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Accidentally Attentive: Comparing visual, close-ended, and open-ended measures of attention on social media

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ABSTRACT

The question of how to measure exposure to different types of content on social media grows in importance with increased use of these platforms. Social media further complicate this task by bringing diverse content into the same space, raising the question of whether selective exposure or incidental exposure theories best explain attention patterns. We contribute to this debate in two ways. First, we test how well visual attention aligns with expressed content preferences to understand attention online. Second, we compare visual attention to diverse social media content to two types of self-reported measures of recalled attention to content – close-ended versus open-ended – to examine how best to measure attention. Using eye tracking, we demonstrate that visual attention to social, news, and political posts is not associated with interest in those topics, suggesting attention to content seen incidentally on social media is quite high. Second, we find that visual attention to social and political (but not news) posts relates to close-ended self-reported measures of recalled attention, but visual attention is associated with open-ended recalled attention only for political posts. We propose that researchers need to go beyond measures of exposure and carefully consider how best to measure attention to social media content.

1. Introduction

Social media have exploded over the last decade, rapidly becoming a dominant form of communication. They can serve as a source of news and information, an opportunity to connect with friends and peers, or a space in which individuals produce and share their own content (Pew, 2015). As social media use grows, it is of increasing importance to understand how people spend their time while engaged with social media—are they engaging with political content? Watching cat videos? Keeping up with their community? Because the answers to these questions affects people's knowledge and behaviors (Bode, 2016a; Boulianne, 2015; Gil de Zúñiga, Jung, & Valenzuela, 2012), it therefore also matters that researchers are confident in the measures they use to determine who is paying attention to diverse content on social media, and whether users can report such exposure accurately. This study integrates work from cognitive psychology, media psychology, and journalism to address the important question of attention to content, as well as the methodological question of measuring such attention via

self-reports.

Two theoretical frameworks can be used to explain the types of content that garner attention on social media. According to the incidental exposure framework, the intersection of different forces – choices by an individual but also by a diverse social network, strategic actors, and algorithmic curation – offer new opportunities for people to encounter otherwise-avoided topics and perspectives (Bode, 2016a; Kim, Chen, & Gil; de Zúñiga, 2013; Thorson & Wells, 2015; Vraga, Bode, & Troller-Renfree, 2016b). In contrast, the selective exposure framework would suggest that social media represent one more place where individuals can deliberately select information according to their preferences, which are then reinforced by social media companies attempting to maintain attention (Bakshy, Messing, & Adamic, 2015; Pariser, 2012).

We see these two possibilities as conflicting hypotheses and consider the extent to which they play out in the social media environment. To do so, we go beyond mere exposure to focus on the role of *attention*. Whereas exposure measures simply whether someone has come into

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contact with something, attention measures more deliberate consideration of that content.

The selective exposure argument is predicated on a belief that an active audience chooses which content to pay attention to based on their preferences (Arceneaux, Johnson, & Cryderman, 2013; Prior, 2005; Skovsgaard, Shehata, & Stromback, 2016; Sundar & Limperos, 2013). However, preferences for particular content, even within social media, may be overruled by other factors that shape attention, such as content source, social cues, post type, or format (Messing & Westwood, 2014; Strelakova & Krieger, 2015; Webster & Ksiazek, 2012; Vraga et al., 2016b). These other factors may be especially important given that the business plan of social media firms is designed around the ability to attract and maintain attention (Oremus, 2016).

Likewise, incidental exposure research is inherently concerned with *attention* to content experienced inadvertently (Bode, 2016a; Kim, Chen, & Gil de Zúñiga, 2013; Tewksbury, 2003). Mere exposure to news or political information an individual did not seek out may not be enough to exert an effect if such information is easily ignored or skipped (e.g., Bode, Vraga, & Troller-Renfree, 2017). By focusing on attention, we gain a better understanding of the extent to which incidental exposure to content on social media has the potential to impact outcomes like knowledge or behavior. Our first research question examines how well interest in a topic relates to visual attention to political, news, and social content on social media to answer whether incidental or selective exposure tendencies are most likely to operate in this space.

