

The symbiosis of big data and behavioral insights – applications and ethical considerations

Abstract:

Since the US-presidency elections of 2016 and the surprising victory of Donald Trump a sudden public interest in “big data” was sparked, since it is suspected to be key in his success. More precisely it was the combination of “big data” and behavioral nudge approaches that was key to strategy of Donald Trump. This essay examines the powerful synergies of “big data” with behavioral economics on the basis of real life examples from politics and business. Moreover the practical limitations as well as ethical considerations will be discussed.

Introduction:

The election of US-president Donald Trump on November the 9th has once again sparked a public debate on big data. However the Donald Trump-campaign was not the first campaign that was largely supported by big data approaches, since it was actually the 2012 Barack Obama-campaign that used such an approach in the first place. A company called Cambridge Analytica quickly strut itself with the victory of Donald Trump. Company officials stated that their approach that combines behavioral insights, big data assessment and ad-targeting was pivotal in bringing about the victory of President Trump. In the German-speaking areas the article “Ich habe nur gezeigt dass es die Bombe gibt” (dasmagazin.ch, 2016) caused sensation on this topic, having been shared over 154,695 times on Facebook alone. On the one hand the article sparked interest on the numerous useful applications of big data, whereas on the other hand the article raised concerns on the ethical use of such approaches. Essentially the concerns are rooted in the allegation of using big data to manipulate people that apart from the big data component has always been a major critique against nudging. Moreover a more topical concern revolves around the limitations of big data and the insights that can be drawn from it – respectively the interpretations of these insights.

This essay aims to explore the synergies of behavioral economics (especially nudging approaches) and the emergence of big data through the rapid digital transformation of Western societies as well as the everyday lives of people. Furthermore this essay aims to address the limitations and ethical concerns that this development brings about.

Behavioral economics came about through the introduction of psychological insight into the field of mainstream neoclassical economics. Psychologists like Kahnemann and Tversky discovered through various psychological experiments that the neoclassical assumption of humans as rational decision makers is incomplete. In reality humans neither have access to perfect information, nor are they capable to process all information that they do have. The aim of behavioral economics was not the refutation of mainstream economics but to increase the explanatory power of economics by providing it with more realistic psychological foundations (Camerer & Loewenstein, 2004).

Central to behavioral economics is the belief that increasing the realism of the psychological foundations of economic analysis will advance the field of economics as a whole. Proponents are convinced that the introduction of behavioral insights into mainstream economics leads to better theoretical insights, allows for making more accurate predictions, and suggesting better policy (Camerer & Loewenstein, 2004). Nowadays many of the insights that were produced by behavioral economists are used by companies and public organizations alike. Marketers today use behavioral insights for commercial purposes, arguably manipulating consumers into buying things they don't really need. Public organizations and policy makers use behavioral insights to nudge people in making better decisions for themselves, thereby increasing the public good.

The rapid digitalization of society since the emergence of the internet has made it possible to gather large amounts of data. “Big Data” is obviously a buzzword that is used to describe the increased amounts of complex and unstructured data and the technologies that produce and gather these type of data. Much of what is referred to as “big data” is in fact behavioral data. These are the digital traces that human beings leave behind as they go about their daily activities using computers, smartphones and other digital devices. Some proponents believe that “big data” heralds the “end of theory”, as the sober collection of an exponentially increasing amount of data on human behavior through an increased amount of digital touchpoints makes models on human behavior increasingly obsolete. Google’s R&D department extends the famous saying by George Box, that “all models are wrong, but some are useful” (Wired, 2008) by saying that with increased amounts of data success can be achieved without relying on models at all. This idea is founded in the belief that not even the best models can describe human behavior realistically, but if human behavior is observed and measured close to perfection and analyzed with sophisticated computing power than the result will be much more accurate than any model could describe. In their aim to find ways to describe and predict human behavior more realistically, the proponents of “big data” resemble the behavioral economists. From my own experience as a former digital marketing professional “big data” and smart algorithms by themselves are rather useless unless human beings use them for better decision making. With regards to behavioral design approaches versus “big data”, the question is not which approach should be favored over the other, but how behavioral design and “big data” can be combined in a manner to achieve leverage. In “big data” applications the last-mile problem of actuating change of behavior tends to be left to the assessment of the model’s end user. On the contrary, behavioral nudge applications are often cut and dried affairs applied to entire populations rather than analytically identified sub-segments. It is legitimate to expect better results when both approaches are treated as integral and applied in tandem. Behavioral science principles should be part of the data scientist’s toolkit, and vice versa (Deloitte, 2015).

