Is the Hierarchy of Effects Dead or Alive?

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Abstract

Advertising influences purchase behavior when it changes how consumers think and feel about brands. While the Hierarchy of Effects (HoE) model has guided advertising decisions for decades, an extensive review found little support for any hierarchy, thus implying the death of HoE. However, the conclusion was not based on empirical comparisons of possible hierarchies. We analyze how mindset metrics intermediate the marketing effects on sales for the top brands in fifteen categories. We compare the fit of 26 models proposed in the literature, and conclude that the original concept of hierarchy (which signifies "sequentiality") holds up firmly. However, the sequence varies across brands, with the Affect→Cognition→ Experience being the most prevalent. Classical dimensions of category characteristics (hedonism and involvement) do not predict which sequence applies, but moderate the effects of marketing on mindset metrics.

1. Introduction

Imagine three graduated MBAs, each working as brand manager in competing potato chip companies. All three have access to data on past marketing activities and sales for their brand, and to survey-based mindset metrics (e.g., awareness, liking). To decide on advertising activities, each of them thinks through the relationships between advertising, mindset metrics, and sales but they remember different elements from the marketing courses they took.

Ariane has excellent memories of her marketing communications course and understood AIDA model (Colley, 1961). In her analysis, awareness comes first, interest and desire follow in sequence and lead to action. Therefore, she conceives a campaign with a primary goal of raising awareness. Victor took the same course but he remembers instead an article by Vakratsas and Ambler (1999) (V&A), who conclude that there is little support for any temporal hierarchy. As Affect and Cognition occur at the same time, and he believes consumer decision-making is mostly driven by emotions, he designs an emotional campaign. Bridget, benefiting from her engineering background, took marketing analytics. She digs up Bruce, Peters, and Naik (2012) (BPN), one of the most challenging articles she read, and rediscovers that the authors find evidence of a temporal hierarchy in which Experience precedes Cognition which in turn precedes Affect. Because potato chips are similar to the one brand analyzed in that article, a soft drink (both are hedonic low-involvement), she applies the same hierarchy and advertises free sampling to get consumers to experience her product.

Our three imaginary MBAs diligently applied what they learned. And their professors diligently anchored their teaching in solid academic research. Unfortunately, that research is apparently contradictory. Marketing textbooks (Kotler & Keller 2015) acknowledge, based on a summary of the literature, that different hierarchical sequences have been proposed, leaving the question of which hierarchical sequence operates for a given brand unanswered.

With the regular tracking of consumer mindset metrics (Keller, 2003), knowing whether there is a hierarchy and which hierarchy is important for managers to use these metrics in a productive way. The notion of Hierarchy of Effects (HoE) allows them to calculate conversion ratios to identify which mental steps of the customer decision-process they should focus on with their marketing actions (Batra & Keller, 2016). These ratios can be calculated with just a few data points over time and do not require much econometric analysis. But, which hierarchy should they use? And could it be that there is actually not really any hierarchy at all?

By concluding that there is no temporal hierarchy, V&A de facto declare the death of the notion of a HoE. Their model is based on a review of more than 250 articles. But none of those sources examine empirically the complete sequence from advertising through mindset metrics to sales to determine which hierarchy applies. Srinivasan, Vanhuele, and Pauwels (2010) were the first to effectively include mindset metrics in a sales response model with the different marketing instruments but they do not examine the possibly sequential nature of these metrics. In contrast, BPN developed a dynamic sales response model of advertising that permits to infer the sequence of mindset metrics that best explains sales. Unfortunately, they only had data for one brand at their disposal. It is therefore not possible to draw general substantive conclusions on the usefulness of the HoE from their work. There are also recent calls for research on the HoE and relevant mindset metrics. Batra and Keller (2016), for instance, call for empirical research that develops dynamic time-series models that capture "sequential effects instead of just simultaneous effects" (p.138) to study specific hierarchical sequences, and Moorman and Day (2016) call for research that considers "whether and how metrics are used jointly" (p. 18) to help managers guide their decision-making.