Second, we test whether current methods of measuring such visual attention are adequate in dealing with complicated social media environments. The majority of studies on social media rely on self-reported close-ended recall measures of content exposure (e.g., Baumgartner & Morris, 2010; Boulianne, 2015; Yamamoto, Kushin, & Dalisay, 2015; for exceptions, see Gustafsson, 2014; Thorson, 2014; Wells & Thorson, 2017), but it is unclear how well such self-report data align with actual attention to content. People are often unable to accurately report how much attention they pay to media (Schwarz & Oyserman, 2001; Tourangeau & Rasinski, 1988; Zaller, 1992). Within social media, research has found both substantial over-reporting of use (Junco, 2013; Staddon, Acquisti, & LeFevre, 2013) but relatively accurate reporting of posting and following behaviors (Guess, Munger, Nagler, & Tucker, 2018).

To explore these issues, we pair survey research of recalled attention with eye tracking, a validated measure of visual attention to compare expressed (self-reported) and revealed (behavioral) preferences (Krupnikov & Levine, 2011, pp. 149–164). Considering three common types of content posted on social media—news, political, and social¹—we begin by examining how well general interest in a topic relates to visual attention to that topic on a simulated Facebook feed to address the theoretical debate between selective and incidental exposure. We next compare those visual attention patterns to two distinct ways of measuring self-reported attention via survey: through *open-ended recalled attention* about which posts they paid attention to as compared to *close-ended recalled attention* to each of three topics – social, news, and political posts.

1.1. Attention patterns on facebook

Two competing theories have largely been applied to understanding attention to social media content: selective exposure and incidental exposure. Both theories examine the relationship between interest in a

¹ These three topics were chosen for their relative frequency (Mitchell, Gottfried, & Matsa, 2015), as well as their theoretical interest—as will become clear in the literature review, many other studies have focused particularly on exposure to news and political information. We define social content as focused on personal life, news as offering public affairs or current events, and political as including political figures, parties, or campaigns.

topic (or viewpoint) and engagement with content that does or does not align with those interests.

Indeed, the question of the relationship between interest and attention is inherent in existing definitions of interest. Education literature has defined interest as “a person's relatively enduring predisposition to reengage particular content over time” (Hidi & Renninger, 2006, p. 113), whereas political communication scholarship offers a classical definition of interest as “a sense that giving attention to some phenomenon is rewarding” (Lane, 1959, p. 133). Both of these definitions highlight an expected link between interest and attention to content that individuals find personally relevant, engaging, or important, which research has often uncovered (e.g., Hidi & Renninger, 2006; Kim, 2009; Lang, 2006).

This understanding of interest as driving attention is also at the root of selective exposure theories. Emerging from cognitive dissonance theory, selective exposure is generally defined as “the preference for information that is consistent with previously held beliefs together with the avoidance of information counter to those beliefs” (Graf & Aday, 2008, p. 87; see also; Festinger, 1957). Later researchers have distinguished selective exposure from selective *avoidance* (see Garrett, 2009) – and found more evidence for selective exposure than for avoidance (Arceneaux et al., 2013; Graf & Aday, 2008; Hart et al., 2009).

In either case, the key driver of selective exposure is interest in a topic; whereby people prefer information that matches their interest, while avoiding information outside of that topic. For example, political interest has been shown to relate to media and news choices (Prior, 2005; Stromback, Djerf-Pierre, & Shehata, 2013), and one comparison found that political interest is more powerful than political ideology in predicting selective exposure (Skovsgaard et al., 2016). More broadly, issue engagement – including interest – strongly drives story selection (Feldman, Wojcieszak, Stroud, & Bimber, 2018; Kim, 2009), while political interest has been shown to predict political uses of social media (Thorson, Xu, & Edgerly, 2018), providing more evidence for a relationship between interest and attention on social media.

