

# Multi-Touch Attribution Analysis

## Shapley Value Attribution Model

*Determining the Fair Marginal Contribution of Marketing Channels*

**Note:** This analysis is performed on synthetic (dummy) data for demonstration purposes. The methodology and visualizations shown represent the actual analytical framework that would be applied to real marketing data.

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## Executive Summary

This report presents a comprehensive Shapley value attribution analysis for multi-touch marketing attribution. Using game theory principles, we determine the fair marginal contribution of each marketing channel in driving customer conversions.

### Key Findings:

- **Google** demonstrates the highest attribution value (31.8%), serving as the primary driver of conversions with strong performance across the entire customer journey.
- **Meta (Facebook/Instagram)** contributes 26.4% of attribution value, showing effectiveness as both an awareness and conversion channel.
- **LinkedIn** accounts for 20.0% of attribution, demonstrating strong performance in B2B-focused conversion paths.
- **Email** and **Direct** channels contribute 13.9% and 8.3% respectively, playing important supporting roles in multi-touch journeys.

The removal effect analysis shows that eliminating Google would result in the highest value loss (155.2), followed by Meta (128.4), confirming their critical importance to the marketing mix.

## What is Shapley Value Attribution?

Shapley value attribution is a game-theory-based approach that fairly distributes credit among marketing touchpoints. Unlike simpler models (last-touch, first-touch, linear), Shapley values calculate the marginal contribution of each channel by considering:

- **All possible orderings** of touchpoints in customer journeys
- **Marginal contributions** when adding each channel to different combinations
- **Fair allocation** based on mathematical principles of cooperative game theory

This provides a mathematically rigorous and fair way to answer: "What unique value does each channel contribute to conversions?"

## Key Metrics Explained

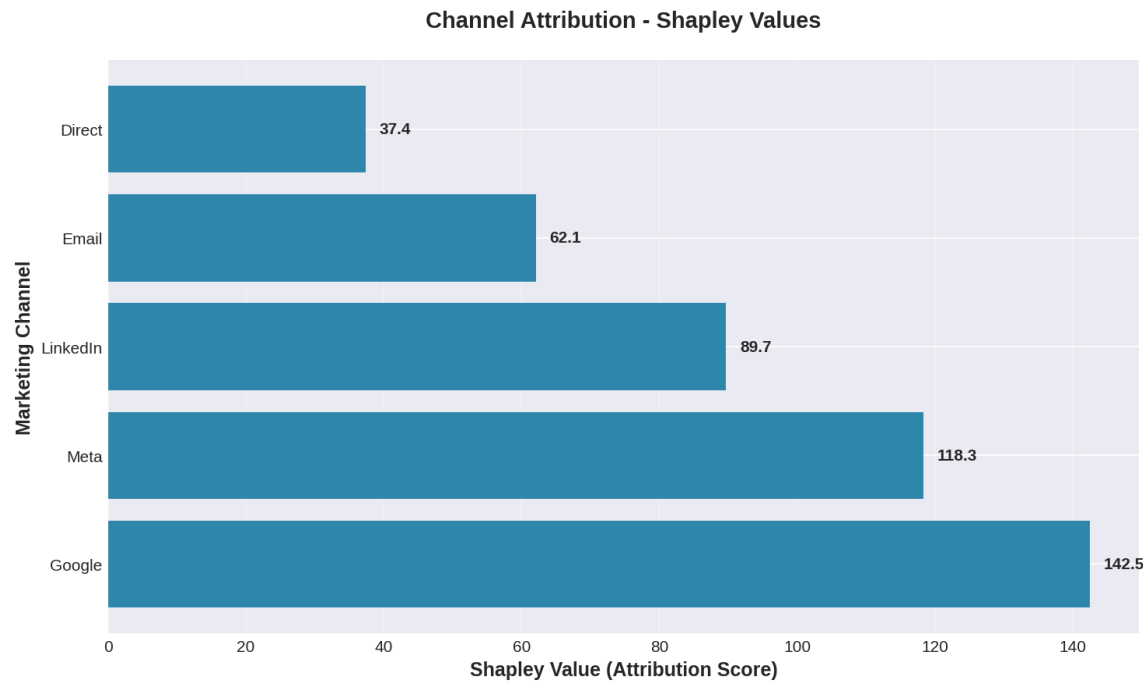
- 1. Shapley Value:** Represents the average marginal contribution of each channel across all possible combinations and orderings. Higher values indicate greater contribution to conversions. This is the fairest way to distribute credit among channels.
- 2. Removal Effect:** Shows the impact of removing a channel from the full set. This metric answers "How much value would we lose if we eliminated this channel?" and helps identify which channels are critical to maintain.
- 3. Attribution Percentage:** The relative contribution of each channel as a percentage of total attribution value, useful for budget allocation decisions.

