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Contributions to attention based marketing: Foundations, insights, and challenges

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ABSTRACT

This special issue compiles a set of cutting-edge articles that use eye tracking methodology to address unresolved problems in Attention Based Marketing (ABM). Understanding consumers' attention, how it influences their behavior, and how to win the competition for attention are the main goals of ABM. We define ABM as a discipline, outline its theoretical and methodological foundations, summarize insights provided by this special issue, and discuss open challenges and research questions.

Attention is the ultimate scarce resource in today's overcrowded markets. As the flood of information raises, the collective attention span seems to diminish. In just three years the average life time of popular social media topics fell from 17.5 to 11.9 h (Lorenz-Spreen, Mønsted, Hövel, & Lehmann, 2019) and we should expect this development to continue as the volume of information continues to grow. Consequently, understanding how to attract, retain, and guide consumers' attention is paramount for the success of many businesses and the increasing recognition of the value of attention has led to the emergence of the so-called "attention economy" (Davenport & Beck, 2001). Only relatively recently has marketing research begun to delve deeper into the role that attention plays in cognitive, affective, and choice processes in the marketplace. While marketers have long acknowledged the necessity of capturing attention, only since the turn of the century have studies begun to show that attention serves much broader roles than merely generating consumer awareness. Instead, attention plays an active role in shaping consumer behavior and the fundamental processes that are involved are now becoming clear, in a large part due to the application of eye tracking to measure attention. Understanding the interconnections between attention and action is even more important as our computers, smartphones, and other digital devices are equipped with eye tracking hardware or software that enable measuring consumers' attention unobtrusively in realworld settings (Bulling & Wedel, 2019).

How to understand and tackle the new possibilities created by the combination of ubiquitous measurement of attention, improved understanding of underlying cognitive processes, and new analytical techniques tailored to their analyses, is the goal of Attention Based Marketing (). We define ABM as a sub-discipline of marketing; it investigates the role of attention by measuring consumer gaze, assessing the impact of its antecedents, and predicting its consequences, to optimize marketing effort and enhance consumer well-being. It is based on insights from consumer behavior, vision research, cognitive psychology and neuroscience. This new discipline emerged as a result of the widespread adoption and use of eye tracking technology and the emergence of the attention economy. Marketing has seen new subdisciplines based on the emergence of other technologies, such as online marketing – from the growth of the World Wide Web, and mobile marketing – from the common use of smartphones. Similarly, ABM is driven by the deployment of hard and software for eye movement recording. By allowing marketers to capture and capitalize on a fundamental but previously unobservable component of consumers' cognitive processes, the practice of ABM provides a strategic advantage in the competition for attention in consumer market places characterized by information overload. This special issue is positioned against this backdrop and purports to showcase research pushing the boundaries of this relatively new field. In this editorial, we describe and define this emerging discipline, its theoretical and methodological foundations, the insights it has already generated, the contributions to it by research in this issue, and the questions and challenges it still faces.

1. Theoretical foundations of ABM

The main research challenge for ABM is how to make sense of eye movements to understand consumers' attention and other cognitive processes. Like other disciplines, ABM research shares a set of discipline-specific theories and concepts. In ABM, these concern eye movement control processes (the two main types of eye movements studied are saccades, rapid jumps of the eyes from one position to another, and fixations, periods where the eye is relatively still and information is extracted), the role of attention and its relation to consumer behavior and to firm performance. These assumptions have been summarized in three tenets (Pieters & Wedel, 2007): (a) Attention is not a mere gate or first stage, but a fundamental part of consumer behavior that mediates exploration, search and choice, (b) Measuring attention can only be done with eye tracking, (c) Attracting and retaining attention is difficult and costly for firms, yet central to business success.

Theoretically-oriented ABM research builds on these assumptions in two main ways: by developing and testing integrative theories, or by relying on auxiliary theories to generate marketing insights. Integrative ABM theories make a direct connection between high-level psychological processes such as decision-making, brand learning, or product usage and measures of attention such as fixation counts, saccade lengths, or fixation durations. For instance, what interplay of cognitive processes explains that a consumer makes several fixations on a brand but ultimately chooses another, or that consumers fail to fixate the