Incidental exposure describes a less deliberate process, whereby people see content they did not seek out and that may not align with their interests (Bode, 2016a; Kim, Chen, & Gil, de Zúñiga, 2013; Tewksbury, 2003). Moreover, individual interest is often context-specific – and situational interest may arise due to environmental stimuli that drive attention in the moment (Hidi & Renninger, 2006), potentially overriding general individual interests.

Incidental exposure may be particularly high on social media, as these platforms produce more diverse information environments than other spaces, such as news or conversational habits (Barberá et al., 2015; Vaccari et al., 2016). Social media complicate traditional understandings of incidental and selective exposure by effectively combining high choice and low choice environments (Bode, 2016a; Thorson & Wells, 2015). First, people's online social networks are often composed of large, heterogeneous social networks characterized by relatively weak ties (De Meo, Ferrara, Fiumara, & Provetti, 2014). Second, the information being presented is further curated by social media algorithms, which select content to attempt to drive attention patterns (Thorson & Wells, 2015). While this could create “filter bubbles” that match pre-existing beliefs (Pariser, 2012), the complex intersection of social ties, content type (e.g., pictures as well as topic), and expectations of audience engagement mean such content is often quite diverse (Bode, 2016b). Although individuals have the ability to filter their information environment, so as to see only content that interests them, there is debate about the level of success for these filtering efforts (e.g., Bakshy et al., 2015; Wells & Thorson, 2017). However, even if incidental exposure is common on social media, individuals may exert control by choosing what to pay *attention* to when facing a range of content (Bode et al., 2017) – as implied by selective exposure theories.

Several problems plague the research on selective versus incidental exposure on social media, which we address through our research

design.

First, many studies use relatively blunt measures of exposure, relying on notably flawed self-reports of exposure to news and political content, leading Prior to argue that “researchers would do well to observe selection directly” (2013, p. 120). We address this by measuring exposure and attention in multiple ways, including eye tracking to precisely measure gaze.

Second, the question of the *content* to which people are exposed – deliberately or accidentally – is often not well-defined. Selective and incidental exposure have largely been studied for news and political content (e.g., Prior, 2005; Stroud, 2011) or for specific issues (e.g., Kim, 2009). Many studies offer competing definitions of content topics, which can be especially problematic given blurred distinctions between news and political content (e.g., Vraga, Bode, Smithson, & Troller-Renfree, 2016a). Likewise, these diverse contexts may complicate the ability of researchers to conclude how frequently selective versus incidental exposure occurs, or whether it is more prominent for some types of content than others (e.g., topical preferences for social or news information). We address this by incorporating a variety of content types in our research design and measuring perceived exposure and attention to each.

Third, existing research tends to conflate selective *exposure* with selective *attention*. These represent two different processes, even if they occur in tandem. Outside of ubiquitous self-reported measures (e.g., Garrett, 2009; Stroud, 2011), experimental studies of selective exposure force individuals to choose what content they want to read, leading to selective exposure and attention co-occurring (Graf & Aday, 2008; Iyengar et al., 2008; Knobloch-Westerwick & Meng, 2009). Likewise, incidental exposure studies often stop at exposure – it is unclear to what extent people pay attention to and remember content they do not deliberately choose, rather than ignore or skip over it (Anspach, Jennings, & Arceneaux, 2019; Bode, 2016a; Bode et al., 2017). In other words, just because someone is *exposed* to content “accidentally” does not mean that they *attend* to that content.

We address this limitation by separating the extent to which users are *paying attention* to certain types of information within Facebook, rather than focusing on whether they *are exposed to* such content, by holding exposure constant. We examine whether a participant’s general interest in a topic on Facebook relates to their visual attention – as suggested by selective exposure theory (Arceneaux et al., 2013; Graf & Aday, 2008) – or whether there is little relationship between general interest in a topic and attention to posts of that topic, as the incidental exposure literature might suggest (Bode, 2016a; Kim et al., 2013) or if situational interest overrides individual interest (Hidi & Renninger, 2006).

RQ1: Will general interest in a topic on Facebook relate to visual attention to posts of that topic?

