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ABSTRACT

Due to the rapid proliferation in the algorithm-driven online tracking and profiling infrastructure, and the increasing business potential of online behavioral advertising, researchers from various disciplines are attracted to the growing body of knowledge on the phenomenon. Although the literature on online behavioral advertising is accumulating, the stream of research is still in the development stage, hence is highly fragmented. This paper aims to review, organize, and integrate the literature on online behavioral advertising and assess the state-of-the-art in order to facilitate future research. The review covers 80 peer-reviewed journal articles from 47 scholarly journals published between 2000 and 2018. The resulting framework summarizes the progress in online behavioral advertising research and provides future research directions.

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Online behavioral advertising; online profiling; targeted advertising; behavioral targeting; retargeting

Introduction

Early years of the Internet technology allowed targeting consumers based on general interests, which is inferred from the editorial content of the webpage on which the ad is to be displayed (Goldfarb and Tucker 2011a). Recent developments in online tracking and profiling technologies made the process of individual-level targeting and personalization not only possible, but also almost instantaneous, occurring in real time as the individuals surf the Internet (Moore et al. 2015; Sinclair 2016). Researchers increasingly embrace the idea that the future of advertising will be more targeted and more personalized (Kumar and Gupta 2016).

Today, it is possible to create a request for an online ad as an individual starts loading a webpage and an ad targeting that particular individual can be delivered just before the loading of the page is completed. There is a complex algorithm-driven automatic analytical system behind this mechanism. Sometimes a simple cookie placed on a user's computer helps to identify recently visited pages to infer salient needs; in other times the ad to be shown is dynamically determined with the use of analytical profiling techniques based on data gathered from massive databases that aggregate historical click-streams of individual users and complex algorithms enabling real-time bidding for an ad space, instantaneously optimizing requirements and requests of multiple advertisers and publishers (Försch and de Haan 2018; Qin, Yuan, and Wang 2017; Sinclair 2016). This process of displaying digital advertisements to consumers based on their previous individual-level online behavior is

broadly called as online behavioral advertising (OBA) or behavioral targeting (Aalberts, Nill, and Poon 2016; Boerman, Kruikemeier, and Borgesius 2017; Chen and Stallaert 2014; Ham 2017). The practice of OBA is becoming increasingly common as the industry claims that it enhances ad effectiveness (Aguirre et al. 2015; Chen and Stallaert 2014) and it allows for experimentation for marketers at relatively lower costs (Alreck and Settle 2007).

Meanwhile, the practice of OBA, especially when online behavioral data are collected in an unscrupulous manner, poses a significant threat to consumers' privacy to a hitherto unmatched extent (Borgesius 2016), and exposes advertisers to numerous potential legal pitfalls (Aalberts, Nill, and Poon 2016). Henceforth, policy makers and regulators heavily debate the use of tracking technologies that enable OBA (Smit, Van Noort, and Voorveld 2014). As of today, it still is not clear if consumers around the world sufficiently understand how OBA works and whether they can effectively control tracking and dissemination of their personal information (Cranor 2012; Nill and Aalberts 2014), and what will be the cost of protective laws and regulations for consumers (Mathews-Hunt 2016).

These developments in the consumer environment have made OBA an attractive area for research, especially for the last couple of years. Although the academic literature on OBA is accumulating, the stream of research is still in its early stages. The purpose of this article is to review, organize, and integrate the literature on OBA and assess the-state-of-the-art in order to facilitate future research.

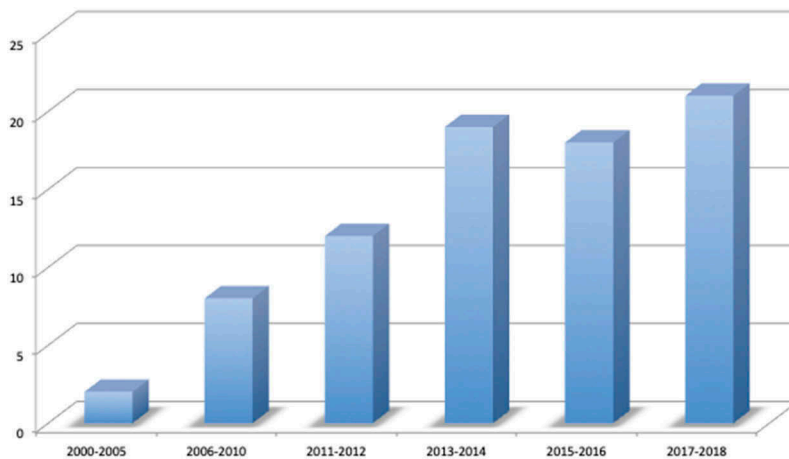
Methodology

Scholars from a multitude of disciplines contribute to the growing literature on OBA. The following online databases were selected and searched to provide a comprehensive bibliography: Web of Science, ABI/INFORM, EBSCOhost, Emerald, IEEE Xplore, Science Direct, and Communication and Mass Media Complete. The literature search was limited to peer-reviewed scholarly journals and was based on keywords: 'online behavioral/behavioural advertising', 'retargeting', 'online profiling', 'online targeted advertising', 'online personalized advertising', 'online customized advertising', and 'mobile behavioral/behavioural advertising'. The search period covered all manuscripts available by the end of December 2018. The full text of each identified article was reviewed to eliminate those that were not principally focusing on the practice of OBA. Eliminated articles either focused on strictly technical aspects of underlying technologies, such as databases, algorithms, and network structures, or addressed personalized advertising based on profiles that were not inferred from online behavior. Then, the references of all the remaining articles were examined to identify journal articles that did not show up in our original literature search. The reviewing process yielded 80 articles focusing on a variety of issues related with OBA.

The list of journals that published more than two articles on OBA is shown in Table 1, and the distribution of articles by years is shown in Figure 1. Although four disciplines make the mainstream of contributions, namely, information science, business/marketing, communication/advertising, and law, the majority of the articles were published in journals belonging to information science and business/marketing disciplines. As seen in Table 1, the top contributing journals were *Computer Law and Security Review*,

Table 1. Journals with two or more articles on OBA.

