'Mind Mining': Better Customer Understanding by Applying Big Data Analysis to Neuromarketing

Article · February 2016

CITATIONS
3

READS
3,789

2 authors:

Steffen Schmidt
Leibniz Universität Hannover
65 PUBLICATIONS **529** CITATIONS
SEE PROFILE

Philipp Reiter
eye square GmbH
11 PUBLICATIONS **21** CITATIONS
SEE PROFILE

'Mind Mining':

Better Customer Understanding by Applying Big Data Analysis to Neuromarketing

By Steffen Schmidt, Philipp Reiter

The added value of advanced data mining techniques is their ability to identify hidden structures (unknown relations) in large bodies of data. In contrast, the measurement of hidden signals from the mind and body in order to illuminate the customer's conscious and unconscious thinking is the expected benefit of applying neuromarketing tools. In the present article, a fruitful cooperation for a better customer understanding is suggested by applying data mining techniques to neuromarketing data. The result might be called something new ... "mind mining."

In a recent article in the Neuromarketing Theory & Practice, Carla Nagel raised the highly interesting question about "competing or completing for better consumer understanding" (Nagel 2015, p.24) regarding neuromarketing and big data, both commonly considered as "the next big thing" in marketing. Beyond the buzz, both fields can provide valuable insights for marketers about customer choices and behavior. In detail, big data applications and neuromarketing tools have in common the generation, collection, and analysis of large amounts of data, but more importantly, they share a need to extract potentially useful information for supporting management decision-making. However, that is the bottleneck in both of these emerging fields. It is easy to store and receive tons of data from various sources, or to apply innovative neuromarketing methodologies such as facial coding and implicit response measures. By all means, those techniques are becoming more common business practices every day. In addition, the development of new hardware and software has helped to increase the acceptance and utilization of both fields. However, it takes more than simply collecting data (e.g., number of tweets per hour) and easy information extraction (e.g., level of joy when a key visual is perceived) to create any competitive advantage. Indeed, it is much more difficult to turn knowledge into actionable insights for business decision- making than it is to acquire and crunch it.

Given the unimaginable amount of rich, unstructured, and unrelated data available today from unlimited and heterogeneous sources, what is needed is an efficient search method for detecting patterns and extracting insights from that mountain of data. Conventional analysis methods such as widely-used correlation or linear regression techniques are stretched to their limits fairly quickly by the demands of both big data and neuromarketing data. Heftier data mining tools, such as neural network analytics, are needed to process all the retrieved data and uncover hidden patterns of knowledge. That is the pitch point for a fruitful cooperation between big data and neuromarketing: apply data mining techniques from big data to neuromarketing data in order to achieve effective "mind mining" as illustrated in Figure 1.

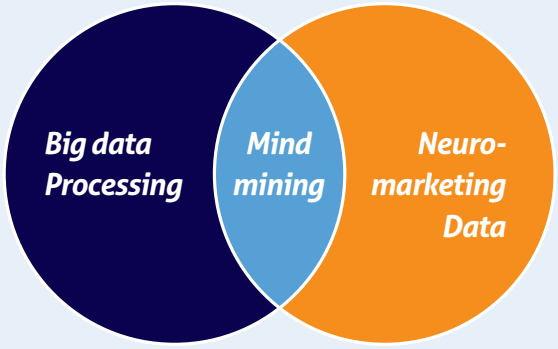

***Figure 1:** Pitch point between big data and neuromarketing*

Data mining techniques for uncovering hidden structures in huge datasets

Companies are collecting more and more data every day, often just because they can, even though they may not know how, why or when to use it to improve their business outcomes. Ordinary and isolated data "silos" will not automatically support decision making. Instead, data need to be converted into meaningful knowledge to reveal valuable insights for evidence-based management, in particular the identification of consistent patterns and relationships between variables. Therefore, the challenge is not so much to get the data, but more to analyze the (right) data for knowledge discoveries to support real-time and future actions.