1.2. Measuring visual attention

Attention to media content is a fraught construct. The limited capacity model of motivated mediated message processing (LC4MP) suggests that media processing occurs in three steps (Lang, 2000; 2006). First, people *encode* their experience by translating a small portion of what was seen into mental representations in working memory, thereby combining both exposure and attention processes. Second, those representations are *stored* and fitted into existing mental models, creating associative networks of thought. Finally, *retrieval* involves recalling specific instances or experiences from memory, based on these associative networks of thought. As such, both attention and memory have been identified as essential cognitive processes for media consumption (e.g., Klimmt & Vorderer, 2003).

Eye tracking technology helps us examine the first stage of the LC4MP process, as visual attention to content improves encoding (Jehee, Bradey, & Tong, 2011) and is necessary (but not sufficient) for memory-related processes (Lang, 2000; 2006). Eye tracking

technologies allow for the examination of how participants allocate and sustain their visual attention in a complex environment (Buschman & Miller, 2007; Mancas, 2009, pp. 212–226; Marquart, Matthes, & Rapp, 2016). The amount of time a participant spends looking at an image (which we call visual attention but is also commonly referred to as ‘dwell time’) reflects extended processing, information extraction, memory formation, and interest (Duchowski, 2002; Pan et al., 2004, pp. 147–154). Therefore, measuring visual attention using eye tracking should help us assess participants’ choices about the types of content they engage with when more than one kind of media is competing for their attention.

Broadly, visual attention theories and the LC4MP both propose that people encode messages based on unconscious processes – often novel stimuli or those that cause an “orienting” response – as well as more conscious choices to engage with content that is motivationally-relevant (Buschman & Miller, 2007; Lang, 2000, 2006; Mancas, 2009, pp. 212–226). Beyond this orienting response, attention as measured by dwell time largely focuses on the conscious decision to engage with content (e.g. Locher, Krupinski, Mello-Thoms, & Nodine, 2008). Thus, when considering attention rather than exposure, incidental exposure theories would suggest that visual attention to diverse content is relatively flat, whereas both selective exposure and avoidance frameworks would suggest an association between interest (or viewpoint) and attention.

1.3. Measurement of social media

Translating social media behaviors into self-reported measures of attention introduces additional difficulties. Measures of media exposure have been frequently criticized for their inaccuracy (e.g., Bartels, 1993; Price & Zaller, 1993; Prior, 2009a; 2009b), leading researchers to suggest that alternative methods may be needed to identify media exposure (Dilliplane et al., 2013; Guess, 2015; Wells & Thorson, 2017).

There are several reasons why self-reported measures of media exposure tend to be suspect. Self-report measures are influenced by what is in the mind of respondents as they answer questions – often, questions to which they have given minimal thought (Zaller, 1992). To accurately answer a survey question, respondents must (1) interpret the question correctly, (2) determine relevant thoughts, (3) integrate those thoughts into a coherent opinion, and (4) determine which response option best reflects that opinion (Tourangeau & Rasinski, 1988) – and may alter their responses for social desirability reasons (especially for news and political information, Price & Zaller, 1993; Tewksbury, 2003). This results in a struggle to represent behaviors using self-report recall measures, with answers reflecting inference or reconstruction more than actual experiences (Bradburn, Rips, & Shevell, 1987; Prior, 2009a, 2013; Tourangeau et al., 2000). Use of prominent media sources (like Facebook) is particularly likely to face over-reporting, as such experiences are more likely to be recalled and may be more responsive to social desirability biases (Guess, 2015; Junco, 2013; Staddon et al., 2013).

The context of social media may further complicate these self-reported measures of exposure. On social media, diverse content – including content not sought out by users – occupies the same space, complicating user experience and likely recall as well (Kim, 2011; Vraga et al., 2016b; Wells & Thorson, 2017). Moreover, social media use features are designed to encourage *attention* but not necessarily *recall*, and people use social media for entertainment purposes, which limits resource allocation to storing experiences for later recall (Ellison, Steinfield, & Lampe, 2011; Lang, 2000; Pew, 2016; Vraga et al., 2016b). Likewise, the presence of emotionally-arousing content on social media may hinder accurate recall (Mundorf, Drew, Zillmann, & Weaver, 1990). As a result, self-reporting recalled attention to content seen inadvertently on social media may be particularly difficult.