Journal	# of articles published
Computer Law and Security Review	7
Marketing Science	6
Electronic Commerce Research and Applications	6
Computers in Human Behavior	5
Journal of Marketing Research	4
MIS Quarterly	4
IEEE Security and Privacy	3
Communications of the ACM	2
International Journal of Advertising	2
Journal of Current Issues and Research in Advertising	2
Journal of Retailing	2
Journal of Business Research	2

**Figure 1.** Distribution of articles by year.

Marketing Science, Electronic Commerce Research and Applications, Computers in Human Behavior, Journal of Marketing Research, and MIS Quarterly.

Next, following Torraco's (2016) guidelines on conducting and writing integrative literature reviews, each identified article was examined thoroughly for thematic structuring of the literature. The themes for thematic structuring are broad issues that encompass streams of related ideas in the literature. The aim was to synthesize the accumulated knowledge on the practice of OBA in a coherent general framework. This approach was instrumental in highlighting under-researched areas, critically assessing progress, and providing directions to future research.

The resulting framework showed that OBA research has a three-layered structure: (1) a macro-level perspective, focusing on the ethical and regulatory issues surrounding the practice of OBA, (2) an eco-system level perspective, focusing on the strategies that optimize the welfare of the system as a whole (advertisers, publishers, and consumers), and (3) a campaign-level perspective, focusing on the effectiveness of a single advertiser's OBA campaign. This new three-layered organization of OBA literature revealed that research in OBA is driven by three fundamentally different research questions and ways of thinking about the topic. This framework is useful in the sense that it provides

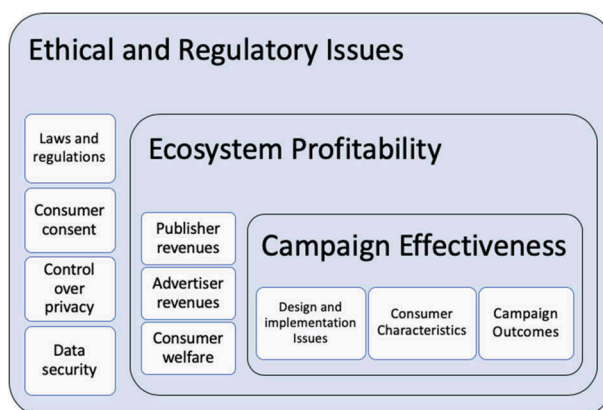


Figure 2. Three-layered structure of OBA literature.

coherence and clarity about what is being investigated in OBA literature and a better understanding of how empirical findings within each distinct stream of research come together to produce a unified body of knowledge. Figure 2 provides an overview of the resulting framework, while Table 2 lists the contributing works to each layer of the framework.

The review of OBA literature presented in this article distinguishes from an earlier review by Boerman, Kruikemeier, and Borgesius (2017) in terms of purpose, scope, and methodology. Boerman, Kruikemeier, and Borgesius' (2017) purpose were to identify all variables that were studied with regard to consumer responses to OBA and group them into three main factors based on the interactive advertising model. In line with their aim, in their review, they only included the articles that report on empirical data solely on consumer responses to OBA, and consequently produced a model explaining individual consumer level attitudinal and behavioral outcomes of OBA. Their model strictly falls into the campaign-level layer of the framework put forth in the present article.

The integrative framework

The macro-level perspective: Ethical and regulatory issues

Along with the technological proliferation of the Internet in terms of the range of available online consumer services, communication platforms, and self-service technologies, information captured by organizations on an individual level for behavioral profiling and targeting virtually has no limits. Research adopting a macro-level perspective is predominantly concerned with evaluating the effectiveness of existing laws and regulations in protecting individuals from the dangers relating to data privacy and misuse that is associated with OBA, along with the ethical dilemma presented by the increasingly significant consumer privacy issues, which challenge the legitimacy of OBA in its present form.

The overarching research question in this research stream is how to provide a balance between protecting individuals, whilst allowing businesses to access and use their data responsibly to continue to deliver quality content, relevant ads, and

Table 2. The integrative framework.

Contribution to the literature	References
Macro-Level Perspective	
Ethical conduct	
Disclosure, control over tracking and receiving ads, personalization-privacy paradox, unscrupulous data collection, time spent to read policies, non-transparency, deceptiveness, invasion of privacy, violation of social norms, opt-in and opt-out policies/consent processes, consumer ignorance of online privacy management, compliance practices, privacy enhancing technologies	Boerman, Kruijkemeier, and Borgesius 2017; Christiansen 2011; Cranor 2012; Goldfarb and Tucker 2011b; Greengard 2012; King and Jessen 2010b; Lynskey 2011; Mathews-Hunt 2016; McDonald and Cranor 2008; McStay 2013; Moore et al. 2015; Mpinganjira and Maduku 2019; Nill and Aalberts 2014; Nill, Aalberts, and Schibrowsky 2012; Sinclair 2016; Stanaland, Lwin, and Miyazaki 2011; Titiriga 2011; Van Noort, Smit, and Voorveld 2013
Legal framework and regulation	
European Data Protection Law, effects of EU Data Protection Law, comparison of different countries' legal approaches, online licensing system, the third-party doctrine, actions taken by the Federal Trade Commission (FTC), industry self-regulation	Aalberts, Nill, and Poon 2016; Basho 2000; Borgesius 2013; Borgesius 2016; Brotherton 2011; De Lima and Legge 2014; Goldfarb and Tucker 2011c; King and Jessen 2010a; Leenes and Kosta 2015; Legge 2015; Lynskey 2011; Mathews-Hunt 2016; Myers 2015; Nill and Aalberts 2014
Ecosystem-Level Perspective	
Structure of competition and profitability of players	
Effect of competitor responses, symmetry of pricing, consumers' and advertisers' heterogeneity in preferences, platform fees, stakeholders' pay-offs, propensity effect, competitive effect, level of feasible customization, level of consumer control	Acquisti 2014; Chen and Stallaert 2014; Dubé et al. 2017; Gal-Or, Gal-Or, and Penmetsa 2018; Gal-Or and Gal-Or 2005; Järvinen and Taiminen 2016; Qin, Yuan, and Wang 2017
Campaign-Level Perspective	
Exogenous Variables	
<i>Communication Design</i>	
Ad slot position, content composition, personalization depth and breadth, matching an ad to website content, obtrusiveness, degree of personalization, price incentives/discounts, timing, frequency, recency, continuous exposure to retargeted ads	Bleier and Eisenbeiss 2015a; Bleier and Eisenbeiss 2015b; Bruce, Murthi, and Rao 2017; Bruce 2017; Förtsch and de Haan 2018; Ghose and Todri-Adamopoulos 2016; Goldfarb and Tucker 2011a; Tucker 2014; Urban et al. 2013; Van Doorn and Hoekstra 2013
<i>Cookie consent and disclosure</i>	
Apriori cookie disclosure, types of appeals, allowing control for privacy, privacy-safe features, overt vs. covert information collection, level of retailer's dissemination of information; use of trust building signals	Aguirre et al. 2015; Jai, Burns, and King 2013; Miyazaki 2008; Tucker 2014; Schumann, von Wangenheim, and Groene 2014; Summers, Smith, and Reczek 2016; Sutanto et al. 2013; Van Noort, Smit, and Voorveld 2013
<i>Profiling and targeting strategy</i>	
Combining different targeting strategies, selection and weighting of profiling criteria, analytical models and frameworks, location-based targeting, size and quality of data.	Chiang, Wang, and Chu 2013; Kagan and Bekkerman 2018; Lian, Cha, and Xu 2019; Loia et al. 2008; Lu, Zhao, and Xue 2016; Miralles-Pechuan, Ponce, and Martínez-Villasenor 2018; Nottorf 2014; Trusov, Ma, and Jamal 2016
<i>Consumer characteristics at the time of ad exposure</i>	

