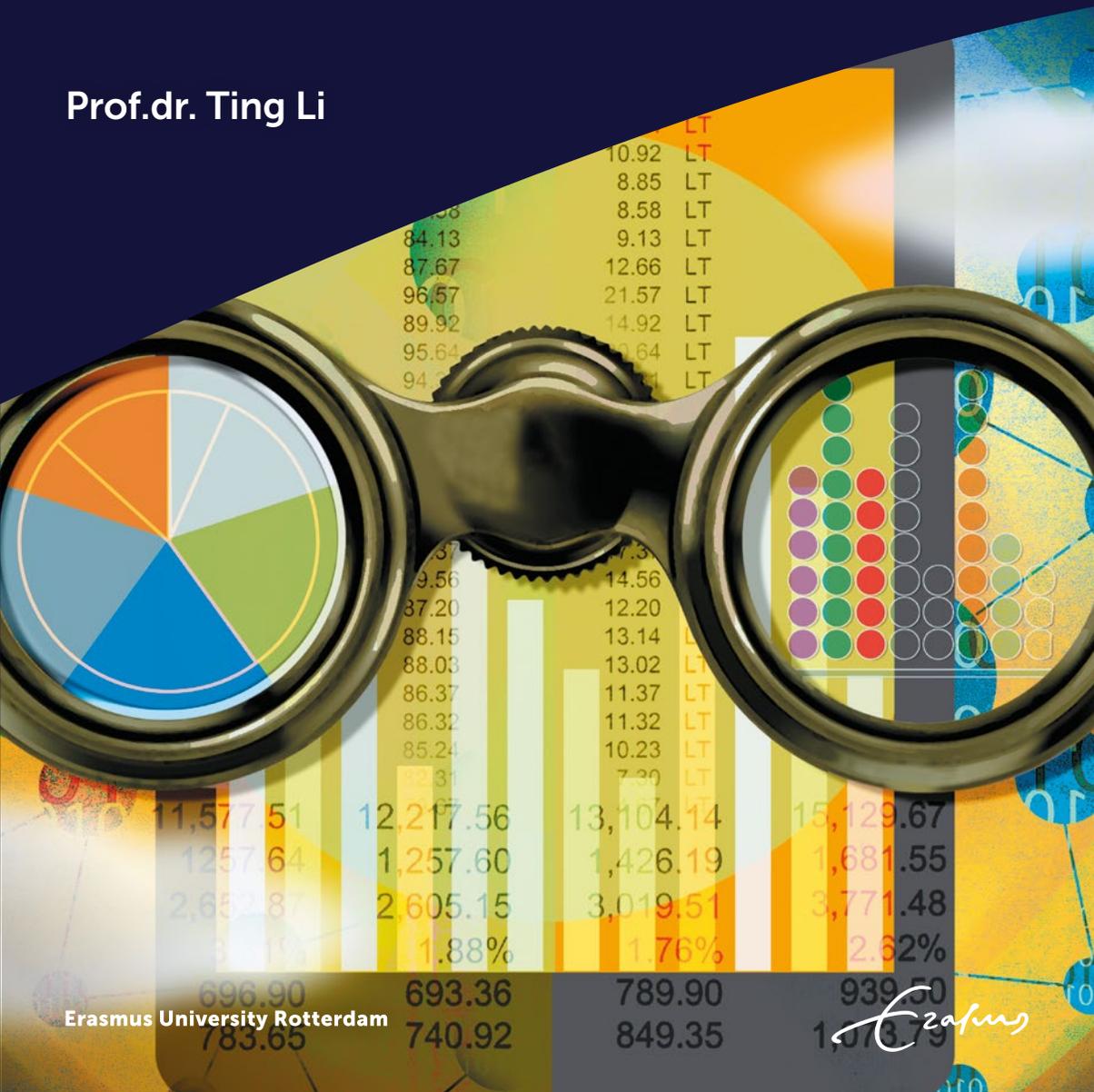


Digital Traces: Personalization and Privacy

Prof.dr. Ting Li



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Digital Traces: Personalization and Privacy

Prof.dr. Ting Li

Address delivered at the occasion of accepting the appointment as
Endowed Professor of Digital Business on behalf of the Erasmus Trustfonds,
Erasmus University Rotterdam, at the Rotterdam School of Management,
Erasmus University Rotterdam on Wednesday 20 June 2018.

Rotterdam School of Management
Erasmus University Rotterdam
P.O. Box 1738
3000 DR Rotterdam
E-mail: tli@rsm.nl
<https://www.rsm.nl/people/ting-li/>

Digital Traces: Personalization and Privacy

Abstract

Our daily use of the web, social media, smart phones, and sensor technologies is creating a digital trail of data from which one can formulate a trace of our movements, interactions, and even emotions in both offline and online environments. Such large-scale and fine-grained digital traces of individual behavior can be highly informative in examining not only what people say and what people do, but also what they are planning to do through their own behavior or the behavior of the people who they interact with. The insights gained from such digitized behavioral traces can facilitate business transformations in various domains, such as operations, marketing, finance, healthcare, and urban transportation.

Businesses increasingly tap into this rich information to uncover the preferences that influence an individual's real-time decision making and provide personalized interactions. However, businesses often find themselves walking a thin line between delivering personalized services to consumers and being intrusive, which increases consumers' privacy concerns. In this talk, I will first explain how we could improve our behavioral insights from exploring digital traces, using offline trajectories and online social interactions. I will then emphasize the increasingly important and intertwined topics: personalization and privacy, which I will illustrate using my own research. I will further discuss personalization-privacy-paradox related challenges to customer behavior, business strategy, public policy, system design, and society at large.