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brand element in an ad? In recent years, several new theories that describe the often complex relation between attention and behavioral processes have been developed. The statistical models developed for this purpose, mainly in the areas of visual search and decision-making, integrate high-level cognitive decision processes. For example, Towal and colleagues proposed a two-step drift diffusion model of consumer choices where eye movements are determined first and choices arise as a function of the allocation of attention (Towal, Mormann, & Koch, 2013). Other authors have developed integrative models of search (Van der Lans, Pieters, & Wedel, 2008a, 2008b) and decision-making (Reutskaja, Nagel, Camerer, & Rangel, 2011; Stüttgen, Boatwright, & Monroe, 2012) that were directly tested with eye tracking data. By integrating high and low levels of cognition and eye movement control, these models gain several advantages: focus on only relevant eye movement metrics, a clear interpretation of eye movement metrics and their relation to cognitive processes, and specific and testable predictions.

A second type of ABM research draws on general theories of consumer behavior that do not directly link to attention. This line of research often relies on auxiliary theories on eye movement control processes in order to test more general hypotheses about consumer behavior. This special issue includes several articles that fit into this research tradition. Myers and colleagues (Myers, Deitz, Huhmann, Jha, & Tatara, 2019) examine the effect of taboos in advertising on consumer attention and rely on auxiliary theories concerning the moderating effect of visual complexity (Donderi, 2006; Pieters, Wedel, & Batra, 2010). In a similar vein, in research by Gordon-Hecker and colleagues, hypotheses about consumer reactions to different types of price promotions are tested (Gordon-Hecker, Pittarello, Shalvi, & Roskes, 2019). Since previous literature on price promotions is silent on consumer attention, the authors use auxiliary theory drawn from research about the close relation between fixation counts and consumer preferences (Orquin & Mueller Loose, 2013). Simola and colleagues (Simola, Kuisma, & Kaakinen, 2019) examine how direct versus indirect advertising influences consumers by using auxiliary theory about the relation between the length of eye saccades and focal versus ambient attention (Follet, Le Meur, & Baccino, 2011; Pannasch, Schulz, & Velichkovsky, 2011). Meißner, Oppewal, and Huber (2019) study how consumers adapt to repeated choice tasks by using auxiliary theory concerning, among other things, the relation between fixation counts and cognitive effort (Kwak, Payne, Cohen, & Huettel, 2015) and between fixation direction and decision strategy (Böckenholt & Hynan, 1994). Vriens, Vidden, and Schomaker (2019) and Florack, Egger, and Hübner (2019) examine the effect of gaze on consumer choice and rely on auxiliary theory about stimulus exposure and preferences (Zajonc, 1968). Thus, this special issue contains a particularly rich set of articles that rely on auxiliary theories of eye movements to formulate hypotheses and generate insights into advertising and promotion effectiveness, consumer preferences and decision-making.

The auxiliary theories typically concern one of three aspects: bottom-up control, top-down control, or downstream effects. Bottom-up control refers to the influence of the visual environment on eye movements, e.g. the effect of visual complexity, visual salience, sizes of objects or areas of interest, or spatial stimulus position. These factors have been shown to influence the allocation of eye movements often independently of the goals or preferences of the consumer (for reviews see Orquin, Perkovic, & Grunert, 2018; Rayner, 2009; Wedel & Pieters, 2006). In this special issue, auxiliary hypotheses about bottom-up control are found in Myers and colleagues (2019) and Wang and colleagues (2019) in both cases relating to the role of visual complexity.

Top-down control refers to the influence of internal psychological factors on eye movement allocation (for a review see Orquin & Mueller Loose, 2013). In this special issue and elsewhere, auxiliary theories about top-down control take into account the effect of goals and preferences on eye movements (Gordon-Hecker et al., 2019), the effect of search styles (Simola et al., 2019), or the implications for decision processes (Meißner et al., 2019). Some studies jointly examine top down and bottom up factors (Orquin, Bagger, Lahm, Grunert, & Scholderer, 2019; Sheng et al., 2019).

Finally, auxiliary theories about downstream effects predict the influence of eye movements on behavior, e.g. that consumers are more likely to choose products they gaze at longer or early in the decision process (for reviews see Orquin et al., 2018; Wedel & Pieters, 2006). Examples in this issue are from the work by Vriens, Vidden, and Schomaker (2019), Florack and colleagues (2019), and Sheng and colleagues (2019).