(Continued)

Table 2. (Continued).

Contribution to the literature	References
Persuasion knowledge, privacy concern, skeptical attitude toward OBA, promotion-focus level, self-perception, cultural differences, prior brand exposure, previous privacy invasion experience, need for transparency, willingness to share information, desire for privacy, trust toward retailer, age, education, online experience, cognitive style, body-type preference, web-browsing mode (goal-directed vs. experiential), stage of consumer's buying process, innovativeness	Alreck and Settle 2007; Antón, Earp, and Young 2010; Awad and Krishnan 2006; Bellman et al. 2013; Bleier and Eisenbeiss 2015a; Bleier and Eisenbeiss 2015b; Gironde and Korgaonkar 2018; Ham and Nelson 2016; Ham 2017; Lambrecht and Tucker 2013; Lee et al. 2015; Miyazaki 2008; Mpinganjira and Maduku 2019; Summers, Smith, and Reczek 2016; Stanaland, Lwin, and Miyazaki 2011; Ozcelik and Varnali 2019; Smit, Van Noort, and Voorveld 2014; Urban et al. 2013; Yu, Hudders, and Cauberghe 2017; Zarouali et al. 2017
Endogenous Variables	
<i>Consumer perceptions, gratifications, and behavioral intentions</i>	
Perceived (security) risks, perceived relevance, perceived informativeness, information value, perceived entertainment, perceived intrusiveness, perceived benefits, ownership, perceived vulnerability, perceived costs of non-personalization, self-efficacy /perceived control over privacy, perceived level of personalization, perceived unfairness, perceived usefulness, perception of brand's ethical value, process gratification, content gratification, perceived invasiveness, Ad avoidance, reactance, ad liking, OBA acceptance	Bellman et al. 2013; Bleier and Eisenbeiss 2015a; Bleier and Eisenbeiss 2015b; Chen et al. 2019; Jai, Burns, and King 2013; Gironde and Korgaonkar 2018; Ham 2017; Mpinganjira and Maduku 2019; Ozcelik and Varnali 2019; Palos-Sanchez, Saura, and Martin-Velicia 2019; Schumann, von Wangenheim, and Groene 2014; Sutanto et al. 2013; Tucker 2014; Van Doorn and Hoekstra 2013; Van Noort, Smit, and Voorveld 2013; Van Reijmersdal et al. 2017

customized services (Aalberts, Nill, and Poon 2016; Basho 2000; De Lima and Legge 2014; King and Jessen 2010b; Leenes and Kosta 2015; Lynskey 2011; Myers 2015). This issue is coined by the term **privacy-personalization paradox** (e.g., Chen et al. 2019; Christiansen 2011; Titiriga 2011). **Personalization of online ads increases their relevance**, which in turn drives both ad effectiveness for advertisers and ad revenues for publishers. **Increased relevance of ads, however, comes in the expense of losing control over the use of personal sensitive information** (Tucker 2012). In plain words, consumers pay for 'free' content with their personal data. This practice becomes more irritating when firms obtain or use information in a covert manner from the consumer's perspective (Moore et al. 2015).

Since online advertisers and their stakeholders seldom agree on what is ethical, it is inherently **difficult to measure and assess the moral side of OBA** (Nill and Aalberts 2014). Regardless, the literature unanimously acknowledges the fact that the technology that allows tracking individuals as they surf the Internet and process this data to single-out and deliver personalized ads **has unprecedented potential to violate privacy** (Aguirre et al. 2015; Awad and Krishnan 2006; Sinclair 2016; Sutanto et al. 2013).

Different countries around the world take **differing stands with respect to how** they approach the issue (De Lima and Legge 2014; King and Jessen 2010a; Legge 2015). The crux of the difference largely lies within the definition and interpretation of **consumer consent** (Borgesius 2013, 2016; De Lima and Legge 2014), **as consent can be explicit,**

informed, or derived from browser settings (Brotherton 2011; De Lima and Legge 2014; Mathews-Hunt 2016).

Major themes arising from this sub-stream of OBA literature include effectiveness of opt-in and opt-out policies and consent practices in empowering consumers, effectiveness of existing technologies in granting control over tracking and receiving ads, effectiveness of a priori cookie disclosure and icons, and consumer ignorance of OBA and online privacy management (Boerman, Kruijkemeier, and Borgesius 2017; Christiansen 2011; Cranor 2012; Goldfarb and Tucker 2011b; McStay 2013; Mpinganjira and Maduku 2019; Stanaland, Lwin, and Miyazaki 2011).

Nill and Aalberts (2014) synthesized six moral guidelines for the practice of OBA to create a stable, unchanging, duty-based set of goals for practitioners, lawmakers, and regulators to pursue in an uncertain legal environment, as (1) free-of-deception, (2) active transparency, (3) control over information, (4) data security, (5) consideration of stakeholder interests, and (6) fairness. Although active transparency via making policies available and provision of increased control over privacy seems to be the commonly agreed upon hygiene factors pertaining to the practice of OBA, reading these policies at least once a year for all the websites puts an incredible burden on consumers (McDonald and Cranor 2008). How to solve this conundrum is still an outstanding question.