Samenvatting

Ons dagelijks gebruik van het web, sociale media, smartphones en sensortechnologieën creëert een digitaal spoor van gegevens. Hierbij kan men in offline en online omgevingen onze bewegingen, interacties en zelfs emoties herleiden. Deze grootschalige, gedetailleerde digitale sporen van individueel gedrag kunnen niet alleen veel vertellen over wat mensen zeggen en doen, maar geven ook inzicht in wat mensen van plan zijn te doen. De inzichten uit dergelijke gedigitaliseerde gedragssporen kunnen bedrijfstransformaties in verschillende domeinen zoals operations, marketing, financiën, gezondheidszorg en stadsvervoer faciliteren.

Bedrijven maken steeds vaker gebruik van deze rijke bron aan informatie om de voorkeuren te ontdekken die de real-time besluitvorming van een individueel beïnvloeden, om zo gepersonaliseerde services aan te bieden. Er is echter een subtiele grens voor bedrijven tussen het leveren van gepersonaliseerde services aan consumenten en het te opdringerig worden, wat kan resulteren toenemende zorgen over de privacy van consumenten. Tijdens deze lezing leg ik eerst uit hoe we onze gedragsinzichten kunnen verbeteren door digitale sporen te onderzoeken en tevens gebruik te maken van offline-trajecten en online sociale interacties. Daarna zal ik de nadruk leggen op twee onderzoeksthema's die steeds belangrijker en meer verstrengeld met elkaar worden: personalisatie en privacy. Deze thema's worden geïllustreerd met behulp van mijn eigen onderzoek. Ik zal verder deze personalisatie-privacy paradox bespreken en de daarmee gerelateerde uitdagingen op het gebied van klantgedrag, bedrijfsstrategie, openbaar beleid, systeemontwerp en de samenleving als geheel.

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1. Introduction

**Dear Rector Magnificus of the Erasmus University,
Dear Board members of the Vereniging Trustfonds,
Dear Dean of Rotterdam School of Management,
Dear family, friends, colleagues, and students,
Dear distinguished guests,**

It is an honor and a privilege to accept the appointment of Endowed Professor of Digital Business at Erasmus University by means of this inaugural address, entitled “Digital Traces: Personalization and Privacy.”

“Alexa, what’s the weather today?” Bryan, my seven-year old son, loves his interaction with this new lady in the house and actually would turn to her, instead of me, for such a question first thing in the morning. It has been three years since Amazon debuted Echo, a speaker that came with a talking digital assistant named Alexa, which you can ask to call an Uber, order a pizza, play a song, read your Kindle book, or play a Pokémon game. One day, Bryan came over and asked me, “Mom, how does Alexa know so much?” I thought about it for a second and said what a typical professor would say in responding to a student’s question: “That’s a very good question, Bryan! I think we have told her a lot about ourselves and she is smart and can remember and link everything.” It’s not only Amazon; Google’s Home and Apple’s HomePod all offer digital home assistants that we hire to provide us better services and convenience in exchange for our privacy.

In theory, Alexa streams audio to the cloud, but not all the time - only when we interact. Then Amazon processes and retains our Alexa interactions, such as our voice inputs, music playlists, and our to-do and shopping lists. Some Google Home units were found to be recording conversations all the time, not just when users were interacting with it (Burke 2017). In the summer of 2017, a hacker showed that an Amazon Echo could effectively be turned into a wiretap (Greenberg 2017). This does lead to concerns about our privacy. It could be such fears are overblown, but cases like this make you wonder.

In this talk, I will first explain how we could improve our understanding of customers and companies by exploring digital traces. Then I will emphasize two major research themes that have become increasingly important and intertwined in the presence of these digital traces: **personalization** and **privacy**. Last, I will discuss some challenges to business strategy, customer behavior, system design, public policy, and society at large.

2. Digital Traces

The web, social media, smart phones, and sensor technologies today allow us to examine not only 'what people say' (e.g., social media, word-of-mouth, online user-generated content), but also 'what people do' in both offline (e.g., physical movement trajectory, mobile health, internet-of-things) and online environments (e.g., search, click stream, purchase). It becomes increasingly important to explore how such large-scale and fine-grained digital traces of individual behavior can help us understand individual decision making and interactions across different platforms and devices, and how the knowledge gained from such digitized behavioral traces can help facilitate business transformations in various domains, such as operations, marketing, finance, healthcare, and urban transportation. Let me demonstrate how we get important insights from individual digital traces from offline and social environments, using two research projects as examples.

2.1 Digital Traces of Offline Trajectory

At the beginning of my academic career, I devoted a number of years to working on smart card (OV-chipkaart) adoptions in the public transportation industry in the Netherlands – a 'smart cities' project we might call it today. People's use of smart cards is creating a digital tail of data from which transport service providers can formulate a trajectory of their physical movements in transportation networks (see Figure 1). The result is that service providers are much better informed. Smart cards allows them to collect new information that they didn't have access to, or was expensive to gather, in the past, including the locations to and from which people travel, what times they travel, how frequently they travel, which mode of transportation they use, and how much they pay. This improved information availability has given service providers ample opportunities to gather, analyze and act on actual behavior in far more detail and precision than previously possible. Individuals are also better informed and with mobile devices they can receive real-time information regarding service disruptions, timetable changes, and levels of crowdedness.

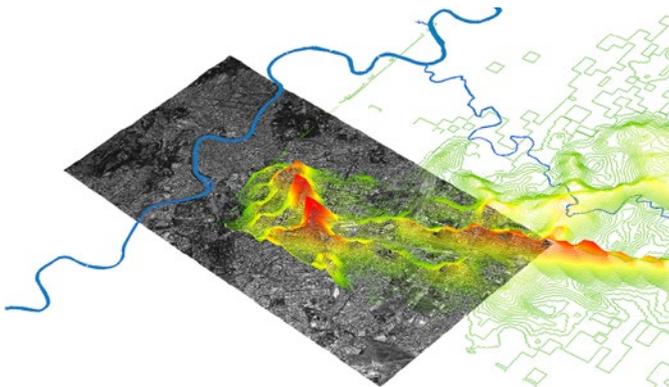


Figure 1. People's use of smart cards is creating a digital tail of data

Together with academic colleagues and industry partners, I investigated the conditions under which service providers can adopt smart ticketing technologies to improve information capabilities for value creation (Li et al. 2009). In addition, I also developed a model-based decision support approach for designing new pricing and revenue management strategies. See Table 1. This is made possible because the improved level of information permits service providers to be more innovative with new travel service offerings, while supporting improved operations and creating higher revenues (Li et al. 2014). Using smart card data and data from field experiments, I further developed an agent-based simulation to help service providers better manage complex transportation networks that satisfy operational and customer requirements (Lovric et al. 2013; Li and Kauffman 2012).