In this paper, we undertake a large-scale econometric analysis in which we compare 13 alternative hierarchies, each in two different versions (correlated and orthogonal errors), leading to 26 models proposed by the literature. These hierarchies come in three types: the Classical HoE, a Simultaneous HoE (based on V&A), and an Integrated HoE (based on BPN). Figure 1 shows the different HoE frameworks. We estimate the corresponding models for the top brands in 15 different product categories. These product categories differ in terms of involvement levels and the extent to which they are utilitarian or hedonic. This variation allows us to test the idea that the nature of a product determines which hierarchy applies (Ratchford, 1987; Vaughn, 1986).
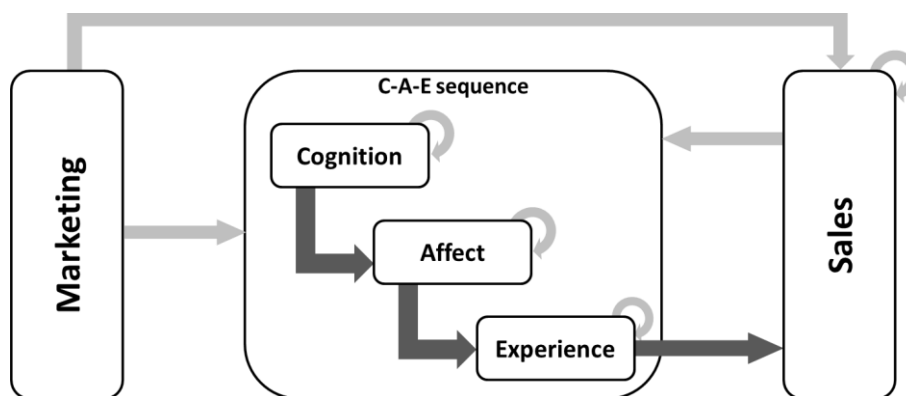
Figure 1. HoE Frameworks

Classical HoE Framework (for C→A→E sequence, other five sequences are possible)
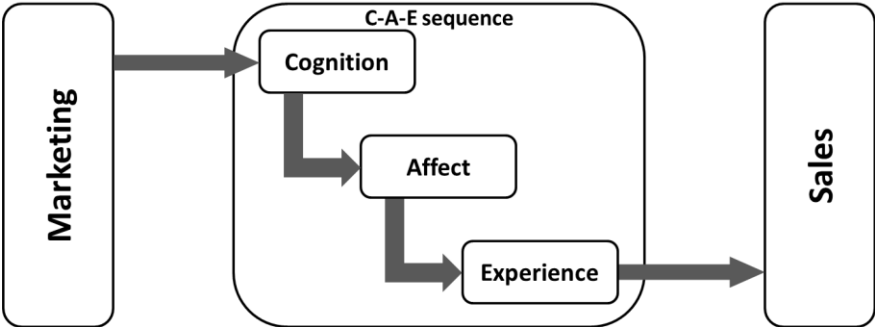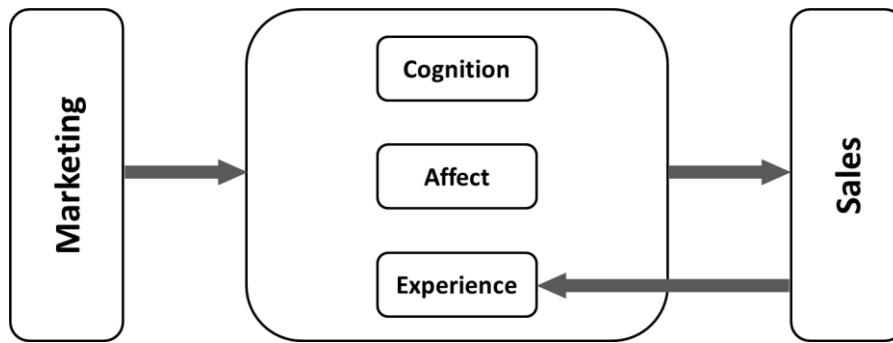
Integrated HoE Framework (for C→A→E sequence, other five sequences are possible)

Note: For Classical and Integrated HoE, five other sequences are possible for the other permutations of the three intermediate factors (C, A, E). The darker gray arrows show the sequence of intermediate factors (adapted from BPN).

We find that the death of the HoE has been greatly exaggerated. Across 30 brands in 15 diverse categories, we show that the Integrated HoE fits better than any alternative. The sequence of the hierarchy differs by brand, with Affect→Cognition→Experience being the most common in our sample. Finally, we find that carryover effects, purchase reinforcement, and marketing responsiveness vary by the involvement and utilitarian/hedonic nature of the product: 1) carryover of Cognition increases with hedonism, but carryover of Affect decreases with hedonism; 2) carryover of Affect decreases with involvement; 3) purchase reinforcement of Cognition decreases with involvement; 4) the effect of promotion on Cognition decreases with hedonism; 5) the effect of promotion on Experience decreases with involvement.