The eco-system level perspective: Profitability of players

OBA has essentially a three-player landscape (i.e., consumers, advertisers, and publishers), employing a horizontal differentiation model as the means to increase the fit between consumers and advertisers, and on that basis advertisers compete for the advertising space provided by the publisher via auctions to display their advertisements to consumers (Chen and Stallaert 2014). A publisher offers an advertising slot for sale. This slot can be used for either OBA or for traditional types of online display advertising, in which the same ad is displayed for all consumers. Behavioral targeting algorithms, using prior online behavioral data, compute a fit score between a consumer and an ad. The advertising slot of the publisher is typically sold by weighted unit-price auctions, in which advertisers place cost-per-click bids and the winner is selected based on both the fit to a consumer and advertisers' cost-per-click bids (Chen and Stallaert 2014; Palos-Sanchez, Saura, and Martin-Velicia 2019; Qin, Yuan, and Wang 2017). In such a system, all three players of the framework must be better off with behavioral targeting when compared to traditional advertising for OBA to flourish. Works classified under this sub-domain focus on this issue and examine how behavioral targeting affects publishers' and advertisers' payoffs, as well as societal welfare.

In an early study, Gal-Or and Gal-Or (2005) showed that product revenues and consumer welfare are highest when the media distributor chooses the highest level of customization feasible. In a comprehensive study on the ecosystem profitability, Chen and Stallaert (2014) showed that (1) although revenue for the publisher can double when behavioral targeting is used, in some cases, depending on the degree of competition and the advertisers' valuations, the prices of advertising and hence the publisher's revenue can be lower; and (2) despite the fact that users and small advertisers are better off under behavioral targeting, the dominant advertiser might be worse off.

Adopting a computational experiment approach Qin, Yuan, and Wang (2017) showed that market segmentation has the potential of improving the total revenue of all the advertisers in a real-time bidding eco-system, however along with the increasing refinement of the market segmentation granularity, the total revenue has a tendency of a rise first and followed by a decline.

More recently, Gal-Or, Gal-Or, and Penmetsa (2018) demonstrated that the presence of heterogeneity in the consumer and the advertiser populations with respect to their preferences for targeting leads to differentiation between platforms, and higher targeting differentiation allows platforms to charge higher advertising fees and earn higher profits. Further, their results suggest that allowing increased consumer control leads to reduced targeting differentiation between platforms and lower advertising fees.

Examining mobile targeting based on consumers' real-time and historic locations, Dubé et al. (2017) showed that in geo-behavioral targeting, substantial gains can be achieved by targeting a competitor's location, however, when the competitor also joins the game, returns are reduced. When symmetric pricing incentives soften competition, a competitor's response increased profitability; however, when asymmetric pricing incentives toughen competition, a competitor's response decreased profitability.

Although they are not typically consumer-facing, data brokerage companies constitute the fourth player in the OBA landscape. Data brokers are 'companies that collect consumers' personal information and resell or share that information with others' (FTC 2014). Collecting and aggregating data from multiple sources, data brokers hold a vast array of information on individual consumers and process this information to form detailed consumer profiles. Most of the demand side platforms connecting to programmatic ad exchanges offer a suite of advanced targeting options via integrating with one or more data brokerage companies (Ash 2016). Since consumers generally are unaware of their data being stored and processed by data broker companies (FTC 2014), their ability to control the use of their data is significantly hindered. How to tackle this fundamental lack of transparency about data broker practices constitutes an important future research avenue.

As a summary, findings cumulatively suggest that depending upon the degree of competition among advertisers, level of feasible customization, heterogeneity in the consumer and the advertiser populations with respect to their targeting preferences, and pricing strategies of competitors, OBA may not always outperform traditional online advertising neither for advertisers, nor for the publishers. When it comes to the welfare of the consumer, empirical findings and the opinions in the literature so far are mixed whether they are better off or not with OBA, all boiling down to the privacy-relevance paradox. On the other hand, it is important to highlight a noteworthy contrast between the findings of macro-level and eco-system level perspectives on this particular issue. Research with a macro-level perspective suggests that consumer control should be increased for OBA to gain legitimacy, however, findings from the eco-system level research suggest that increased consumer control results in lower advertising fees, hurting revenues of the ecosystem players. This particular conflict of interest may be the main reason for the slow progress in OBA landscape in allowing increased consumer control.



The campaign-level perspective: Effectiveness of a single advertiser's OBA campaign

The studies adopting a campaign-level perspective adopt a strategic lens and mostly focus on delineating critical success factors in stimulating consumer response. These works aim to develop models to explain the acceptance and effectiveness of OBA in a single advertiser setting. In plain words, these works are predominantly concerned with the best way of deploying OBA to leverage its unique abilities as a marketing vehicle, while mitigating privacy concerns. In these studies, consumer characteristics at the time of exposure and advertiser-controlled factors are treated as exogenous variables, whereas perceptions, gratifications, behavioral intentions, and observed clicking behavior are usually considered as endogenous variables.

Exogeneous variables of OBA campaign effectiveness model

Communication design. A number of studies focus on critical communication design issues, such as the creative and informational composition of the ads (Bruce, Murthi, and Rao 2017; Goldfarb and Tucker 2011a; Huang 2018), degree of personalization of the ad (Bleier and Eisenbeiss 2015a; Van Doorn and Hoekstra 2013), positioning of the ad within the layout of the webpage (Bleier and Eisenbeiss 2015b; Huang 2018), and campaign execution (Försch and de Haan 2018; Ghose and Todri-Adamopoulos 2016) in OBA and developed causal frameworks which link these critical design issues to expected customer responses, and finally to business model viability.

Several of the contributing studies made considerable advancements in terms of understanding how ad content influences consumer response toward OBA. In one of the earliest studies in OBA, Goldfarb and Tucker (2011a) showed that both matching an ad to website content and increasing an ad's obtrusiveness independently increase purchase intent; however, in combination, these two strategies are ineffective. Van Doorn and Hoekstra (2013) showed that higher degrees of personalization (e.g., adding personal identification or transaction information to browsing data) increase feelings of intrusiveness, and negatively affect purchase intentions. Offering discounts could not offset these negative effects, which could be partly mitigated by presenting an ad with a high fit to consumers' current needs. However, by showing that a high fit may lead to not only higher purchase intentions, but also higher perceived intrusiveness levels, they underscored the double-edged sword nature of OBA (Van Doorn and Hoekstra 2013).