Characteristics	Traditional approach	New approach
Focus	Products and requests	Services and consumers
Collecting data	Traditional survey method is mainly used to collect product-level data.	Emerging technologies support the collection of micro-level consumer behavior data. For example: online clickstream data, smart card data, mobile transaction data, email data, and Google search trend data.
Modeling consumer demand	Independent demand models are used where demand is modeled as a series of requests for a product or service. It is independent from other alternatives and market environment.	Consumer behavior and decisions are modeled to understand what influences consumer choices, how decisions are made, what consumer preferences are and how much they are willing to pay.
Integrating demand and supply	Firms are concerned with accepting or rejecting consumers' product requests.	Firms are concerned with creating alternative services to influence consumer choices and assess the effects of consumer reactions on service operations.
Evaluating service designs	Analytical methods are predominant. Sometimes simulation is used but generally in an aggregated level.	Analytical models are possible. Simulation is possible too at the disaggregated individual consumer level to model consumer behavior and interactions.

Table 1. A decision support approach for adaptive learning in service operations

2.2 Digital Traces on Social Platforms

Social media is a major communication tool within society and its widespread use has lasting impact on individuals and companies in various industries. Companies have engaged in social listening for quite some time now. Some of them have dedicated social media experts to listen to customers' conversations on Facebook, Twitter, Instagram, and Pinterest in order to capture customer sentiments, make product recommendations and improvements, or even come up with new service designs. Over the years, colleagues and I have worked on research studies to demonstrate the economic value of social media information; for example, using Facebook information to predict company performance, using Twitter information to forecast music album sales, and using Google trends to predict macro-economic indicators such as the Consumer Price Index (nowcasting). Lately, one particular research study related to the use of Twitter in making stock market predictions has received quite some media attention. In this research Jan van Dalen and I showed the value of stock related tweets in helping individual investors make better trading decisions (Li et al. 2018).

Twitter allows users to broadcast short messages with up to 140 characters, so-called 'tweets'. These messages capture the wisdom of the crowd in ways that are different from other social media and social networking platforms, because they provide a live conversation, in which the information is pushed to people in a timely manner; and tweets are unique in their ability to generate, share, and spread information virally. These distinguishing characteristics create a social contagion effect that drives the unparalleled speed of digital information diffusion (Aral and Walker 2011). Does Twitter really have the power to swing the stock market? Here is a lively illustration of how strongly stock markets could react to Twitter messages in the modern day financial system. On April 23, 2013, the Twitter account of the Associated Press was hacked. Hackers sent a faked tweet saying that President Barack Obama had been injured after explosions in the White House. This fake tweet sent stock markets (Standard & Poor's 500 Index) down 1% in a matter of seconds, wiping out \$136 billion in value (Lee 2013). See Figure 2.

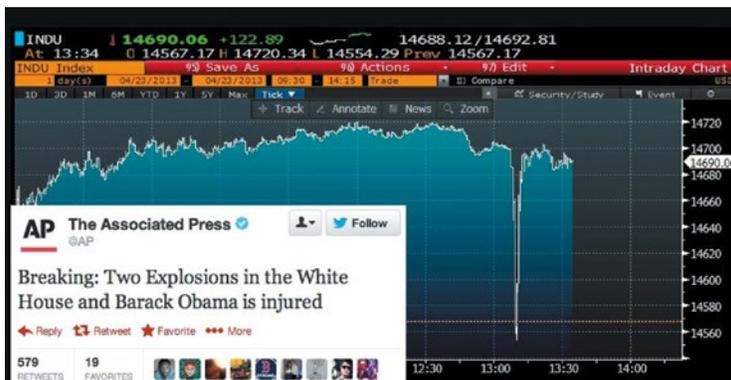


Figure 2. AP Twitter account hack tipped stock market by \$136 billion

In fact, Twitter's public timeline has turned into an extensive real-time information stream with many messages about public companies and trading ideas. The investor community has labeled Twitter 'a Bloomberg for the average guy.' As such, these stock microblogs in Twitter capture the market discussion. Our question is: if one could know all these conversations embedded in the digital traces people left on the Twitter platform, could an individual investor make better investment decisions and potentially 'beat' the market? Or perhaps not, based on the efficient market hypothesis, which suggests that stock prices at any time fully reflect all available information in an efficient market.

With such a question in mind, we gathered 21 weeks' worth of tweets – millions of tweets – about Standard & Poor's 100 companies. We examined the relationships between their information content using computational linguistics and stock market performance, as well as the role of social influence. More specifically, we investigated the relationships between Twitter message features (message bullishness, message volume, and message disagreement) and stock market performance (stock returns, trading volume, and volatility) both on a daily basis, and on a 15-minute basis. We also studied the possible mechanisms of the efficient information aggregation by studying the extent to which good investment advice receives greater attention. We found that message bullishness is indeed associated with daily abnormal returns. New information, reflected in the Twitter messages, is incorporated into market prices quickly. Users that provide above average investment advice are given a greater share of voice through higher levels of retweets, as well as larger influence. Notably, following expert users amplifies the relationship between message bullishness and abnormal returns. Further, we simulated a set of trading strategies based on our sentiment analysis and the results suggest that it is possible to exploit market inefficiencies even with the inclusion of fixed and variable transaction costs, though the existence of transaction costs challenges investors' opportunities to collect the gains.