For managers, like the three MBA graduates in our opening example, we show that using the right HoE framework and hierarchical sequence helps determine which mindset will have most sales lift. It also helps inform the managers' advertising decisions on copy content and expenditure. Finally, the knowledge of the right HoE framework helps brand managers predict how much sales improvement an increase in advertising will produce for their brands.

2. Research Methodology

Our research objectives impose several modeling requirements. Following BPN, these requirements lead us to specify a Dynamic Factor Model (DFM) (Sargent & Sims, 1977). In our application, the observation equation is expressed in the following matrix-vector form:

$$
\begin{bmatrix} y_{1t} \\ \vdots \\ \vdots \\ y_{kt} \end{bmatrix} = \begin{bmatrix} q_{11} & \cdots & \cdots & q_{1n_f} \\ \vdots & \ddots & & \vdots \\ \vdots & & \ddots & \vdots \\ q_{k1} & \cdots & \cdots & q_{kn_f} \end{bmatrix} \begin{bmatrix} C_t \\ A_t \\ E_t \\ S_t \end{bmatrix} + \begin{bmatrix} u_{1t} \\ \vdots \\ \vdots \\ u_{kt} \end{bmatrix} \tag{1}
$$

where the observed dependent variables are consumer attitude metrics (e.g., aided awareness, liking, purchase intention) and sales. C, A, E, and S stand for Cognition, Affect, Experience, and Sales, respectively. Our transition equation is expressed in the following form:

$$
\begin{bmatrix} C_t \\ A_t \\ E_t \\ S_t \end{bmatrix} = \begin{bmatrix} \alpha_{11} & \alpha_{12} & \alpha_{13} & \alpha_{14} \\ \alpha_{21} & \alpha_{22} & \alpha_{23} & \alpha_{24} \\ \alpha_{31} & \alpha_{32} & \alpha_{33} & \alpha_{34} \\ \alpha_{41} & \alpha_{42} & \alpha_{43} & \alpha_{44} \end{bmatrix} \begin{bmatrix} C_{t-1} \\ A_{t-1} \\ E_{t-1} \\ S_{t-1} \end{bmatrix} + \begin{bmatrix} \beta_{11} & \beta_{12} & \beta_{13} \\ \beta_{21} & \beta_{22} & \beta_{23} \\ \beta_{31} & \beta_{32} & \beta_{33} \\ \beta_{41} & \beta_{42} & \beta_{43} \end{bmatrix} \begin{bmatrix} Adv_{t-1} \\ Price_{t-1} \\ Promo_{t-1} \end{bmatrix} + \begin{bmatrix} v_{1t} \\ v_{2t} \\ v_{3t} \\ v_{4t} \end{bmatrix} \tag{2}
$$

where *ADV*, *PRICE*, and *PROMO* stand for advertising, price, and promotion, respectively.

Overall, besides allowing for the different HoE sequences, our DFM allows for intermediate factors carryover, sales dynamics, purchase reinforcement, marketing effects, and different sequences for intermediate factors. Hence, the three HoE frameworks—Classical, Simultaneous, and Integrated—and six sequences are nested in our DFM.

In each framework, advertising triggers the intermediate factors differently. According to the Classical HoE, advertising triggers one of the intermediate factors to initiate the sequence, and the last factor in the sequence drives sales. Hence, for the hierarchy E→C→A, which we call Model 1, the transition equation of the DFM is formulated as follows:

$$
\begin{bmatrix} C_t \\ A_t \\ E_t \\ S_t \end{bmatrix} = \begin{bmatrix} 0 & 0 & \alpha_{13} & 0 \\ \alpha_{21} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & \alpha_{42} & 0 & 0 \end{bmatrix} \begin{bmatrix} C_{t-1} \\ A_{t-1} \\ E_{t-1} \\ S_{t-1} \end{bmatrix} + \begin{bmatrix} 0 & \beta_{12} & \beta_{13} \\ 0 & \beta_{22} & \beta_{23} \\ \beta_{31} & \beta_{32} & \beta_{33} \\ 0 & \beta_{42} & \beta_{43} \end{bmatrix} \begin{bmatrix} Adv_{t-1} \\ Price_{t-1} \\ Promo_{t-1} \end{bmatrix} + \begin{bmatrix} v_{1t} \\ v_{2t} \\ v_{3t} \\ v_{4t} \end{bmatrix} \tag{3}
$$

where β_{31} implies that advertising triggers Experience (E_t); prior Experience (E_{t-1}) influences current Cognition (C_t), captured by α_{13}; prior Cognition (C_{t-1}) influences current