Bleier and Eisenbeiss (2015a) offered a two-dimensional conceptualization for ad personalization, as (1) personalization depth defining how closely the ad reflects a consumer's interests, and (2) personalization breadth determining how completely the banner reflects these interests. Their lab results revealed that it is possible for more trusted retailers to increase the perceived usefulness of their ads through a combination of high depth and narrow breadth of personalization, without eliciting increased reactance or privacy concerns. For less trusted retailers, on the other hand, higher depth was not perceived as more useful, but instead triggered increased reactance and privacy concerns, regardless of their personalization breadth (Bleier and Eisenbeiss 2015a).

Urban et al. (2013) also contributed to the understanding on how to increase the fit of OBA by showing that banners matched to cognitive styles, as well as the stage of the consumer's buying process and body-type preference, significantly increase click-through

rates, brand consideration, and purchase likelihood. Later, Bruce, Murthi and Rao's (2017) results show that carry-over rates for dynamic formats are greater than those for static formats generally in online display ads; however, static formats can still be effective for price ads and retargeting.

Bleier and Eisenbeiss (2015b) investigated effectiveness of content personalization in banner advertising by taking into account the interplay between timing and placement factors. In a series of experiments they showed that (1) banners with a high degree of content personalization are most effective when a consumer has just visited the advertiser's online store, but quickly lose effectiveness as time passes since that last visit; (2) banners with medium degree of personalization are initially less effective, but more persistent, such that over time they outperform banners with high degree of personalization; and (3) perceptions of ad informativeness and intrusiveness drive these results depending on consumers' experiential or goal-directed browsing modes.

Studying the interplay of content composition and the slot position of personalized banner ads, Huang (2018) showed that, in the context of a female audience in fashion apparel industry, placing banner ads next to articles associated with apparel and fashion increases the overall amount of attention that consumers give to the ad, and ads in the top-center slot on portal sites receive greater total contact time and number of fixations than those in the right sidebar. Finally, findings across the reviewed studies cumulatively suggest that offering price incentive information into the ad content increases the effectiveness of OBA (e.g., Bruce 2017; Bruce, Murthi, and Rao 2017; Huang 2018).

As per campaign execution, analyzing a large data set containing information on 5.8 bn ad impressions and 1.8 m clicks delivered for 158 different advertisers from 25 industries Försch and de Haan (2018) revealed that higher ad frequency and higher ad recency relate to a lower click-through rate, especially when having a less diverse campaign, for brands which are spending more on advertising, and for firms selling durables. Deploying a quasi-experimental study, Ghose and Todri-Adamopoulos (2016) examined the effects of various types of display advertising (e.g., prospecting, retargeting, affiliate targeting, video advertising, etc.) to demonstrate that relative to the mean probability of search triggered by display ads in general, retargeting is less effective in terms of increasing users' propensity to search for the brand and the corresponding product, but in the long run it increases consumers' propensity to convert by an average of 26.12%.

Cookie consent and disclosure. Research classified under this heading constitutes a sub-stream of research focusing on how a website's information collection strategy influences acceptance and eventually effectiveness of OBA. In one of the earliest contributions to OBA literature, Miyazaki (2008) demonstrated that consumers' negative reactions to cookie use could be significantly reduced by a priori cookie disclosure by the visited Website. Following works picked-up where Miyazaki (2008) left and made significant advancements. Jai, Burns, and King (2013) showed that the level to which a retailer disseminates its customers' information to third parties has a significant effect on the perceived riskiness of personalized online ads. Sutanto et al. (2013) showed that delivering a personalized service but avoiding transmitting users' personal information to third parties might reduce users' perceptions that their information boundaries are being intruded upon.

Several works studied the effectiveness of **trust-building marketing strategies** that transfer trust from another website or signal trust with informational cues in mitigating these negative effects (Aguirre et al. 2015; Stanaland, Lwin, and Miyazaki 2011). Aguirre and colleagues (2015) showed that overt information collection might result in greater click-through intentions in response to more personalized advertisements, in contrast to when firms collect information covertly. Summers, Smith, and Reczek' (2016) results provide corroborative evidence for the importance of full disclosure in OBA, based on the fact that behaviorally targeted ads act as implied labels only when consumers know that the ad was behaviorally targeted.

Through comparison of privacy-concerned groups, Smit, Van Noort, and Voorveld (2014) showed that **a dual approach is needed in communicating about OBA**, not only to **inform but also to reduce worries**, especially in older and less-educated groups. Schumann, von Wangenheim, and Groene (2014) studied effects of different types of appeals to find that normative reciprocity appeal is more effective than utilitarian arguments in acceptance of OBA. Finally, Tucker (2014) demonstrated that **giving users greater control over their personally identifiable information might increase the likelihood to click on personalized ads**.

Profiling and targeting strategy. Studies classified under profiling and targeting strategy explore how to best deploy targeting in OBA either by focusing on the selection of profiling criteria or the analytical modeling approach. For instance, using a binary logit model with a Bayesian mixture approach, Nottorf (2014) showed that it is possible to model the clickstream across multiple online advertising channels to estimate individual click probabilities for consumers in online display advertising context. Similarly, Kagan and Bekkerman (2018) trained a multi-labeled classification model on the clickstream of panel members with distinctive online purchase profiles to predict the purchase potentials of individuals in an online panel, with very promising results. Chiang, Wang, and Chu (2013) proposed a time function to increase/decrease the weight of the old data in evaluating members' past behaviors. Lu, Zhao, and Xue (2016) demonstrated that targeting a user with behavioral characteristics that are loosely related to ad content performs better in increasing the click-through rates, when compared to targeting a user with behavioral characteristics that are closely related to ad content. Trusov, Ma, and Jamal (2016) showed that although search engines cover smaller portions of consumer Web visits than major advertising networks, their data are of higher quality; and thus, even with the smaller information set, search engines can effectively recover consumer behavioral profiles. With a randomized field experiment in the restaurant industry, Lian, Cha, and Xu (2019) revealed that nearer distance, right timing, matching with users' preference for service type, and users' recent visits to food websites all increase the ad click-through rate.