Not surprisingly, nearly all journalists who called us were interested in the answer to the million-dollar question: "Can such a method help investors predict the movement of the Bitcoin or cryptocurrency value?" I'm not sure this is what our research implies, but what I am certain about is we should tap into these digital traces and harness the power to benefit customers, companies, and societies.

3. Personalization

Personalization is a popular and effective way in which companies provide customers relevant content and reduce their need to assess abundant information. Most of you are familiar with the product recommendations of Amazon, the personalized music recommendations of Spotify, and personalized movie recommendations of Netflix. These tech companies are putting major effort into improving the accuracy of their recommendation algorithms. For example Netflix had an open competition to improve their movie recommendation engine and offered a \$1 million prize to improve their algorithm by 10%. Amazon generates more than 30% of their revenue through behavioral recommendations.

Companies increasingly use customer information from a variety of sources, to infer their preferences and provide personalized interactions across different channels, including information obtained from click-stream data, bidding data, advertising campaign data, social media data, mobile usage data, search data, and sales data. Apart from personalized product recommendations, companies are also working hard to tailor their interactions with customers by addressing them with customized e-mail communications and targeted advertising messages based on customers behavioral information (Bleier and Eisenbeiss 2015; Wattal et al. 2012). Some companies develop business models that provide personalized products and service offerings and tailor individual pricing and referral policies for each customer. Let's look at three major areas where we see an increasing proliferation of personalization practices by businesses for enhanced customer experience and maximizing business opportunities.

3.1 Personalized Digital Advertising – Competing for Consumer Attention

Some of you may remember a scene in the film *Minority Report* where Tom Cruise enters a mall and sees holograms of personally targeted ads. This is no longer science fiction, but a reality that we experience on a daily basis. In the area of digital advertising for example, advertisers are competing for customer attention online by increasing ad relevance through personalization across different marketing channels. Advertising personalization refers to company-initiated adjustment of advertising content towards consumer preferences with the aim of increasing ad relevance (Arora et al., 2008). Companies can target you based on where you are, can retarget you through banner ads or search ads based on your past browsing behavior including what you have searched, the keywords you used, and the behavior of your friends. Companies know not only what you searched and bought in the past, but also what you may be looking to buy through either your own behavior or the behavior of the friends you interact with.

3.2 Personalized Mobile Targeting – Hyper-Contextual

Over the last few years, mobile internet, mobile apps, mobile advertising, and mobile commerce grew fast and drove rapid growth in the mobile economy, which includes 5G, the Internet of Things, smart cities and connected cars, and is expected to reach a value of \$1 trillion by 2020. There is an increasing interest in research and practice that

taps into the big data opportunity that specifically pertains to mobile generated data, which leverages the uniqueness of mobile data for targeting the right customer, with the right message, at the right location, at the right time, and on the right device. Companies are using information-based strategies (e.g., location-based services) to target consumers, including geo-fencing (i.e., sending mobile coupons to people within the virtual perimeter of a focal store), geo-conquesting (i.e., sending mobile coupons to people within the virtual perimeter of a competitor's store), Bluetooth-based beacons (i.e., sending deals to devices within venues), and hyper-contextual targeting (i.e., using environmental contexts such as weather and crowdedness) (Andrews et al. 2015; Bart et al. 2014; Fong et al. 2015; Ghose 2017; Li et al. 2015).

As consumers increasingly use multiple devices, would such information strategy vary across different devices? The answer is yes. As consumers' attention differs across mobiles, tablets and PCs, so does the information strategy. I have worked with companies and mobile advertising platforms to investigate how consumers evaluate information, search, and react to information strategies differently across different devices. I find consumers have different mindsets when they are exposed to information, depending on the device they use to access the information, the tasks they perform, the location they are in, and the time of day (Li et al. 2018). Figure 3 shows the relative importance of unique selling propositions (USP) and appeal for consumers across devices in this research.

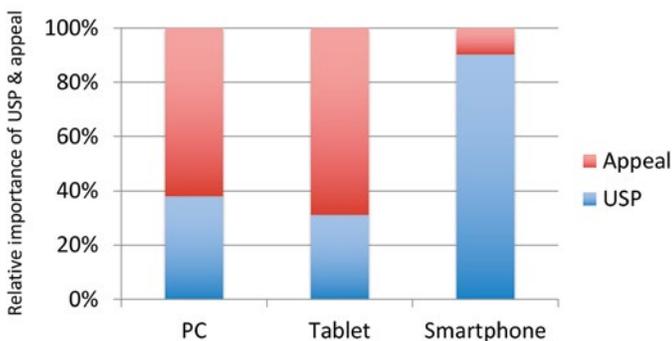


Figure 3. The relative importance of unique selling proposition and appeal across devices

When consumers are in a deliberative mindset, they evaluate information more cognitively; when consumers are in a leisure mindset, they evaluate information more affectively. In a recent study, Michelle Andrews, Francesco Balocco, and I found, through a large-scale ad campaign producing more than 70 million ad impressions, that mobile seems to be a very effective information acquisition device, whereas PC and tablet are used more as a conversion device. The findings suggest that when companies boost their search ad spend on mobile, it increases not only how much consumers search on mobile, but it stimulates search across devices. Clicks and conversions also rose across devices when spending on mobile search ads increased. These cross-device effects were stronger for high-funnel mobile keywords (Andrews et al. 2018).

3.3 Personalized Referral Program – Digital Platform Growth

From Uber to Alibaba to Airbnb, the spectacular growth of innovative platform-based companies abruptly changed their industries. With platforms, the fundamental rules of strategy change. Strategy shifts from controlling to orchestrating resources; from optimizing internal processes to facilitating external interactions; and from increasing customer value to maximizing the value of the ecosystem. Information technologies make “building and scaling up platforms vastly simpler and cheaper, allows nearly frictionless participation that strengthens network effects, and enhances the ability to capture, analyze, and exchange huge amounts of data that increase the platform’s value to all” (Parker et al. 2016).