Affect (A_t), captured by α_{21}; and, finally, prior Affect (A_{t-1}) drives sales (S_t), captured by α_{42}. The β parameters in columns two and three control for price and promotion effects.

Similarly, we formulate Models 2 to 13 to capture the three different HoE frameworks with the different hierarchies, as shown in Figure 1.

The assumption that the intermediate factors are orthogonal (independent) might be violated. Thus, we estimate and compare the fit of all our models with: 1) non-orthogonal (correlated) factors, and 2) orthogonal (uncorrelated) factors. To ensure the stability of the model, we check whether the roots of the AR polynomial are outside the unit circle. We estimate the above models by maximum likelihood (Stock & Watson, 1993). We use the model likelihood and information criteria (AIC and BIC) to compare the models and determine for each brand 1) which HoE framework operates, 2) which hierarchical sequence of intermediate factors is present, and 3) whether intermediate factors are correlated.

DFMs are flexible in treating the variables as endogenous. We treat all variables, except the three marketing variables, as endogenous. All the HoE frameworks assume that marketing initiates the hierarchy, i.e., marketing is an exogenous variable in the model. However, from an empirical point of view, it might be that marketing and other factors are determined simultaneously. We alleviate this concern in two ways. First, we use lagged values of marketing (BPN). Second, we allow for non-zero correlations between the errors.

In order to assess whether the HoE depends on the product category and/or the brand, we conduct two second stage analyses. We first examine whether FCB grid category characteristics can explain which model has the best fit for each brand. We estimate brand-level multinomial regressions, where the dependent variable is which of the 13 models has the best fit for the brand with the FCB characteristics as explanatory variables. Second, we collect the estimated coefficients of the best model per brand and examine whether they depend on the FCB grid category characteristics. We estimate weighted least square regressions with each coefficient as dependent variable weighted by the standard error of the estimate and use the FCB characteristics as main explanatory variables.

3. Data

The main data set includes four-weekly brand level consumer attitude metrics, purchases, and marketing mix data from 2003 to 2010. For consumer mindset metrics, a panel of households is surveyed weekly. We use seven consumer metrics in Equation 1: advertising

awareness, aided awareness, consideration set, liking, whether is the main brand, whether it was purchased in the past, and purchase intention. Purchase data are measured with a nationally representative household panel using hand-held scanner device information. Finally, Kantar Worldpanel provides advertising expenses, prices, and promotion levels.

The final sample consists of 30 brands of 15 categories with 98 periods, for each of which all 26 models converge. In the final sample, category representation is as follows: 1) shaving, cleaning, coffee, frozen meals, and cereal categories have the three brands each, 2) detergent, milk, facial cream, shower, and yogurt categories have two brands each, and 3) makeup, soft drink, snack, shampoo, and candy categories have one brand each.

To examine whether the best fitting model is predicted from the characteristics of the product in terms of hedonism and involvement, we collect primary data for the 15 categories. An panel company collected the data using a stratified sample based on sociodemographics.

4. Results

We estimate 780 models, 13 models with correlated factors and 13 models with orthogonal factors for each brand. For all 30 brands, the DFMs with correlated factors outperform the DFMs with orthogonal factors in terms of model fit. This result allows us to make the first generalization: *Cognition, Affect, and Experience are mutually dependent.* For example, Cognition partly explains Affect, or Affect partly explains Experience. Therefore, all the subsequent analyses and results are based on the DFMs with correlated factors.

First, for each brand, we discover the operating framework by identifying the model that best fits the data. For all brands, the Integrated HoE scores the highest likelihood and lowest AIC and BIC. The differences are statistically significant as shown by the log-likelihood ratio tests. Overall, we generalize that the *Integrated HoE is the operating framework across brands*. That is, for all brands across all product categories: (1) *marketing simultaneously influences sales and intermediate factors*, (2) *a hierarchy between the intermediate factors exists*, (3) *sales and intermediate factors are dynamic*, and (4) *sales reinforces the three intermediate factors*. In sum, the HoE is alive and a relevant framework!