Consumer characteristics at the time of exposure. Three general types of consumer characteristics are identified in the present review, as (1) **inherent**, such as demographics, psychological traits, and predispositions, (2) **perceptual**, arising from prior experiences, hardwired beliefs or salient needs, and (3) **spatial-temporal**, arising from the imminent conditions of the individual at the time of ad exposure.

The inherent consumer characteristics that interact with the unique features of OBA are identified as privacy concern (Antón, Earp, and Young 2010; Bleier and Eisenbeiss 2015a; Lee et al. 2015; Smit, Van Noort, and Voorveld 2014; Zarouali et al. 2017), the extent to which the person is promotion focused (Ozcelik and Varnali, 2019), self-perception (Summers, Smith, and Reczek 2016) needs for transparency (Awad and Krishnan 2006), age, education (Smit, Van Noort, and Voorveld 2014), innovativeness (Gironda and Korgaonkar 2018), willingness to share information (Lee et al. 2015), cultural differences (Yu, Hudders, and Cauberghe 2017), desire for privacy (Miyazaki 2008; Mpinganjira and Maduku 2019; Stanaland, Lwin, and Miyazaki 2011), cognitive style, and body-type preference (Urban et al. 2013).

The perceptual consumer characteristics arising from prior experiences, hardwired beliefs or salient needs that interact with the unique features of OBA include skeptical attitude toward OBA (Zarouali et al. 2017), previous privacy invasion experience (Awad and Krishnan 2006), perceived control of privacy (Gironda and Korgaonkar 2018; Tucker 2014), online experience (Miyazaki 2008), persuasion knowledge (Alreck and Settle 2007; Ham 2017; Ham and Nelson 2016; Smit, Van Noort, and Voorveld 2014), prior brand exposure (Bellman et al. 2013), and trust toward retailer/advertiser (Bleier and Eisenbeiss 2015a).

Finally, the spatial-temporal characteristics arising from the imminent conditions of the individual at the time of ad exposure that is found to matter in the context of OBA are web-browsing mode (Bleier and Eisenbeiss 2015b), and the stage of consumer's buying process (Bleier and Eisenbeiss 2015b; Lambrecht and Tucker 2013; Van Doorn and Hoekstra 2013; Urban et al. 2013).

Endogenous variables

Consumer perceptions, gratifications, and behavioral intentions. In this section, variables that are explained by the functions within the behavioral models of OBA are detailed. Consumer perceptions and gratifications occurring as a result of the interaction between consumer characteristics at the time of exposure and advertiser-controlled factors are often treated as mediators, while behavioral intentions and actual clicking behaviors constitute the dependent variables.

Drawing upon uses and gratifications theory (Katz, Blumler, and Gurevitch 1973), a number of studies examined perceived usefulness (Bleier and Eisenbeiss 2015a; Gironda and Korgaonkar 2018; Palos-Sanchez, Saura, and Martin-Velicia 2019), informativeness (Bellman et al. 2013; Bleier and Eisenbeiss 2015b), entertainment (Ozcelik and Varnali 2019), and intrusiveness/invasiveness (Bleier and Eisenbeiss 2015b; Gironda and Korgaonkar 2018; Van Doorn and Hoekstra 2013) of OBA and how these perceptions influence subsequent behavioral responses. It has been demonstrated that perceived risks associated with OBA exert both direct and indirect negative effects on OBA outcomes through reducing perceived informativeness and entertainment of OBA, while increasing its intrusiveness (Ham 2017; Jai, Burns, and King 2013; Ozcelik and Varnali 2019).

Drawing upon rational choice theory, Chen et al. (2019) examined the mediating effects of perceived costs of non-personalization, opportunity costs, and privacy concerns on the relationship between reactance and affective factors of ownership and vulnerability. Balancing for perceived risks, several studies combined consumer perceptions regarding the potential benefits of OBA under one construct, namely perceived benefits (Ham 2017; Jai, Burns, and King 2013).

Studying OBA in the context of mobile applications, Sutanto et al. (2013) further included process and content gratification in the conceptual framework of OBA. 'Content gratification includes use of the messages carried by the medium, and process gratification relates to enjoyment of the act of using the medium, as opposed to interest in its content' (Stafford and Stafford 2001, 96). Sutanto et al. (2013) found that the provision of a privacy-safe feature (which stores and processes user information locally) in a personalized mobile advertising application resulted in a higher level of users' process and content gratification, when compared to both an app without personalization, and an app with personalization without a privacy-safe feature (which transmits user information to a marketer's central server). Additionally, perceived levels of relevance (Van Reijmersdal et al. 2017) and personalization (Bleier and Eisenbeiss 2015a; Ham 2017) have been shown to influence OBA outcomes.

As it is the case across all types of online advertising, studies in OBA literature also use **click-through intention** and **click-through rate** in survey-based studies and field experiments as proxy measures for advertising effectiveness (e.g., Aguirre et al. 2015; Ozcelik and Varnali 2019; Tucker 2014). On the other hand, attitude toward OBA (Alreck and Settle 2007; Mpinganjira and Maduku 2019), acceptance versus avoidance (Mpinganjira and Maduku 2019; Ham 2017; Schumann, von Wangenheim, and Groene 2014) and reactance (Bleier and Eisenbeiss 2015a; Chen et al. 2019; Ham 2017) are considered as the attitudinal outcomes of OBA.

Critical assessment and future research

The scope and definition of OBA

The Federal Trade Commission defined OBA as: 'the tracking of a consumer's activities online – including the searches the consumer has conducted, the web pages visited, and the content viewed – in order to deliver advertising targeted to the individual consumer's interest' (Stallworth 2010, 481). In addition, scholars in the field use many differing definitions for OBA, Ham (2017, 632) define OBA as 'a type of digital advertising targeting method that tracks and compiles individual Internet users' online behavioral data, such as what websites they visit, how long they stay there, and what they do (e.g., shopping; searching; surfing)'. For Smit, Van Noort, and Voorveld (2014, 15) OBA refers to 'adjusting advertisements to previous online surfing behavior'. McDonald and Cranor (2010, 2) put it as 'the practice of collecting data about an individual's online activities for use in selecting which advertisement to display'.