Platforms are generally faced with the challenge of how best to attract and retain participants to achieve and maintain a critical mass and ultimately turn a profit. This cold-start problem is the main challenge in achieving and maintaining platform participation and growth. In a recent study, Rodrigo Belo and I worked with an exclusive online dating platform to study if a personalized referral program would help to stimulate network growth (Belo and Li 2018). Companies can amplify social contagion and accelerate product purchases by directly requesting members to invite their friends and acquaintances (Aral and Walker 2011). In this study, we examined the underlying processes, dynamics, and implications of personalized referral policies for individual behaviors and platform growth. We collected data from a large-scale randomized field experiment over three years, in which different referral policies were used to request existing users to invite referrals to join the platform. Our findings show that referral programs can work as a double-edged sword. On the one hand, asking users to invite more new users provides benefits in terms of increased number of successful referrals and total payment. On the other hand, these benefits appear to come at the cost of reduced level of user engagement. Furthermore, in collaboration with the platform, we developed a method for designing personalized referral policies that account for consumer heterogeneity to maximize consumer life-time value. We demonstrated in real-life how such personalized policies lead to considerable improvements in customer life-time value and company profit, when compared to randomly assigned policies.

4. The Personalization Privacy Paradox

The **personalization privacy paradox** refers to when personalization increases content relevance but simultaneously triggers privacy concerns as companies make use of consumers' information (Awad and Krishnan 2006; Li and Unger 2012; Sutanto et al. 2013). Let's look at the example of social retargeting, a very popular social advertising strategy. Imagine you just finished browsing for a new laptop on an online retailer's website, and then logged in to your Facebook account. On your Facebook newsfeed, you see the exact same laptop you saw a minute ago, personally targeted to you by the retailer. On the top of the targeted ad, it says "Your friends like this retailer!" along with their names and pictures, and perhaps even with a special offer (based on your age and interests).

While you may view targeted social ads as more relevant and appealing at first, particularly since they are placed alongside regular messages from your friends (e.g., Facebook newsfeed), targeted social advertising may intrude on people's privacy. Providing personalized services depends on the user's willingness to disclose personal information and on the website's ability to obtain and process this information. Disclosing personal information can expose individuals to multiple privacy risks, such as the risk that they would lose control over their private information or their information being shared inappropriately with parties that may harm them. Individuals face a trade-off between risks and benefits, and as such engage in a 'privacy calculus' when deciding whether or not to disclose private information. When perceived benefits exceed perceived risks, users are more likely to surrender personal information.

The failure to use personal information fairly or responsibly may raise two kinds of information privacy concerns. First, an individual's privacy may be invaded if unauthorized access is gained to personal information as a result of a security breach or an absence of appropriate internal controls. Second, because computerized information may be easily duplicated and shared, there is the risk of unauthorized secondary use of the data. That is, information provided for one purpose may be reused for unrelated purposes without the individual's knowledge or consent. Secondary use includes sharing personal information with others who were not a part of the original transaction, with or without commercial goal; or the merging of transaction and demographic data to create a computerized profile of an individual by the organization that originally collected the information (Bélanger and Crossler; Smith et al. 2011).

Serious concerns have arisen in the past months over how social media firms guard the privacy of their users' personal data, and how the analytics of such data can influence voter preferences and turnout. Cambridge Analytica, a data analytics company, had unauthorized access to more than 50 million Facebook profiles and micro-targeted voters to benefit Donald Trump in the 2016 U.S. presidential election. This scandal is a case of unauthorized secondary use, where organizations make deliberate choices

about reuse of their customers' personal information, which was done without customers' consent. That's why users consider disclosing personal information to be a risky choice, because they become vulnerable to a company's potential opportunistic behaviors.

Social network information can be very powerful in predicting. In a 2015 study, researchers found that just using Facebook likes, models can better predict personality than a work colleague through analyzing 10 likes, a friend with 70 likes, a family member through 150 likes, and a wife or husband using 300 likes. On average, a Facebook user has 227 likes on their social network profile (Youyou et al. 2015).

In a recent study, Thomas Frick and I investigated the effects of social retargeting, a combination of behavioral targeting and social targeting (Frick and Li 2018). Behavioral targeting readdresses consumers with personalized ads based on their external browsing information, whereas social targeting makes use of consumers' social connections. In this study, we conducted a large-scale randomized field experiment in collaboration with a major European e-retailer on Facebook's advertising platform. We randomly assigned 198,234 individual consumers to one of two types of ads with different levels of ad personalization: category-specific and product-specific ad personalization. The experimental conditions are shown in Figure 4.

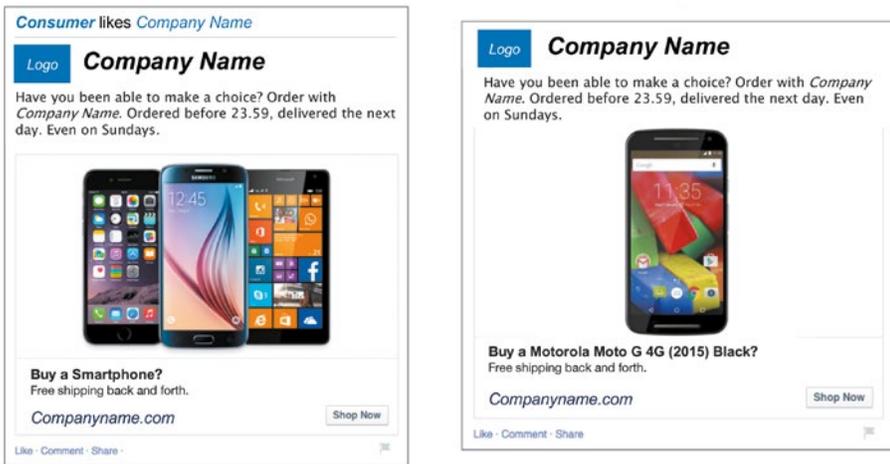


Figure 4. The experimental conditions in the social retargeting study

For personalization, we found that consumers respond more positively to product-specific than category-specific ads. For social targeting, surprisingly, we found that socially targeted consumers, who according to previous studies would respond more positively to ads (Tucker 2016), are in fact less likely to click on personalized ads and make a purchase. The findings challenge Facebook’s policy of not having the option to not include social endorsements for advertisers. Perhaps most interestingly, we found that social targeting decreases consumers’ click likelihood on more personalized ads. This suggests a conflict between more specific ad personalization and social targeting. While ads that are more specific can lead to more positive consumer reactions, there seems to be a cost to pay by companies for exploiting and using consumers’ social connections (Frick and Li 2018).