Auxiliary theory is essential to selecting and interpreting eye movement metrics. There is a wide range of possible eye tracking metrics available to ABM researchers (for an extensive list, see Holmqvist, Nyström, Andersson, Dewhurst, & Halszka, 2011), but selecting the relevant ones and interpreting them in terms of attention, effort, decision style, etc., require an explicit measurement model to relate them to the underlying attentional constructs of interest. They should ideally be organized in an extensive nomological network that reflects their relationships to bottom-up and top-down factors, and to downstream effects, which requires one or more auxiliary theories. Ideally, ABM researchers should understand and be explicit about their auxiliary hypotheses as in the examples discussed here.

2. Statistical foundations of ABM

In ABM research, the standard toolkit of consumer behavior researchers, in particular ANOVA, multiple regression, logistic regression, and mediation analysis, is often applied to analyse eye movement data. However, eye movement metrics mostly do not follow a Normal distribution. For example, fixation frequencies are best described with a Poisson distribution, and the area of interest first fixated follows a Bernoulli distribution. In addition, eye movement data mostly has a hierarchical structure, with repeated measures (areas of interest, brands, ads, etc.) for each participant. This necessitates the use of multilevel generalized linear models, such as hierarchical linear, logistic and Poisson regression. This special issue showcases many powerful applications of these models (see for example, Florack et al., 2019; Meißner, Oppewal, and Huber, 2019; Simmonds, Bellman, Kennedy, Nenycz-Thiel, & Bogomolova, 2019; Simola et al., 2019; Vriens, Vidden, & Schomaker, 2019; Zuschke, 2019). They improve on traditional statistical analyses, because they allow for distributional assumptions that reflect the measurement properties of eye movement metrics, accommodate hierarchical data structures resulting from repeated measurement designs, and reflect unobserved individual differences in the response to the experimental treatments. Recently, Bayesian extensions of these models have been developed offering additional advantages in that they alleviate some of the problems of classical null-hypothesis significance testing (NHST), allow one to quantify support for (rather than only reject) a null-hypothesis, and are valid for the small sample sizes common in experimental research (Wedel & Dong, 2019). In this special issue, Pieters and Wedel (2019) deploy such Bayesian approaches to the analysis of attention data. We hope to see more widespread application of these methods to eye movement data in the future.

Nevertheless, by formulating models that represent cognitive and behavioral principles, eye movement data have been analysed in more fundamental ways. By relying on auxiliary theories to formulate hypotheses, calculating eye movement metrics that represent the constructs in those theories, and then formalizing a statistical model to describe the associations between the metrics and bottom-up, top-down and downstream factors, statistical models are developed that directly reflect the theories and allow them to be tested. In this special issue, examples are the finite mixture model for attribute non-attendance in conjoint analysis by Yegorian, Guhl and Klapper (2019), and the artifical neural network that links bottom-up factors to gaze hits on dynamic stimuli by Rumpf, Boronczyk, and Breuer (2019). These

approaches fit in a sizable and growing literature that blends behavioral theory, eye movement data collection and statistical modeling to develop integrated models of visual perception, search and choice (see, for example Van der Lans, Pieters, & Wedel, 2008b, 2008a; Reutskaja et al., 2011; Stüttgen et al., 2012). This has the potential to incorporate deeper theories, postulating a theory-based data-generating mechanism, separating out the effects of multiple component processes from a single set of observed data, and to provide novel theory-driven insights.

3. Methodological foundations of ABM

It is in the very definition of ABM to rely on eye tracking in one of its many forms: desktop, mobile, or through newer pervasive methods. The mere use of eye tracking is, however, not a fulfilling description of the methodology of ABM. Measures corrolary to eye movements, including pupil dilation, blinks, facial expressions, and head movements (Pieters & Wedel, 2019) are also used to an increasing degree. There are many use scenarios for the application of eye tracking in marketing, and various aspects of the general approach to a problem may differ depending on the research goal. ABM is fundamentally problem oriented, seeking to understand and improve on (visual) marketing stimuli, marketing effectiveness, and consumer behaviors. Addressing these issues effectively through the use of eye tracking and related methods introduces the need to rely on theories, methods and findings from basic science concerning the cognitive mechanisms underlying eye movement control and the methods that should be used to assess them. In Stokes' terms, ABM is situated squarely in Pasteur's quadrant (Stokes, 2011) combining basic and applied research. ABM involves integrative research, by necessity at the intersection of disciplines that include marketing, economics, psychology, statistics and computer science. In this, ABM perhaps should be no different from consumer psychology in general, but the use of eye tracking leads to methodological considerations that are unique to ABM and that pose more stringent demands on the integration of theories and methodologies across disciplines.