Applications:

As briefly mentioned in the introduction behavioral design applications that combine predictive analytics with behavioral nudge applications have been used for the presidential campaigns of both Donald Trump and Barack Obama. For the Trump campaign Cambridge Analytica composed a strategy that was built upon the psychological OCEAN-Model (Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism). The model postulates that every human character trait can be accurately explained by the aforementioned ‘Big Five’-factors (Goldberg, 1993). According to the model a human being can quite accurately described – his needs and fears and likely behaviors can be grasped. For the Trump campaigns this model was triangulated with “big data”-analytics and ad-targeting.

The aim of this strategy consisted in the identification of voters that had a high probability to be persuaded into voting for Trump. It would have been a waste of resources to have targeted individuals that are either committed Trump voters or dedicated Hillary Clinton supporters. Essentially the core of the strategy was to identify those voters most likely to change their behavior if visited by a campaign worker. One promising indicator for a prospect Trump-voter was for example the interest in US-produced cars. Moreover Trump’s campaign workers were equipped with an app that made it possible to uncover the political attitudes and character traits of prospective voters. Consequently, the campaign workers would have only visited people that were susceptible to the messages of Trump. Based on this information, the campaign workers have used tailored interview guides for each personality type. Afterwards the responses were put back into the app and used for refining the algorithms. Additionally the digital advertising was

personalized to various voter types, optimizing many variables from message, to images, to colors among other factors to yield best possible results.

Somewhat counter-intuitively, the many contradictions with the speeches of Donald Trump resulted in a vast pool of components out of which very versatile messages could be crafted that fit with a wide array of voter identities.

During the Obama 2012 campaign very similar approaches that combine nudge tactics and big data were used. Predictive behavioral approaches were used to identify undecided prospects with a high likelihood of responsiveness. For example the consistency principle was used by letting prospective voters to fill in commitment cards with a picture of Barack Obama on them. They were also asked to write up a small plan how they would go on about voting for Barack Obama, also dedicating themselves to a specific time for when they would vote. The so-called consistency principle is in line with psychological research that people tend to behave consistent to their past behaviors and commitments (Cialdini, 2013). Furthermore campaign workers used the concept of social proof, by informing prospective voters that most people in their peer group also committed to vote for Barack Obama.

Both the Trump and the Obama campaigns demonstrate how a combination of “big data” analytics and behavioral nudge tactics suggest how powerful such approaches can be. Just as behavioral science can help overcome the last-mile issue of “big data”-approaches, perhaps “big data”-approaches can help with the last-mile issue of behavioral economics - In certain contexts, useful nudges can manifest as digital data products (Deloitte, 2015).

Especially the so-called internet-of-things offers many possibilities to combine “big data” approaches with behavioral nudge tactics. Self-tracking-devices like Jawbone-Up make use of peer effects to nudge people into doing more sport, e.g. by communicating to the users that their friends are doing more sport than them. Data on energy consumption of people can be used to nudge people into saving more energy. The effect of social proof could be used to tell the individual person that they consume more energy than their neighbors. The UK insurance company ingenie uses black-box data in order to calculate risk scores, thereby making use of the peer effects to inform drivers via app on the riskiness of their driving behavior. Incentive structures that reward safe driving by lowered insurance premiums nudge drivers into driving more safely.

Limitations and ethical considerations:

Thaler & Sunstein (2008) refer to these type of approaches as choice architecture. The idea behind such approaches consists into designing policies and programs that consider the mechanisms of human psychology. These approaches are not believed to restrict choices, since options are arranged and presented in ways that help people make daily choices that are in line with their long-term goals. Contrasting hard incentive structures of classical approaches, behavioral nudges are soft techniques for prompting a desired change of behavior (Thaler & Sunstein, 2008).