In a related study, Dimitrios Tsekouras, Thomas Frick and I focused on explicit behavioral targeting and again found strong empirical evidence that consumers respond negatively to behavioral targeting, especially when the personal information used to tailor personalized messages is made explicit. In addition, the findings reveal that highlighting the hedonic benefits of a product in the messages can alleviate the negative effect. Our findings caution firms about the negative effect of using personal information salient to consumers and suggest ways to mitigate this negative effect (Tsekouras et al. 2018).

Could it be possible that the presence of social endorsement by friends mitigates the increase in privacy concerns caused by the personalization of ads? Thomas Frick, Paul Pavlou, and I recently conducted follow-up research, using a set of lab experiments and eye-tracking technology, to investigate how social advertising affects consumers’ privacy concerns by shaping their affective and cognitive reactions (Frick et al. 2018). See Figure 5. We find that although social influence leads to more positive consumer responses to ads, it does **not** mitigate privacy concerns triggered by ad personalization. We also find personalization increases privacy concerns, which leads to a decrease in attention, eventually decreasing ad performance. This finding challenges the belief that companies can attract consumers’ eyeballs with more intrusive ads.



Figure 5. Using eye-tracking to understand the trade-off between personalization and privacy

5. The Challenges Ahead

Companies need to be cautious about the specificity of advertising and product recommendation, and their practice of inserting themselves into consumers' micro-moments. They often find themselves walking a thin line between delivering personalization services to consumers and being 'creepy', which increases consumers' privacy concerns. Some of you may know the case in which Target, the American retailer, used analytics to identify pregnant women based on their purchases (Hill 2012). Target developed a prediction model and sent coupons of baby products to expectant mothers. A father apparently learned his teenaged daughter was pregnant when Target mailed her one of these coupons. The well-publicized result was that Target received backlash from consumers. What we have seen is just the tip of the iceberg in the increasing practice of information-based strategy. There are many challenges ahead:

5.1 The Challenges to Business Strategy – Control and Transparency

Companies will continue to learn from the digital traces of their consumers, and to provide a personalized experience. However, companies should not forget that they need to be transparent by sharing their privacy policy in an easy way. Companies need to be mindful about how to protect consumers' data, and empower consumers by giving them the control to choose what, when and how their data is collected and used. They need to ask users to give them explicit consent for any usage of their information. Today's companies need to develop strategies that serve customers rather than exploit or irritate them. They must work to ensure greater transparency over the use of customer data and should build trust and confidence in this increasingly challenging environment.

Transparency is a valid way to find out what consumers are or are not comfortable with. A clear and open privacy policy can go a long way towards achieving this end. For example, CarePredict (<https://www.carepredict.com>) developed a wearable sensor that tracks the movement of seniors living independently, giving their families peace of mind. "It tracks everything from how long one is laying on the couch to the number of trips they take to the bathroom. Advanced monitoring and learning of both location and tempo determine whether someone is taking a nap or has fallen down in the living room. The data is also accessible by healthcare providers to enable them to look for patterns that indicate undiagnosed illnesses" (Sena 2015). To ease the concerns of users that this wearable is an intrusive product that collects very personal data, the company puts their privacy policy prominently on their site. This comprehensive policy breaks down information collection and use, personally identifiable information, cookies, log files, security, referrals, corrections and notifications of changes. The more personal the data companies collect, the more they have to give their consumers control over their data, and keep them informed about exactly what they will do with the data.

5.2 The Challenges to Consumer Behavior – Striking a Balance

People often say they want to protect their right to privacy. But when asked how much they are willing to pay, or willing to give up in customer experience, the result is not too much. There is a difference between how much we care about privacy as an idea, and how much we are willing to give up to protect it. Some level of lost privacy will exist, as long as digital advertising is allowed on social media, as it funds the free service. It is not unlikely that Facebook will introduce a paid, ad-free, premium account in addition to the free account. Continuous experimentation and learning is needed to determine the right amount to charge, whether people are willing to pay for it – especially for the user base that built on a free model – as this would change companies' advertising budgets.

People want to have abundant choices but easily get overwhelmed (Ghose 2017). Perhaps they want the illusion of making the choice, but not to feel like it has been made for them. In the case of Target, consumers didn't ask for the intrusion, and therefore were shocked when they received the unwanted and unsolicited ads. Target would argue that their prediction is about satisfying consumer needs. But there is a clear distinction between consumer-initiated buying process and brand-initiated unsolicited communication that annoys consumers. Consumers have the desire for a relevant message. Consumers will be unsatisfied and install ad blockers if they find ads annoying. But consumers will also be delighted that companies are able to better tailor the brand interaction to precisely what they need in that moment. This requires companies to make smart use of context information to let them know about a transaction that is consumer-initiated.