In this respect, using predictive analytics based on data mining techniques is receiving increasing popularity. A famous example of predictive data mining is Barak Obama's election campaign of 2012 (Issenberg, 2012). Obama's analytics team identified the interests of individual voters and predicted which voters would be positively influenced by various campaign touchpoints such as door knock, social media or TV ad. Specifically, the Obama campaign found the greatest value of advanced data mining techniques to be in their ability to identify hidden structures and unknown relations, which would be beyond the capacity of any one human mind to comprehend, or even recognize.

Data mining techniques are not limited by the restrictions of conventional (multivariate) analysis methods. They can reveal complex, nonlinear and dynamic relationships - such as those found in living systems - in a practical way. The history of the last 25 years – from the birth of the World Wide Web to the thoroughgoing digitalization and automation of virtually every domain of daily life –has paved the way to the current era of big data. Today, the role of the data scientist may very well be "the sexiest job of the 21st century" as recently proclaimed in the Harvard Business Review by Davenport & Patil (2012).

Neuromarketing tools for uncovering hidden structures in the mind

As an applied science, neuromarketing uses tools from brain research, cognitive neuroscience, neuropsychology, and social psychology, and other emerging disciplines. The motivation behind using tools such as electroencephalography (EEG), electrodermal activity (EDA), or latency-based measures (e.g. implicit association test) is to resolve marketing issues, especially with regard to the classic "four Ps" of marketing – Product, Price, Promotion and Place. Among all these source disciplines, neuroscience has provided considerable insights for marketing science and business practice by exploring human decision-making from a consumer research perspective, e.g. the winner-take-all / first choice brand effect indicating customer's favor for a brand or product by a reduced activation in brain areas related to working memory and reasoning, and an increased activity of areas associated with emotion processing and self-reflections (Deppe et al., 2005). It is not surprising that expectations for neuromarketing have been raised in the recent past with the promise of tapping into customers' "black box" of unconscious and automatic, so-called implicit processes (Ariely & Berns, 2010). Marketers have expressed great hope that neuroscience-based techniques can reveal knowledge about consumer preferences that are unobtainable through conventional methods such as focus groups, interviews, or self-reports. The measurement of that hidden information in order to illuminate the customer's mind is the expected benefit of applying neuromarketing tools.

A use case: applying artificial neural networks to uncover hidden patterns in implicit and explicit user experience data

In order to assess how an integrative analysis approach might work, a case study was conducted that examined people's implicit and explicit user experiences (UX) while they interacted with a smartphone interface. While participants engaged in various tasks (e.g. writing a text message, installing an app), two implicit responses were recorded – task-related average cognitive workload (using EEG) and average arousal (using EDA). Also collected were participants' explicit ratings of two aspects of the UX, task-related usefulness and ease of use (both self-reported on a 5-point Likert scale). In addition, task outcome (fail or success), task satisfaction (on a 5-point Likert scale) and product recommendation (11-point semantic differential) were captured as UX key performance indicators (see Figure 2).

» Page 12

» continued reading from page 11

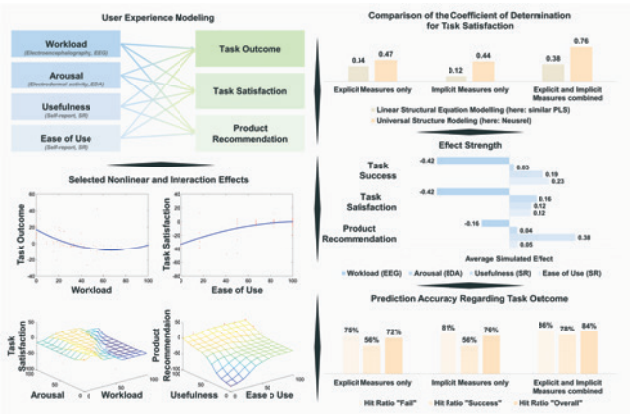

***Figure 2:** Conceptual modeling and selected study results*

Nineteen subjects participated in the lab study. Each subject performed five UX tasks. Thus, 95 UX cases were included in the final dataset. A Universal Structure Modeling (USM) analysis was applied to the dataset using the statistical software package NEUSREL (Neusrel, 2015). USM uses a Bayesian neural network approach to test structural equation models (SEM). This data mining technique is able to quantify and visualize nonlinear and interactive effects among model constructs. USM represents a more exploratory approach to finding and testing hidden model structures, in contrast to more conventional SEM approaches (such as LISREL or Partial Least Squares) that can only estimate models with hypothesized paths pre-specified (Buckler & Hennig-Thurau, 2008).