What does it mean to be problem oriented when working with eye tracking? First, the problem in question must be a recurrent one that is important enough to warrant scrutiny and enable generalization of findings across contexts, situations or stimuli (ads, shelves, products, brands, etc.). Second, and more specific to eye tracking is the need to map the structure of the problem or situation and to address one or more specific aspects of this structure. For example, in their work on size effects in advertising, Pieters and Wedel content analyzed 1363 ads and showed that there is a consistent structure to the size of elements in advertising: the largest element being the pictorial followed by the text and finally the brand (Pieters & Wedel, 2004). They found, however, counter to the common belief in practice, that it is not the size of the picture but that of the brand element that has the most impact on attracting attention to these elements, while only the size of the text element increases attention to the ad as a whole. In a related study, the authors analyzed 249 ads and demonstrated that ads are subject to considerable variance in feature and design complexity, and that the latter improves attention capture for the ad while the former hurts attention capture for the brand (Pieters et al., 2010). In the area of fast moving consumer goods, Orquin and colleagues analyzed 158 food products and found a consistent structure in the size, salience and position of packaging elements: brand-related elements are larger, more salient, and more centrally positioned while health and nutrition elements are the smallest, least salient and most peripherally positioned elements. The authors showed that this structure leads consumers to ignore health and nutrition information resulting in less healthy food choices (Orquin et al., 2019). In these examples, the authors took care to map the structure of the consumer environment and to examine it in the laboratory using a representative research design (Brunswik, 1956). The aim of this mapping is not only to achieve ecological validity but also to enhance internal validity. Without such a prior mapping, it is very likely that the experimental stimuli are not representative. Because eye movements are highly susceptible to context, non-representative stimuli may lead to entirely different results due to selective feature sets (e.g. the brand being smaller than average and therefore not attracting as many fixations). The problem with potentially non-representative stimuli is ameliorated to some extent by using more exemplars, i.e. more ads or products in the previous examples (Orquin & Holmqvist, 2018, 2019). Studies in which one investigates only a single ad or product might be useful for one particular company but are close to useless in generating generalizable findings.

Ensuring that the experimental stimuli are representative of a real consumer stimulus or situation is important, but other issues remain. Just as eye movements are susceptible to selective stimulus features, they also respond to the task or paradigm (Pieters & Wedel, 2007). The "hypothetical bias" is a well-known challenge (Murphy, Allen, Stevens, & Weatherhead, 2005), but in ABM little is known about to which degree hypothetical scenarios bias results. A few indications may be found in studies comparing lab-based versus mobile eye tracking (Foulsham, Walker, & Kingstone, 2011). In general, it is advisable to avoid what has been termed "mushy variables" wherever possible, i.e. measuring consumers' own beliefs about their attention, memory, or behavior rather than directly measuring these constructs themselves (Woodside, 2016). Previous ABM studies have, for instance, mitigated this challenge by comparing eye movements to feature advertising with actual sales data from stores (Zhang, Wedel, & Pieters, 2009). Others collected data directly in the consumer environment by means of mobile eye trackers (Gidlöf, Anikin, Lingonblad, & Wallin, 2017; Otterbring, Wästlund, Gustafsson, & Shams, 2014). Unfortunately, such efforts to ensure realism are not common and many studies unintentionally reduce external validity by relying on fixed exposure time, i.e. predetermined stimulus exposure rather than allowing participants to decide the pace (for discussion of this, see Orquin & Holmqvist, 2018, 2019). Fixed exposure times unfortunately reduce realism in application contexts where consumers may decide to terminate the exposure at any time, thereby diminishing the representativeness of results for real-life scenarios. In this special issue, comparisons are provided by Simola and colleagues (2019), and Vriens and colleagues (2019).

More research on the role of stimulus and task realism in ABM is needed, and future studies should address this by, for instance, comparing results obtained in lab versus field situations, or under hypothetical versus incentive compatible paradigms. Furthermore, in working towards better research practices, ABM must sooner or later adopt the standards of open science. Adopting those standards will lead to more reproducible and replicable results and therefore better marketing decision-making. In the current special issue, we see a gradual move towards open science: replications of own studies (Pieters & Wedel, 2019; Sheng et al., 2019; Simola et al., 2019; Vriens et al., 2019), replications of studies of others (Florack et al., 2019), open data (Krefeld-Schwalb & Rosner, 2019; Orquin et al., 2019), open stimuli (Vriens et al., 2019; Wang, Ma, Chen, Ye, & Xu, 2019), reanalysis of shared data (Yegoryan, Guhl, & Klapper, 2019), and a transition from null-hypotesis significance testing to a more complete quantification of evidence for hypotheses and predictive validity (Rumpf et al., 2019). We hope that ABM will take a leading position in the use of open science practices.