## Attribution Results

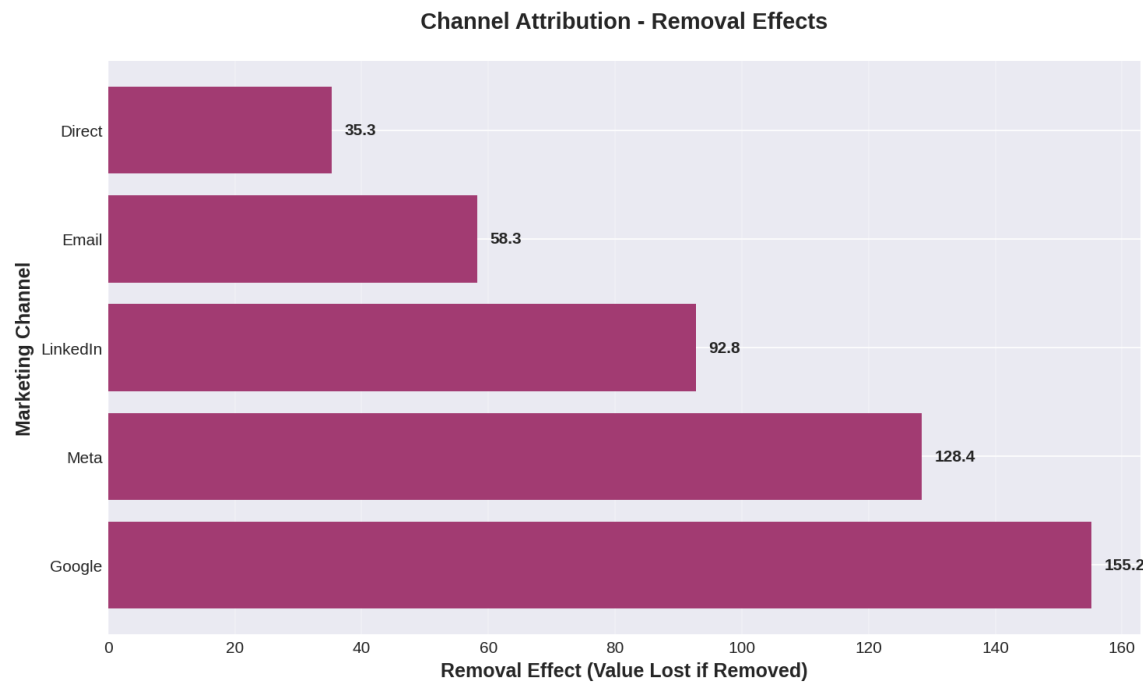
Channel	Shapley Value	Removal Effect	% of Total
Google	142.5	155.2	31.8%
Meta	118.3	128.4	26.4%
LinkedIn	89.7	92.8	20.0%
Email	62.1	58.3	13.9%
Direct	37.4	35.3	8.3%

