timestamp** Timestamp of the request creation.
- **days** Number of days associated with the request.
- **devices_panel** The total number of panel devices in the target market and the target segment over all the days in the analysis.
- **target_devices_routed** The total number of panel devices that were routed in the target market and the target segment.

- **target_devices_observed** The total number of panel devices that were routed in the target market and the target segment and interacted with the set of places from start date to end date.
- **device_events** The total number of target_devices_observed that interact with the set of spots.
- **eff_freq_1_reach** Percentage of the target segment within the target market that are reached at least 1 time (effective reach).
- **eff_freq_2_reach** Percentage of the target segment within the target market that are reached at least 2 times (effective reach).
- **eff_freq_3_reach** Percentage of the target segment within the target market that are reached at least 3 times (effective reach).
- **eff_freq_4_reach** Percentage of the target segment within the target market that are reached at least 4 times (effective reach).
- **eff_freq_5_reach** Percentage of the target segment within the target market that are reached at least 5 times (effective reach).
- **eff_freq_6_reach** Percentage of the target segment within the target market that are reached at least 6 times (effective reach).
- **eff_freq_7_reach** Percentage of the target segment within the target market that are reached at least 7 times (effective reach).
- **eff_freq_8_reach** Percentage of the target segment within the target market that are reached at least 8 times (effective reach).
- **eff_freq_9_reach** Percentage of the target segment within the target market that are reached at least 9 times (effective reach).
- **eff_freq_10_reach** Percentage of the target segment within the target market that are reached at least 10 times (effective reach).
- **eff_freq_11_reach** Percentage of the target segment within the target market that are reached at least 11 times (effective reach).
- **eff_freq_20_reach** Percentage of the target segment within the target market that are reached at least 20 times (effective reach).
- **eff_freq_50_reach** Percentage of the target segment within the target market that are reached at least 50 times (effective reach).
- **eff_freq_100_reach** Percentage of the target segment within the target market that are reached at least 100 times (effective reach).

Response schema.

Column Name	Type	Example
request_id	String	4db7092ff5df9ff7c9b2e431b1d18616
created_timestamp	Datetime	2022-09-23T10:19:06.513Z
days	Integer	14
devices_panel	Integer	12657982
target_devices_routed	Integer	561154
target_devices_observed	Integer	231215
device_events	Integer	1432315
eff_freq_1_reach	Number	23.45
eff_freq_2_reach	Number	20.21
eff_freq_3_reach	Number	17.35

...	...	...
eff_freq_100_reach	Number	0.00

Example

The following shows an example JSON request body submitted to the API:

```json
{
  "start_date": "2021-04-26",
  "end_date": "2021-05-23",
  "base_segment": "9330",
  "target_segment": "1941",
  "target_geo": "DMA524",
  "market": "DMA524",
  "spot_list": [
    "30972344",
    "30849809",
    "30849801",
    "50411713",
    "30987774"
  ]
}
```

The following shows its response:

```json
{
  "request_id": "23ceabb5301d67eb7d741dcf5e5fdee5",
  "created_timestamp":
    "2022-09-29 19:58:02.196099 UTC",
  "days": "28",
  "devices_panel": 12657982,
  "target_devices_routed": 561154,
  "target_devices_observed": 231215,
  "device_events": 1432315,
  "eff_freq_1_reach": "11.93",
  "eff_freq_2_reach": "4.50",
  "eff_freq_3_reach": "2.46",
  "eff_freq_4_reach": "2.02",
  "eff_freq_5_reach": "1.44",
  "eff_freq_6_reach": "1.13",
  "eff_freq_7_reach": "0.93",
  "eff_freq_8_reach": "0.79",
  "eff_freq_9_reach": "0.43",
  "eff_freq_10_reach": "0.43",
  "eff_freq_11_reach": "0.30",
  "eff_freq_20_reach": "0.01",
  "eff_freq_50_reach": "0.00",
  "eff_freq_100_reach": "0.00"
}
```