Boerman, Kruijkemeier, and Borgesius (2017, 364) extracted two common characteristics of OBA from the plethora of definitions existing in the literature as '(1) the monitoring or tracking of consumers' online behavior' and '(2) use of the collected data to individually target ads' and based on these criteria proposed a unifying definition as 'the practice of monitoring people's online behavior and using the collected information to show people individually targeted advertisements'. Online behavior can include web-browsing data, search histories, media consumption data (e.g., videos watched), app use data, purchases, click-through responses to ads, and communication content, such as what people write in e-mails (e.g., via Gmail) or post on social networking sites'. This definition successfully reconciles the differing wordings in the literature and provides an updated list of online behaviors that fall into the domain of OBA at the time of the publication of the article.

However, today, online behavioral data are not only generated by users' mobile handsets or desktop computers, but also by making use of sensors in mobile devices or other robot chaperones that measure ambient contextual attributes, or even user biometrics, in the case of wearable devices (Lamberton and Stephen 2016). For instance, Stock (2019) reports that at least one in five auto insurance policies in the US offers a potential discount if the customer consents to a vehicle monitor. As such, insurers can now target consumers with ads and personalize their price tags based on data provided by robot chaperones. Therefore, the question that warrants repetitive revisits to the definition of OBA is *what qualifies as online behavior?* As of today, the answer to this question is not so straightforward, as it depends upon a number of other questions: What are the latest sources for online behavioral data? Does the consumer have to intentionally do something online (e.g., write a post, watch a video, click an ad) for an online data event to be produced? As the line separating online and offline behavior blurs, does instant geo-location of the user or other offline behaviors that can be recorded via tracking technologies such as video-based face-recognition and/or Bluetooth communication technology qualify as online behavioral data? Near future will bring even more sophisticated ways of producing individual-level data along with the introduction of a novel set of interconnected technologies. Therefore, the demarcation of the conceptual domain of OBA should be as follows: *to the extent that a behavior can be monitored and recorded as a data event linked to an individual profile and can be used for personalizing online advertisements, it qualifies as an online behavior.* This guiding principle of demarcation might be helpful for future research in all three layers of OBA research as defined in the present review.

The theoretical underpinnings of OBA

The majority of the studies reviewed in the present study stand upon the pillar of increased relevance of the ad in explaining why OBA should excel, if it does, in terms of performance (i.e., click-throughs, purchase, acceptance, etc.) when compared to non-behaviorally targeted ads. For instance, Bellman et al. (2013) research highlight was demonstrating how changes in ad relevance affect attention and ad exposure. The underlying assumption has roots in the elaboration likelihood model (ELM), such that the more personal and relevant a message is, the more likely that the message will be noticed, hence be more effective (Petty, Cacioppo, and Schumann 1983). Since behavioral tracking and profiling enables inferring a person's general interests and salient needs, and delivering the online ad at the right time (i.e., while searching for a particular product), the resulting ad exposure should, in theory, be more relevant.

On the other hand, the loss of personal privacy (e.g., Antón, Earp, and Young 2010; Zarouali et al. 2017), and perceived risks associated with OBA (e.g., Ham and Nelson 2016; Jai, Burns, and King 2013; Ozcelik and Varnali 2019) are included in theoretical models to capture the downside of OBA (i.e., having a deteriorating effect on OBA acceptance). This overview reflects social exchange theory (e.g., Thibaut and Kelly 1959), which suggests that people evaluate social exchanges in terms of costs and benefits. Consequently, consumers should accept OBA if they perceive that the benefits arising from increased relevance of online ads are greater than the corresponding cost to their privacy (Schumann, von Wangenheim, and Groene 2014). Drawing upon this theoretical

foundation, multiple theories have been employed to enrich the domain of inquiry with a multitude of antecedent and mediating variables. The persuasion knowledge model (Van Noort, Smit, and Voorveld 2013; Ham and Nelson 2016), psychological reactance theory (Aguirre et al. 2015; Bleier and Eisenbeiss 2015a; Tucker 2014), privacy calculus theory (Girona and Korgaonkar 2018) and information boundary theory (Sutanto et al. 2013) have been used to explicate potential costs of OBA, while uses and gratifications theory (Ozcelik and Varnali 2019; Sutanto et al. 2013) has been mainly used to identify potential benefits as reflecting positively upon the advertising value.



One study singles out from the rest of the literature as it adopts a completely fresh theoretical perspective on how behaviorally targeted ads work. Summers, Smith, and Reczek (2016) empirically demonstrated that behaviorally targeted ads provide consumers with information about themselves from an external source, and that via recognizing an implied social label, consumers make adjustments to their self-perceptions, which serially mediate behavioral intentions. Apparently, there can be other explanations for the effectiveness of OBA, other than the 'relevance argument' strictly based on the social-contract theory, which inevitably brought the research in OBA to the dead-end of privacy-personalization paradox. There is immense potential in adopting lenses of fresh theories in future research in OBA to widen our perspective on how behaviorally customized ads might have an influence on consumers' decision-making process and behavioral market responses.

Future research agenda

The two types of consumer characteristics that have been mentioned several times in the contributing studies are privacy concerns and persuasion knowledge. It is intuitive to regard privacy concern and persuasion knowledge as the usual suspects for explaining the downside of OBA, as the most prevalent unique feature of OBA is the way it collects and uses sensitive personal information. The majority of the studies have found corroborative findings regarding the persistent negative effect of privacy concern on the acceptance and effectiveness of OBA (Lee et al. 2015; Smit, Van Noort, and Voorveld 2014). Employing a qualitative inquiry, Moore et al. (2015) even concluded that consumers often find the practice of behavioral tracking as invasive, in violation of social norms, annoying, and even 'creepy'.

Interestingly, by combining the two constructs, privacy concern, and persuasion knowledge, Ham (2017) identified a boundary condition. According to Ham (2017), the likelihood of a consumer's acceptance of OBA might be dependent upon whether the marketer's persuasion intent is inferred as cooperative or not (i.e., whether the persuasion attempt will help the consumer to achieve his or her goal). When the marketer's intent is not perceived as cooperative, it might be inferred as manipulative, and subsequently concerns over invasion of privacy override the potential benefits of relevance (Ham 2017). The literature might benefit much from future research exploring such interaction effects among the constructs identified in this review. For instance, since it is now well established that the stage the consumer is in along the decision-making process has an effect on effectiveness of and reactance toward OBA (Bleier and Eisenbeiss 2015b; Lambrecht and Tucker 2013; Van Doorn and Hoekstra 2013; Urban

et al. 2013), the observed effects of design and implementation strategies, as well as the consumer characteristics might differ on each stage of the consumer journey.