The preceding analysis implies that the type of operating HoE framework from among the Classical, Simultaneous, and Integrated HoE does not depend on product category characteristics: the Integrated HoE operates for all brands. Hence, *the prevalence of the Intergrated HoE generalizes across categories.*

Second, we evaluate whether the model with best fit is significantly better than the second best model for each brand. The fit between two models is not statistically distinguishable if the difference in AIC between them is less than two (Burnham and Anderson, 2002). Overall, for 19 of the 30 brands, the operating sequence can be identified based on statistical grounds. Model 13 is statistically superior for 42% of these brands: *A→C→E is the most common hierarchical sequence*. Models 9, 10, and 12 with *C→E→A* (16%), *E→A→C* (16%), and *A→E→C* (16%) are in a tie for the distant second best model.

Third, since brands differ in the operating sequence, we next examine in our second stage anlysis whether these differences are explained by FCB product characteristics. We plot the association between the operating sequence and FCB characteristics for the 19 brands that have a dominating sequence. Based on visual inspection, there seems to be no relationship since a comparable number of brands are placed above and below the median values of hedonism and involvement. Moreover, tests confirm that there is no statistically significant association between the operating sequence and FCB characteristics. We therefore conclude that *the operating sequence does not depend on FCB characteristics*.

Fourth. we examine whether the effects of carryover, sales dynamics, purchase reinforcement, and marketing effects depend on the FCB grid characteristics. For the 19 brands with a dominant HoE sequence, we collect the coefficients of the operating model and their standard errors. For the 11 brands without a dominant operating sequence, we average the coefficients and standard errors for the top models that are statistically undistinguishable. We regress the coefficients on the FCB grid characteristics controlling for brand-level metrics. For the estimation, we use weighted least squares, where the weights are the inverse of the standard errors of the coefficients. The results show that several parameters in the models are moderated by the FCB grid characteristics:

1) *Carryover of Cognition increases with hedonism, but carryover of Affect decreases with hedonism* (.184, $p < .1$ and -.381, $p < .1$).
2) *Carryover of Affect decreases with involvement* (-.491, $p < .1$).
3) *Purchase reinforcement of Cognition decreases with involvement* (-.131, $p < .1$).
4) *The effect of promotion on Cognition decreases with hedonism* (-.120, $p < .1$).
5) *The effect of promotion on Experience decreases with involvement* (-.389, $p < .1$).

5. Managerial Implications

First, managers may want to know which metrics' lift would drive their sales most. To explore this, we increase mindset metrics that best represent the components of the sequence by one standard deviation, and trace their impact on sales. Our simulations show that managers get a higher sales lift if they manage to increase the last instead of the first component in the hierarchy (contrary to the MBA's interpretation in the opening examples). Second, managers may want to assess how much their financial performance would increase by using the correct HoE framework. We compare the sales lift from increasing advertising spending by one standard deviation depending on the three HoE frameworks. We show that quantifying the sales lift with the Integrated HoE framework leads to 4.3% and 6.8% higher sales lift than with the Simultaneous and the Classical frameworks, respectively. Third, we compare the in-sample and the out-of-sample predictions of the models. The Integrated model is superior by 2.6 percentage points (vs. V&A) and 4.1 percentage points (vs. Classical) in MAPE improvement.

6. Conclusion

The death of the HoE models is greatly exaggerated. V&A concluded that there is little support for any hierarchy in the sense of temporal sequence. They proposed instead a three-dimensional space defined by the dimensions of Cognition, Affect, and Experience. Now, with the data sets at our disposal, we could test this framework against alternatives. The V&A model is dominated by other models (which are hierarchical) for all studied brands.

While the notion of HoE is clearly supported by the data, the sequence varies across brands. This variation is not driven by involvement and hedonic nature. The default sequence in our data set is A→C→E, but other sequences are also observed. We show that determining the exact sequence can make a real difference for a brand manager's decision-making.

In conclusion, while our research demonstrates that the notion of HoE remains fully relevant as a framework to guide advertising decision-making, its operationalization is more challenging than previously thought or taught as reflected in the training of the three brand managers in the paper introduction. There are complex interactions between the metrics and the operating hierarchy needs to be determined empirically for the brand of interest.

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