The considerations towards nudge approaches are closely related to the surface discussions of “big data”. It has already been established that the majority of so-called “big data” is in fact behavioral data. This type of data is controversial for reasons not only limited to basic privacy concerns. Behavioral data that is gathered in one context can be repurposed for use in other contexts where inferences on preferences, psychological traits and attitudes are done with such precision that it can be unsettling for many, invoking fears of an Orwellian society.

Cambridge Analytics claim that based on Facebook „likes“, they can accurately predict whether a man is homosexual or not. Also secret services and public authorities use such methods to identify potential Islamic terrorists. The problem with such approaches consist that they tend to neglect the base rates for individual traits or behaviors (Kahneman, 2011)

Let's use terrorism as an example:

For the sake of Bayesian calculation let us assume that 20 out of 100.000 persons are terrorists. Consequently there is a probability of anyone being a terrorist $P(K) = 0,0002$. The probability that a person is not a terrorist is henceforth $P(K^c) = 0,9998$. Assuming that there is an algorithm that predicts a person to be a terrorist with 95% accuracy [$P(T | K) = 0,95$]. However let us assume that the algorithm predicts someone falsely to be a terrorist at a probability of 1% [$P(T | K^c) = 0,01$]. It follows that [$1 - P(T | K^c) = 1 - 0,01 = 0,99$].

If we add the numbers into the Bayes formula, we get the following results:

$$P(K | T) = \frac{P(T | K)P(K)}{P(T | K)P(K) + P(T | K^c)P(K^c)} = \frac{0,95 \cdot 0,0002}{0,95 \cdot 0,0002 + 0,01 \cdot 0,9998} \approx 0,0186.$$

Consequently, out of 100.000 individuals only 20 are actually terrorists. It follows that out of 1.019 marked individuals only 19 are actually terrorists.

The implications of that can be dire. For the calculation example it follows that in such a case 1.000 out of 100.000 individuals would be falsely considered to be terrorists, with all the potential legal procedures and consequences. There is a danger that in certain cases such an approach could be performative (Mackenzie, 2006). In the case of Mohammed Emwazi, the infamous ISIS executioner known as “Jihadi John”, sources claim that he became a terrorist because he was often harassed by MI5 because he was believed to be a potential terrorist (The Guardian, 2015). Even though this is impossible to prove, it is a terrible thought that this type of profiling could become a self-fulfilling prophecy.

Another point to consider is the incompleteness of data measurement. In 2014 a 27 year old man was killed in Düsseldorf by speeding with car operated by the car sharing company DriveNow (bild, 2014). During that time I remembered that the pay-structure of DriveNow incentivizes people to speed as users are charged by time and not by distance travelled. Consequently it appears to be rational to speed as one would want to save up money. DriveNow also gathers data for commercial use, including GPS-data of driving behavior and the personal details of its clients. If it were the case that DriveNow would sell their data to an insurance company and hypothetically assuming the information on their payment-structure would not be transferred than the assumptions the insurance based on the driving data would be flawed. This is just a hypothetical example on how confidence in a complex system can be dangerous as small flaws (i.a. the absence of a vital information) can lead to great vulnerabilities.

Additionally, there are people that reject the idea of using psychology to nudge people's behavior under the premise that it is manipulative or a form of social engineering (Deloitte, 2015).

Certainly these concerns are real and must be taken seriously. Furthermore, it should be noted that both behavioral data and behavioral nudge science are approaches that can be used in either socially useful or socially useless ways. There is no clear distinction that separates the useful personalization from the creepy, or the inspired use of behavioral design from hubristic social engineering (Deloitte, 2015). Principles of social responsibility are henceforth not only part of

public and regulatory debate but core to the process of planning both “big data” approaches as well as behavioral science.

Finally, there is the problem on who defines what is socially useful or not – respectively another problem consists in who actually does the evaluation of what is “good” and what is “evil”. Not only societal values can change over time but also the very regimes. Moreover if companies, government or secret services amass large quantities of personal and behavioral data they will also amass increasing power over the population. As it can be witnessed as of 2017 there have been right-wing parties on the rise in the Western world. Consequently such powers can fall into the hands of undemocratic regimes, possibly leading to very dangerous consequences.