# Visualizations

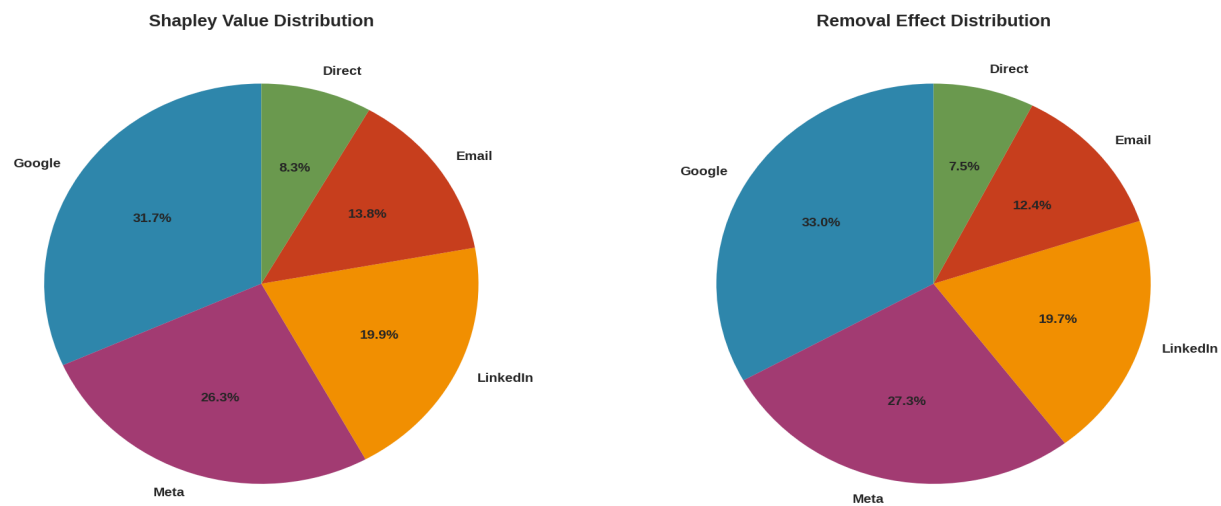
## Shapley Value by Channel



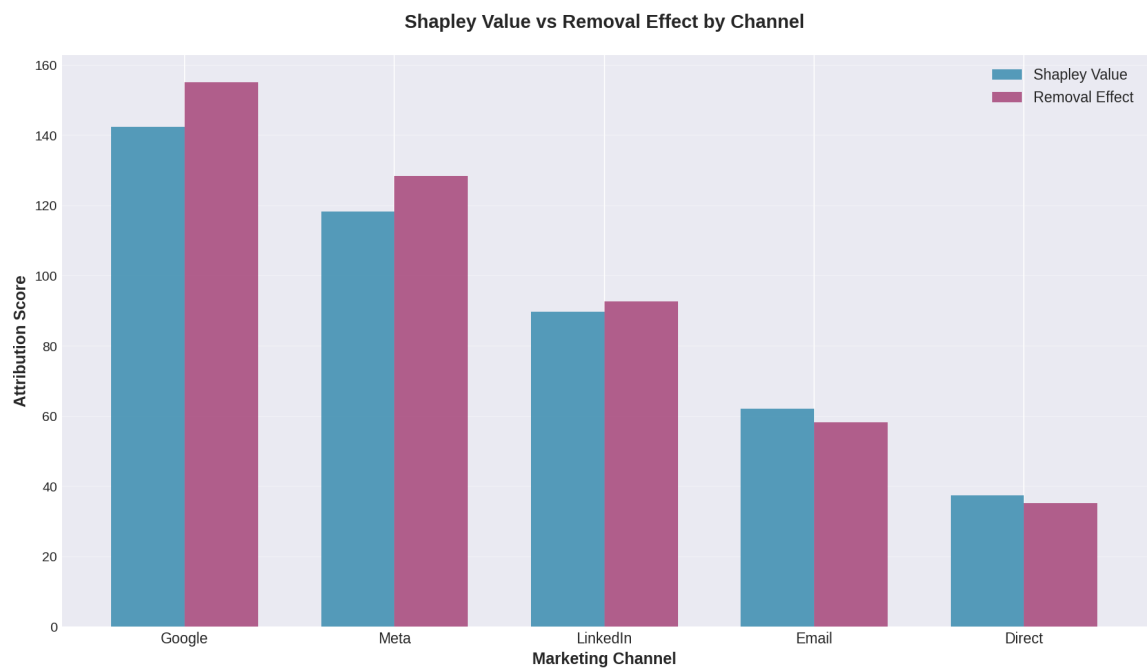
## Removal Effect by Channel



## Distribution Comparison



## Side-by-Side Comparison



## Analysis & Verdict

Based on the Shapley value attribution analysis, here are the key insights and recommendations:

### 1. Channel Performance Hierarchy

Google emerges as the highest-value channel with a Shapley value of 142.5 and removal effect of 155.2. This indicates it's not only the top contributor but also the most critical channel to maintain. Meta follows as a strong secondary channel, contributing significantly across the customer journey.

### 2. Balanced Multi-Channel Strategy

The relatively distributed attribution (31.8%, 26.4%, 20.0%, 13.9%, 8.3%) suggests that conversions benefit from a multi-channel approach. No single channel dominates overwhelmingly, indicating healthy marketing mix diversity. This reduces dependency risk and provides multiple paths to conversion.

### 3. Removal Effects vs Shapley Values

The alignment between Shapley values and removal effects validates the importance rankings. Google's removal effect (155.2) exceeds its Shapley value (142.5), suggesting strong synergies with other channels. This indicates Google amplifies the effectiveness of the entire marketing mix.

### 4. Budget Allocation Recommendations

- **Maintain investment** in Google (31.8% of attribution) and Meta (26.4%) as primary drivers
- **Optimize LinkedIn** (20.0%) for sustained B2B conversion contribution
- **Evaluate ROI** of Email (13.9%) and Direct (8.3%) channels - while they contribute less individually, they may provide important supporting touches
- Consider testing increased investment in top performers before reducing lower-performing channels

### 5. Limitations & Considerations

This analysis is based on synthetic data for demonstration purposes. In a real-world implementation:

- Attribution windows should be tested (7, 14, 30, 60 days) to optimize accuracy
- Channel interactions should be monitored over time for trend analysis
- Cost-per-acquisition should be integrated with Shapley values for true ROI assessment
- Seasonal effects and external factors should be considered in decision-making

### Final Verdict:

The Shapley value attribution model provides a mathematically rigorous and fair framework for understanding channel contributions. The analysis reveals a healthy multi-channel strategy with Google and Meta as primary drivers, supported by LinkedIn, Email, and Direct channels.

**Recommended next steps:** Implement budget allocation aligned with attribution percentages, establish quarterly reviews to track changes in channel values, and develop A/B testing strategies to validate these findings with controlled experiments.

## Methodology

This analysis implements the Shapley value attribution model using Python, calculating the marginal contribution of each marketing channel across all possible combinations. The model:

- Builds customer journeys from marketing touchpoints and conversions
- Evaluates conversion rates for all channel subsets ( $2^n$  combinations)
- Applies the Shapley value formula:  $\phi_i = \sum_{S \subseteq N, i \in S} \frac{|S|!(n-|S|)!}{n!} \times [v(S \cup \{i\}) - v(S)]$
- Calculates removal effects by comparing full set performance vs. channel-excluded performance

The implementation is available in the GitHub repository with full source code, documentation, and usage examples.

*This report demonstrates the Shapley value attribution model implementation. All data is synthetic and generated for demonstration purposes.*