The majority of the existing studies on exploring the effectiveness of OBA conspicuously reduce the practice of OBA into a two-player game including only the advertiser and the targeted consumer, disregarding the third player, publisher. Not only the publisher's welfare is a crucial predictor of the potential future of OBA (Chen and Stallaert 2014), but also the publisher constitutes the context in which OBA is delivered. In this respect, several issues may have significant direct and indirect effects on the process through which OBA creates conversions.

The first issue is about context-ad mismatch that might occur despite of the context-aware ad distribution. A user labeled as a potential car buyer might be shown a banner display ad of an auto brand, right within an editorial news piece he was reading about the statistics of recent deadly car accidents. Another user labeled as a potential customer of a mothers-only-event might be shown a promotional ad regarding a relatively high-risk outdoor sports group event for mothers, while reading a blog article about how badly babies need the presence of their mothers for a healthy emotional development (thus reducing her risk-taking appetite). These are not examples of a context mismatch by relevance, because a news article about automobiles is a highly relevant context for an automobile ad. Similarly, a blog article about babies is a highly relevant context for a mothers-only-event ad. However, these are examples of difficult to predict and avoid instances of context mismatch, exposing advertising brands to severe safety issues. Applying obsessive filtering on potential context – ad mismatches might overcome this problem, but it would also significantly reduce the number of alternative advertisers for a specific target customer on a specific website, which would eventually render OBA an inferior ad technology in terms of revenue generation for publishers when compared to non-behaviorally targeted ads (Gal-Or, Gal-Or, and Penmetsa 2018). How to tackle this conundrum presents a potential research avenue.

Another important issue is the unaccounted effect of the attitude toward the publisher on the effectiveness of OBA. Negative reactions triggered by OBA (either because of inaccurate targeting or merely because of the feeling of intrusiveness or loss of privacy) might reflect not only on the attitudes toward the ad and the advertiser brand, but also on the attitudes toward the publisher, as well, which in turn might have negative effects on the overall ad effectiveness on a particular publishing website. Overall, research in OBA would significantly benefit from future works appreciating the three-layered structure of OBA and modeling potential interaction effects between the characteristics of target consumers, the personalized ad, and the website in which the behaviorally customized ad is delivered.

Another potential research avenue is exploring the relative performance of OBA across different industries, types of brands and products. The relevant literature provides very limited insight regarding this issue. Summers, Smith, and Reczek (2016) interpret their findings to suggest behaviorally targeted ads are likely to be more rewarding for brands with a large share of a category associated with a personality attribute, such as Whole Foods (being 'healthy') or NorthFace (being 'rugged' or 'outdoorsy'). Another study conducted in the context of Facebook provides corroborative evidence for this conclusion (Lee, Hosanagar, and Nair 2018). From another perspective, Bellman et al. (2013) suggest that since ad relevance matters more for low-involvement products, which have a short pre-purchase search process, using web-browsing behavior to make inferences about current ad relevance is more accurate for low-involvement products. These findings signal

that there is potential in further exploring this issue via cross-industry and cross-category research.

Cross-cultural studies in the domain of OBA are also quite scarce. Only one such empirical study was identified in the present review, and it found significant differences between China and Netherlands (Yu, Hudders, and Cauberghe 2017); hence the search for a single, global OBA strategy may be imprudent. Further research is necessary for better understanding of the cultural dimensions that may have influence on the acceptance of OBA.

Very little insight exists on how to best leverage triangulation of OBA and contextual targeting. The practice of mobile behavioral advertising involves monitoring and analyzing customer mobile browsing behavior and location in order to provide behavior-based personalized advertisements (Mpinganjira and Maduku 2019). Real-time geolocation of individuals can be obtained ubiquitously by using mobile carriers' geolocation aware technological infrastructures (Varnali and Toker 2010) or via online self-disclosures of consumers in social media, such as check-ins in Foursquare and sharing of geo-labeled photos in Instagram (Varnali and Toker 2014). Indeed, using an individual-level click-stream data set of an automobile advertising from an Internet advertising intermediary, Lu, Zhao, and Xue (2016) demonstrated that behavioral targeting performs better when combined with contextual targeting. An experimental study by Xu et al. (2011) suggest that consumers are more likely to regard location-aware marketing as valuable if advertising messages are perceived to be relevant and customized to their context. Future research should consider to explore this issue further to provide a more nuanced understanding of how the use of contextual information might enhance the predictive ability of profiling based on online behavioral data and reflect upon consumer responses toward OBA.

Finally, only a handful of articles focused on how the emerging field of online tracking, data aggregation, and analytics affect relevant industries. Changes in the economics of supply and demand in online advertising, free-internet funded by advertising, changes in the advertising and media industries, shifts in ad revenues, new players, and changes in marketing strategy constitute the dominant themes in these conceptual articles (Christiansen 2011; Goldfarb and Tucker 2011b; Greengard 2012; Sinclair 2016; Popescu 2014). These articles have been instrumental in terms of providing anecdotal evidence and a narrative plot to the relevant academic literature. However, empirical research that illustrate the industry-level effects of OBA and how it relates to the course of changes occurring in relevant industries, especially in advertising and media, is non-existent.

The present research organized the accumulated knowledge in OBA into a three-layered structure, synthesized and critically assessed progress in each layer, and provided future research directions. The technology driving personalized advertising and its consequences on consumer behavior has been evolving much faster than its corresponding discussion in academia and society. This review underscores that the potential future of OBA depends not only on how well it performs in terms of driving individual consumer responses to online ads, but also on its ability to sustain increased revenues to publishers and how it meets ethical standards and legal requirements. One of the contributing factors to the paradoxical status of the practice of OBA is the long-enduring idea that content on the Internet is or should be 'free'. Future research in this domain will eventually have to focus on how

policymakers and publishers can walk consumers past the idea that content is free and help them fully understand the currency value of their online behavioral data.

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No potential conflict of interest was reported by the author.

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