4. Insights from attention based marketing

Insights from attention based marketing has played and will continue to play an important role in the attention economy whenever companies compete for consumer attention. The insights can be structured broadly in three categories: insights on marketing stimuli, on consumer psychology, and insights related to interactive gaze technologies. The three topics in that order correspond roughly to the historical development of the discipline. This special issue contributes in

various ways to extant knowledge.

Research on consumer attention to marketing stimuli is characterized by a perspective where focus is on the optimization of marketing stimuli such as promotional material, product presentation, pricing, physical environment, or staff, and eye tracking is instrumental to achieving this goal. This line of research has been defining for ABM and pioneered by previous studies on promotional material which have sought to optimize the presentation of ad elements such as the brand, image and text (Pieters, Wedel, & Zhang, 2007). In this special issue, other topics have been examined such as the effectiveness of personalized ads (Pfiffelmann, Dens, & Soulez, 2019), the use of taboo elements in ads (Myers et al., 2019), the effectiveness of direct versus indirect messages in ads (Simola et al., 2019), or the optimal placement of sponsorship ads (Rumpf et al., 2019).

To a large extent research on product presentation has been concerned with product packaging and with the role of product labels and attributes on consumer attention and choice (for reviews see Graham, Orquin, & Visschers, 2012; Van Loo, Nayga, Campbell, Seo, & Verbeke, 2018). In this special issue, a new perspective is presented on the visual ecology of product packaging (Orquin et al., 2019) and another study examines the visual design of online stores and the use of images in e-commerce (Wang et al., 2019). ABM research on pricing strategies is a relatively new area, which has been pioneered in this issue with two studies on the role of unit pricing (Bogomolova, Oppewal, Cohen, & Yao, 2019) and buy-one-get-one-free deals (Gordon-Hecker et al., 2019). Research on the physical environment has previously dealt with elements of store design such as the use of signage in supermarkets (Otterbring et al., 2014). In this issue, we find the first study on the effect of instore lighting on consumer attention (Laski, Brunault, Schmidt, & Ryu, 2019), and this special issue also presents the only study thus far on the role of attention during sales encounters (Arndt, Khoshghadam, & Evans, 2019).

Research on consumer psychology takes the consumer rather than the marketing stimuli as its focal point and aims at understanding psychological processes such as perception, learning, recall, search, or decision-making. Along these lines, studies in this special issue examine the effect of prior brand use on attention to TV ads (Simmonds et al., 2019) and the coordination of body and eye movements during ad viewing (Pieters & Wedel, 2019). Other studies in this issue focus on consumer adaptation to changing decision environments (Meißner et al., 2019), the role of cueing on recall and (online) decision-making (Krefeld-Schwalb & Rosner, 2019), or the use of eye tracking to infer and model consumer preferences (Yegoryan et al., 2019). This special issue also presents an extensive review based on co-citation analysis (Zuschke, 2019), which reveals the connections between the various research streams on consumer psychology.

The most recent research topic in ABM revolves around interactive gaze technologies. Processing gaze data collected from consumers' interaction with digital devices in real time creates large datasets and various interesting possibilities for research and marketing optimization. By combining virtual reality and eye tracking, researchers have begun developing shopping support systems that respond interactively to what consumers are looking at and make recommendations based on product similarity (Meißner, Pfeiffer, Pfeiffer, & Oppewal, 2019). The same shopping support was also made possible by combining eye tracking and augmented reality (Pfeiffer, Pfeiffer, & Meißner, 2015). Bigne, Llinares, and Torrecilla (2016) presented initial findings that specific eye tracking metrics are associated with purchase behaviors in virtual reality settings. Considering that eye tracking is likely to become an everyday technology in the near future (Bulling & Wedel, 2019), this line of research might grow considerably when gaze data becomes as ubiquitous as click stream data. Add to this that it is possible to estimate consumer preferences from eye movements alone (Glaholt, Wu, & Reingold, 2009; Vriens et al., 2019), and the future of interactive gaze technology seems to present rich opportunities for personalized marketing.