Conclusion:

Undoubtedly behavioral design enriched with the capabilities of “big data” analytics offers a wide range of applications to improve decision making. Nevertheless the technological limitations of such approaches must be considered as an exaggerated euphoria tends to cloak the downsides and weaknesses of such approaches. This essay has demonstrated that especially the increased complexity of such approaches, while creating a sense of perfect knowledge, are actually highly vulnerable due to false interpretations by humans. Moreover the general problem of induction also applies to “big data”-based approaches as there is always a risk to miss a crucial variable that would falsify the eloquent approach. As it is the case with predictive systems that are used in financial markets to predict e.g. option prices, also “big data”-approaches cannot accurately predict future behaviors. On the bottom line such approaches are based on very sophisticated heuristics that essentially were defined by limited human beings (Taleb, 2007).

The ethical implications for such approaches should be regarded separately. The behavioral component is often criticized for manipulating the free will of those targeted by the nudge tactics. Even though the core principle of nudging is based on the premise that people should be influenced to make better decisions for themselves it can be questioned whether there are objective standards for ‘better’ or ‘worse’. This is of course a philosophical question, where there is no clear answer to. Thaler & Sunstein (2008) would argue that choice architecture does not actually manipulate people but gives them crucial information through which they are more inclined to make better decisions for themselves. This is of course a perspective that accepts the existence of objective morality (Peter, 2015). Considering the ethical implications with “big data” there is obviously the issue with the ownership of data which is foremost a privacy concern. Also the process of gathering increased amounts of data on individuals can invoke Orwellian fears. In my opinion the major ethical concern with “big data” approaches has to do with the overconfidence bias in the idea that “big data” reveals the unquestionable truth about a situation. In reality “big data” approaches are dependent on human design and interpretation which is prone to mistake. Besides the neglect of Bayesian rules, the division of labor can lead to fallacies, i.a. the data scientists may have good understanding of the limitations that a practitioner such as a policy maker or an agent might not be aware of (Taleb, 2007). That is why an open discussion and education on “big data” and behavioral approaches is important to minimize the risk of misuse and misunderstandings.

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Articles:

Bild.de (2014), "DriveNow-Crash - Fahrer tot"
<http://www.bild.de/regional/duesseldorf/medienhafen/horror-crash-35464742.bild.html>
(accessed, 06.03.2017)

Dasmagazin.ch (2016), "Ich habe nur gezeigt, dass es die Bombe gibt"
<https://www.dasmagazin.ch/2016/12/03/ich-habe-nur-gezeigt-dass-es-die-bombe-gibt/>
(accessed, 06.03.2017)

Deloitte (2015), Deloitte Review Issue 16, „The last-mile problem: How data science and behavioral science can work together“, <https://dupress.deloitte.com/dup-us-en/deloitte-review/issue-16/behavioral-economics-predictive-analytics.html> (accessed, 06.03.2017)

The Guardian (2015), "Cage: the campaigners put in the spotlight by Mohammed Emwazi"
<https://www.theguardian.com/world/2015/feb/26/cage-campaigners-put-under-spotlight-mohammed-emwazi-jihadi-john> (accessed, 06.03.2017)

Wired.com (2008), "The End of Theory: The Data Deluge Makes the Scientific Method Obsolete" <https://www.wired.com/2008/06/pb-theory/> (accessed, 06.03.2017)

Books:

Camerer, C.F. & Loewenstein, G. (2004). Behavioral Economics: Past, Present, Future
Sage Publishing, New York, NY.

Kahneman, D. (2011). Thinking, fast and slow. *Farrar, Straus and Giroux*. New York, NY.

Taleb, N.N. (2007). The Black Swan. The Impact of the Highly Improbable. Random House, Inc.
New York, NY.

Thaler, R.H. & Sunstein, C.R. (2008). Nudge – Improving Decisions About Health, Wealth, and Happiness. *Yale University Press*. New Haven & London

Journals:

Goldberg, L. R. (1993). "The structure of phenotypic personality traits". *American Psychologist*. **48** (1): 26–34.

Mackenzie, D. (2006). Is Economics Performative? Option Theory and the Construction of Derivatives Markets. *Journal of the History of Economic Thought*. Volume 28 / Issue 01 / March 2006, pp 29 – 55

Peter, F. (2015). From Objective Reason to Public Reason. *Unpublished*. Department of Philosophy, University of Warwick (March, 2015).