

# **Media Exposure through the Funnel: A Model of Multi-Stage Attribution**

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## **Abstract**

Consumers are exposed to advertisers across a number of channels. As such, a conversion or a sale may be the result of a series of ads that were displayed to the consumer. This raises the key question of attribution: which ads get credit for a conversion and how much credit does each of these ads get? This is one of the most important questions facing the advertising industry today. Although the issue is well documented, current solutions are often simplistic; for e.g., attributing the sale to the most recent ad exposure. In this paper, we address the problem of attribution by developing a Hidden Markov Model (HMM) of an individual consumer's behavior based on the concept of a conversion funnel. We apply the model to a unique data-set from the online campaign for the launch of a car. We observe that different ad formats, e.g. display and search ads, affect consumers differently based on their states in the decision process. Display ads usually have an early impact on the consumer, moving him from a disengaged state to an state in which he interacts with the campaign. On the other hand, search ads have a pronounced effect across all stages.

Further, when the consumer interacts with these ads (e.g. by clicking on them), the likelihood of a conversion increases considerably. Finally, we show that attributing conversions based on the HMM provides fundamentally different insights into ad effectiveness relative to the commonly used approaches for attribution. Contrary to the common belief that display ads are not useful, our results show that display ads affect early stages of the conversion process. Furthermore, we show that only a fraction of online conversions are driven by online ads.

## **Speaker Profile**

Vibhanshu (Vibs) Abhishek is an Assistant Professor of Information Systems and Management at the Heinz College of Carnegie Mellon University. His research focuses on the effect of emerging technologies on consumers' behavior, business strategy and market structure. He is particularly interested in multi-channel coordination and examines issues in multi-channel retail, advertising and pricing.

He studies how consumers respond to different forms of advertising and how companies can strategically use new advertising channels to connect with their consumers. Most recently, he is trying to solve the attribution problem in advertising. In another stream of research, he examines the dynamics of e-commerce retailers like Amazon and iTunes and their interaction with traditional retail channels.

His research has received several awards like the Nunamaker-Chen Dissertation award, the ISA-INFORMS best paper award, CIST best paper award and CSWIM best paper runner-up. His research has also been cited in Knowledge@Wharton, Forbes and the New York Times. He works with companies like LEGO, Adobe, FICO, IBM, Omnicom, PNC Bank, The Pirated (Go BUCS!!) and advises several hi-tech startups on strategy, big data and marketing.

Vibhanshu received a B. Tech. in Computer Science from IIT Kanpur, and a MA in Statistics and a PhD in Applied Economics and Managerial Science (OPIM) from the Wharton School of the University of Pennsylvania.