Selected results are presented in Figure 2. With regard to the coefficient of determination (R-squared value) results, the integrated approach (incorporating both implicit and explicit measures) and the USM approach performed best for predicting the dependent variable 'task satisfaction.' Indeed, the R-squared value is roughly twice as high as that for the conventional UX assessment (including explicit measures only) and the analytic approach (using modest linear structural equation modeling) – two approaches still often applied in contemporary marketing research.

The superior performance by the integrative measurement approach appears to be based largely on the detection of nonlinearity and interaction effects (cf. Figure 2). However, the impact of the key performance drivers (KDIs) varies depending on the chosen KPIs. With regard to task success and task satisfaction, results indicate highest effect strength (here: average simulated effect, ASE) by cognitive workload. In accordance to the research in the field of human-computer interaction, the impact of workload is negative, meaning high workload increases the chances of errors (failed task outcomes) and decreases the perceived satisfaction (since subjects feel frustrated).

For product recommendations, the explicit measurement of usefulness shows highest influence. The higher the perceived usefulness, the higher the rated intention to recommend the product. Finally, the USM prediction accuracy regarding the estimated task outcome is highest when integrated implicit and explicit measures are used. This is especially true when estimating a succeeded task outcome. Taken together, these results demonstrate that performance can most accurately be predicted using an integrated, implicit-explicit analysis approach.

Predictive Mind Mining Analysis: What belongs together comes together

Returning to Carla Nagel's question at the beginning of this article about the competing or complementary relationship between big data and neuromarketing, we see in this case that integrating the best elements of both approaches provides the greatest potential enhancing customer understanding and improving marketing business results. Applying sophisticated tools from neuromarketing for data collection in cooperation with advanced data mining techniques from big data for data analysis enables an efficient knowledge and decision-support platform for optimizing future management actions. In conclusion, one could state in reference to the HBR quote, "Predictive Mind Mining Analysis" is the hottest job in marketing."

Dr. Steffen Schmidt is Assistant Professor at the Institute of Marketing and Management, Leibniz University of Hannover. Phillipp Reiter is partner and COO of Eye Square

References

Ariely, D., Berns, G.S. (2010): Neuromarketing: the hope and hype of neuroimaging business. Nature Reviews Neuroscience, 11(4), 284–292.
Buckler, F., Hennig-Thurau, T. (2008). Identifying Hidden Structures in Marketing's Structural Models Through Universal Structure Modeling: An Explorative Bayesian Neural Network Complement to LISREL and PLS. Marketing - Journal of Research and Management, 4(2), 47–66.
Davenport, T.H., Patil, D.J. (2012). Data Scientist: The Sexiest Job of the 21st Century. Harvard Business Review, October 2012, 70–76.
Deppe, M., Schwindt, W./Kugel, H., Plassmann, H., Kenning. P. (2005. Nonlinear responses within the medial prefrontal cortex reveal when specific implicit information influences economic decision making. Journal of Neuroimaging, 15(2), 171–182.
Issenberg, S. (2012). How President Obama's campaign used big data to rally individual voters. MIT Technology Review, www.technologyreview.com/featuredstory/509026/how-obamas-team-used-big-data-to-rally-voters. Accessed 2015/12/11.
Nagel, C. (2015). The Battle: Big Data vs. Neuromarketing. Competing or complementing for better consumer understanding? Neuromarketing Theory & Practice, 13, August 2015, 24–26.
Neusrel (2015). Neusrel Analytic Software. www.neusrel.com/causal-analytics. Accessed 2015/12/07.