5.3 The Challenges to Public Policy – The General Data Protection Regulation (GDPR)

As more personal data is processed and used, the protection of personal data has become increasingly important. The European Union's new General Data Protection Regulation (GDPR), which just became effective on May 24, 2018, is an important step in this direction (www.eugdpr.org). As a response to the challenges triggered by new technologies, new business models, and new cyber risks, European lawmakers decided to update and harmonize the European data protection laws by replacing the existing guidelines from 1995 with the GDPR. It is a set of rules and requirements aimed at protecting personal data held by businesses and other organizations. The GDPR protects the personal identifiable information of individuals with permanent residence in the EU. Any company that controls personal data or processes personal data by itself or on behalf of another company must comply with the GDPR, even if the company is based outside of the EU. Under the GDPR, non-compliance companies or companies having data breaches can face fines up to 4% of their global revenues and a personal liability of up to €20 million. Consecutive breaches will result in higher penalties and stricter regulatory monitoring.

Many companies are already on their way to compliance, but many struggle to have the systems and processes in place to handle two major requirements. First, the most prominent and complex new change is an individual's 'right to be forgotten', which means any individual can request that a company erase their respective personal data. Google for example has received 650,000 'right to be forgotten' requests since 2014 (Doubek 2018). To make it possible, companies need to put the processes in place to

locate the data and comply with these requests. The challenge lies in deleting not only a single data record, but also the ones that were copied to numerous databases, aggregated, or shared with a third party. This request could also change entirely how search engines work and may require built-in mechanisms to selectively link information rather than indexing everything. Second, there is the new requirement to notify authorities of a data breach within 72 hours of its occurrence – another major challenge. To do this right, companies will need to put adequate processes and systems in place to identify what data is affected, and to improve internal collaboration before informing the regulator.

5.4 The Challenges to System Design – Artificial Intelligence Combined with Intelligence Augmentation

Artificial intelligence (AI), the intelligence demonstrated by machines, is everywhere. It's in our phones, cars, online search, dating, banks, and all over the media. The visionary physicist Stephen Hawking explained, "Everything that civilization has to offer is a product of human intelligence... Success in creating AI would be the biggest event in human history." At the core of AI is machines making predictions. AI performs better with more data. It is better able to personalize predictions with access to more personal data. The provision of more personal data will often come at the expense of reduced privacy. The implementation of GDPR will create an environment that benefits EU residents. It may even "create conditions for a more dynamic market for private information where individuals can more easily decide whether they wish to trade, sell, or donate their private data" (Agrawal et al. 2018). However, it may also create disadvantages to European companies and consumers in markets where AIs with better access to data are more competitive.

To encourage data protection, GDPR requires 'privacy by design' and 'privacy by default' from the early stage of any project or initiative. If companies approach GDPR requirements with due diligence, they are bound to augment cyber security through process refinement and increased security measures. This also means future personalization should be done with a privacy-aware and privacy protective design, where information systems collect information only on an as-needed basis. I can also imagine that in the future, companies will provide personalization using a **personalized privacy design** as each individual may have different privacy sensitivity in different contexts. Perhaps this could be done with a Blockchain-similar consent architecture that keeps track of all communication and sharing activities, independent from any service provider. To achieve this, future system design would require a focus that optimally combines the abilities of human beings with various technologies and algorithms, that is, combining AI with IA (Artificial Intelligence with Intelligence Augmentation). As such, system designers need to focus more on interactions and interface such that the resulting system is efficient, effective, and addresses the issues of appropriate level of choices and control to provide what we truly want, in the right context, to make our life simpler, easier, and better.

5.5 The Societal Challenges – Technologies Amplify Human Capacity

Technology amplifies human capacity. A recent article published in Science showed that fake news (i.e., lies) diffused significantly farther, faster, deeper, and more broadly than the truth in all categories of information, especially for false political news, based on true and false news stories on Twitter between 2006 to 2017 (Vosoughi et al. 2018). The top 1% of false news cascades to between 1000 and 100,000 people, whereas the truth is rarely diffused to more than 1000 people. The differences are attributed to the degree of novelty and the emotional reactions of recipients.

It is important to keep in mind that just because technology makes something possible doesn't mean it is something people should do. There are many examples of using data in new ways that, while technically amazing, turn people away by being too intrusive. Next time you visit China, think twice before racing across a busy street to beat the crossing light before it turns red: your face will likely pop up on video screens above the street, thanks to the facial recognition technology. This technology is becoming a feature of daily life in China, where authorities are using it on streets, in subway stations, at airports and at border crossings in a vast experiment in social engineering with the goal of identifying lawbreakers and influencing behavior. Such public shaming could impact a person's social credit, as well as their insurance premiums and chance of getting a loan. By 2020, the Chinese government hopes to implement a national 'social credit' system that would assign every citizen a rating based on how they behave in public, at work, and in financial transactions (see Figure 6). The social credit system mixes the familiar credit scores with more expansive and intrusive measures, in an attempt to promote 'trustworthiness' in society. The government will, in the end, have an enormous amount of data, which will help them allocate resources, solve problems, control, and intervene in society, politics, and the economy.



Figure 6. China plans to introduce a nation-wide 'social credit' system by 2020

Unfettered by privacy concerns or public debate, using sophisticated technologies to offer convenience is one thing; but rushing to deploy new technologies to monitor people would spook many in the West. Human Rights Watch called it “chilling” and some others have called it “a futuristic vision of Big Brother out of control” (Botsman 2017). I have no doubt we will soon see massive personalization happening at a country-wide scale, but coming at the cost of privacy. Despite the heavy criticism, some Chinese citizens say that ‘social credit’ is making them better people already. We need to be clear: privacy is a right granted to individuals that underpins the freedom of expression that is essential for a free and democratic society. Privacy is certainly under pressure in the digitized society through such large-scale state and individual surveillance. The government needs to be extremely cautious about the consequences of such massive surveillance; and aware that the lack of anonymity can cause the loss of freedom, which is harmful for individuals and societies. It will take some time to reach consensus and implement the Chinese equivalent to the GDPR (**The Personal Information Security Specification**) in the context of political realities, but efforts are needed to ensure that 2020 bears no resemblance to ‘1984’ (Orwell 1949).