5. Research questions and challenges in ABM

The three research areas discussed above will most likely remain important topics also in future research in ABM. Although much has been learned over the past decades, many research questions remain at least partially unresolved, and the articles in this special issue hint at several of these. For example, a very fundamental issue is how attention shapes and is shaped by consumer decision processes. Several studies have pointed to causal effects of attention on choice (Armel, Beaumel, & Rangel, 2008; Ghaffari & Fiedler, 2018; Pärnamets et al., 2015). The work by Florack et al. (2019), Meißner, Oppewal, and Huber (2019), and Yegoryan et al. (2019) in this issue builds on that. Nonetheless, the exact mechanisms driving these effects need to be explored in depth, especially in real-life contexts outside the laboratory. Another critical extension of current research streams concerns the coordination of visual attention with attention to other sensory modalities, such as auditory, olfactory, gustatory, and proprioceptive. For example, (Lwin, Morrin, Chong, & Goh, 2016) studied attention to olfactory and visual cues. In particular the coordination of visual and auditory attention needs more investigation. Such coordination may occur when watching television, or when using multiple media simultaneously, for example watching television while searching on a tablet or cellphone for information (Brasel & Gips, 2011). One question is whether commercials in the "peripheral channel" (say audio) have a smaller effect than when fully paying attention to them.

Then, research has commonly focused on a few popular eye movement metrics, which was needed especially in the early stages of the development of the ABM discipline and helped to establish a core of coherent and generalizeable findings. Now attention research has the potential to move beyond this in several directions. One direction addresses visual attention as a coordinating mechanism of body, head, and eye movements, as (Pieters & Wedel, 2019) in this issue point to. Their findings suggest that the head position during ad exposure contains additional information about consumer attention, independent of eye movements. These findings should be generalized to other tasks and contexts, and with other stimuli, such as when consumers make brand choices on their smartphones or tablets. In addition, the value of measures such as pupil dilation, blinks and facial expressions should be further explored. A second direction is attention during very short exposures to brands and ads (Satomura, Wedel, & Pieters, 2014; Wedel & Pieters, 2014). Typically, these exposures are too short to make eye tracking a useful research tool, but they do fall squarely in the purview of ABM. It has only recently begun to become clear what can be communicated during such short exposures, but many research questions remain, for example about the cumulative effect of multiple of those brief exposures for various types of ads.

Elements of the classical marketing mix, including pricing (Bogomolova et al., 2019), promotions (Gordon-Hecker et al., 2019), advertising (Myers et al., 2019; Pfiffelmann et al., 2019; Rumpf et al., 2019; Simola et al., 2019), sales (Arndt et al., 2019), and distribution (Laski et al., 2019) were studied in contributions to this issue, yet the important role that attention was revealed to play in consumer reactions to the mix calls for a yet broader and deeper exploration. Especially in the area of advertising many issues remain. More work is needed on the joint effects of advertising repetition and self-paced and forced exposure durations on attention and memory. Further, emerging forms of advertising, such as retargeted ads, search advertising, pre- and post-roll ads, social media advertising, video ads, trailers and clips need more research, while the potential role of eye tracking in the attribution of advertising effects remains unexplored.

Besides these, the role of attention in many newer areas of marketing, such as search, recommendation, social, mobile, and location-based marketing, as well as in the processing of product comparison pages, product reviews, and blogs is virtually uncharted, yet all of these forms of marketing have an important visual component, and information overload is common. With future everyday eye tracking and

the big gaze datasets it will likely become an important area of inquiry as well. Here the approach becomes real time, interactive and dynamic, and will cut across media and devices. ABM will become normative in the sense that marketing decisions can be optimized in real time, using gaze contingencies, based on theories and models applied to eye movement data. Application areas extend further into natural user interfaces, robotics, virtual and augmented reality, and artificial intelligence. Eye tracking will be truly democratized if it becomes available for any consumer interacting with any digital device. Eye movement and facial expression data then become available on a massive scale, but consumer concerns over privacy are important, and it is good business practice, and a legal requirement, to address them. What consumers' concerns are and how they are best addressed is another area of future research. In this issue, Sheng et al. (2019) investigate attention to online privacy information. Although many questions remain, this special issue compiles an exciting collection of articles pushing some of the current boundaries of ABM research, and hopefully laying the foundations for those future explorations.

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