6. Concluding Remarks

Maybe we will reach a new comfort level that views the benefits of receiving relevant personalized services as outweighing the risks of providing personal information. Maybe some of us will always consider personalized offers as being intrusive and never fully offset that fear. In the right hands, sophisticated data ultimately leads to consumer empowerment. True value from data collection lies not in the complexity and breadth of inputs that companies are able to measure, but in the strength of the output or insight that they are able to provide for people. Personalization vs. privacy is just one of the paradoxes that individuals, companies, and governments face in their pursuit of harnessing the power of the digital economy. In a similar vein, more research and debate are needed to strike the balance between Big Data and Big Brother, between human and machine (such as research topics around superintelligence, and the ethics of AI), and between AI and productivity growth.

With my chair in Digital Business, I will strive to make strong contributions to understanding the impact of emerging technologies and information on consumers, companies, public policies, system design and society at large. This requires working with inter-disciplinary teams in management science, behavioral science, computer science (for data mining and machine learning), and statistics. Practically, the goal is to introduce methods, models, and principles that guide individuals, organizations, and societies to manage informational challenges and strategize the fully-informed market environment.

Exponential improvements in artificial intelligence, robotics, networks, analytics, and digitization will affect more of the economy and society; more research is needed to explore how people and businesses will work, interact, and prosper in an era of profound digital transformation. Given my research and educational interest in this area, I will continue to lead research efforts related to digital business; to foster collaborations between university faculties and industry leaders to research the effects of and causes behind these phenomena; to provide related education in RSM's bachelor, master, and executive programs; to help companies adapt to new ways of doing business in the digital economy; to help NGOs and other organizations understand how the digital transformation is affecting society and everyday life; and to help people become more productive and thrive in a time of great and uncertain change.

I am proud of being part of an academic community, together with our colleagues around the world, the participants of the Symposium on Statistical Challenges in Electronic Commerce Research (SCECR), that takes up the challenges: creating responsible information-based strategies and transformations that truly empower individuals, companies, and societies.

Words of Thanks

It is a tradition to end the inaugural address with some words of thanks to those who have made it possible that I am standing here today. I would like to start by thanking the Executive Board, President, and Vereniging Trustfonds of the Erasmus University Rotterdam, the members of the appointment and advisory committees, and the Dean of the Rotterdam School of Management, Steef van de Velde, for my appointment as the Endowed Professor of Digital Business. I would like to thank you for the opportunity to develop this chair and to connect with local and global networks of academics and practitioners. I feel honored and privileged to be part of such a vibrant, visionary, and talented community of scholars, students, and staff. I am extremely grateful for the generous support of many wonderful people.

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I appreciate having been able to work with amazing colleagues throughout my academic career at Erasmus University. I was fortunate to be the academic director of one of the largest MSc programs at RSM, perhaps also one of the largest MSc programs in Information Systems in the world. BIM grew ten-fold over the last ten years and reached its peak enrollment of 360 students in 2016. My job would not be possible without the work of many wonderful colleagues involved. Their great work is what makes the success of BIM possible and for which I am grateful: Eric van Heck, Dimitrios Tsekouras, Otto Koppius, Wolf Ketter, Mark Boons, Rodrigo Belo, Yashar Ghiassi-Farrokhfal, JooHee Ho, Zike Cao, Tobias Brandt, Jeffrey Sweeney, Philipp Cornelius, Peter Vervest, and Marcel van Oosterhout. I also want to thank the tremendous support of Cheryl, Ingrid, Carmen, and Yanick. I've enjoyed our strategy days, outing, barbecue, retreat, ice skating, and escape room activities. I'm grateful to all of you for making BIM a success, and at the same time a fun environment in which to work.

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I am always passionate about working with industry partners to dig into pressing, real-life questions. Pursuing such evidence-based research requires building fruitful partnerships with business, which can be challenging at times. I had the luxury of working with mentors who encouraged me to collaborate with business – much needed advice that is too often forgotten as we strive for top publications. I am tremendously grateful for the wonderful collaboration with a number of organizations over the years. My earlier years working on the smart card project were a rewarding experience. I would like to thank our colleagues at NS, in particular Paul Rooijmans, Freek Hofker, and Jan Henk Keijzer. For my recent industry partners, I would like to thank Pieter Zwart, the CEO of Coolblue; David Vermeulen and Serge Samusya, the CEO and CTO at InnerCircle; Edwin Metselaar, the CTO of MobPro; and Remco Wilting, the former Director of Data Science at Wehkamp. I am tremendously grateful for the multiple-year collaboration with VIVAT and its research sponsorship. I want to especially thank Ron van Oijen, the CEO of VIVAT for his support, and other colleagues in the company who supported the collaboration. I am also grateful to the financial support of the Dutch National Science Foundation (NWO) for two major research grants on complexity science.

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Ting Li is the Endowed Professor of Digital Business and the Academic Director of the MSc in Business Information Management at Rotterdam School of Management (RSM), Erasmus University. She is the founding member of the Erasmus Centre for Data Analytics. Ting's research interests focus on the impact and the economic value of digital technologies on consumers and businesses. Her work has been published in top scientific journals and recognized with best paper awards. Her interdisciplinary research has been sponsored by multiple grants from the Dutch National Science Foundation (NWO) and multinational companies. She teaches in various bachelor, master, (E)MBA and executive education programs. Prior to joining academia, Ting worked for General Electric and IBM. She obtained her Ph.D. in Management Science at Erasmus University and her MSc in Computational Science at the University of Amsterdam. In 2017, she was named by Poets & Quants as one of the Top 40 Professors Under 40 Worldwide.

In her inaugural address, Ting explains how we could improve our behavioral insights from exploring digital traces, using offline trajectories and online social interactions. She then elaborates on the increasingly important and intertwined topics - personalisation and privacy - using her own research. She further discusses personalization-privacy-paradox related challenges to customer behavior, business strategy, public policy, system design, and society at large.

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3000 DR Rotterdam, The Netherlands
T +31 10 408 1182
E info@erim.eur.nl
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