What may influence self-reported recalled attention other than actual attention? Most notably, individuals often infer their attention

patterns from their general interests; in other words, individuals assume they pay attention to content they are generally interested in (e.g., Guess et al., 2018; Prior, 2009a). Similarly, availability heuristics may bias self-reported attention: salient or emotional exemplars may inflate self-reported recalled attention (Bradburn et al., 1987; Lang, 2000; Tourangeau et al., 2000). We therefore contrast general interest in a topic with visual attention to determine which best explain recalled attention.

We also consider two ways of measuring self-reported recalled attention: open-ended versus close-ended recall questions. While most research measuring social media exposure and attention has focused on close-ended measures (e.g., Boulianne, 2015; Gil de Zuniga et al., 2012; Kim et al., 2013), others have used qualitative research to elicit open-ended recall of social media experiences (e.g., Marwick & Boyd, 2011; Thorson, 2014). Scholars have distinguished between open-ended and close-ended recall measures for content exposure, demonstrating that such questions produce differences in reported media experiences (Guess, 2015; see also; Dilliplane et al., 2013; Lang, 2000). While open-ended questions are still self-reported measures and thus are subject to many of the same biases outlined above, they introduce separate biases as well. Open-ended posts (also called “free recall,” e.g., Lang, 2000) are based on what stands out, as opposed to recall of a prompted type of post, and thus may be driven more by unique attributes of a piece of content, such as novelty (Curtin, 2010), emotion (Lang, 2000), or sensational content (McCabe & Peterson, 1990). Thus, while any measure of recalled attention inherently combines actual attentional processes with processes related to encoding, storage, and retrieval when responding to survey questions, open-ended recalled attention are further biased by salient content features (Guess, 2015; Lang, 2000; Prior, 2009b; Zaller, 1992). Because research has used both close-ended and open-ended recalled attention to gauge media experiences (e.g., Guess, 2015; Prior, 2009b; Thorson, 2014), it is important to explore whether these measures produce competing indicators of attention or differentially relate to general interest in a topic or visual attention.

Therefore, we test how well open-ended versus close-ended recalled attention to content after exposure align with general interest versus visual attention to a topic. We expect that self-reported recall of attention will not only track with visual attention, but will also represent inferences about content users enjoy on social media, as measured by general interest in that topic (Bradburn et al., 1987; Hidi & Renninger, 2006; Prior, 2009a). While previous research has tested bias in close-ended measures of media attention (e.g., Guess, 2015; Guess et al., 2018; Prior, 2009a; 2009b), they have not been tested with regards to recalled attention to Facebook content, which represents a fundamentally different media experience. We also compare close-ended and open-ended recalled attention to see if the same mechanisms apply.

H1. Close-ended recalled attention to a topic on Facebook will relate to both (a) general interest in a topic and (b) visual attention to that topic on Facebook.

H2. Open-ended recalled attention to a topic on Facebook will relate to both (a) general interest in a topic and (b) visual attention to that topic on Facebook.

Second, we examine whether the predictors of close-ended and open-ended recalled attention differ depending on the topic being examined. Many scholars are interested in distinguishing between content preferences on social media, with special interest in news and political content (e.g., Baksy et al., 2015; Gil de Zuniga et al., 2012; Kim et al., 2013; Vitak et al., 2011). Yet these topics may be not be equally well-measured using traditional techniques. For example, political content tends to be a very salient and often disliked feature of social media (Pew, 2016; Thorson, 2014), which may hinder accurate assessments of the amount of political content or their attention to that content (e.g., Bode, 2016a; Vraga et al., 2016b). In contrast, people may be better able to recall their attention to the more palatable social content that motivates social media use (Ellison et al., 2011; Pew, 2018).

RQ2: Will the relationships between interest and visual attention to close-ended and open-ended recalled attention differ for political, news, and social posts?

2. Methods and measures

2.1. Eye tracking methodology

To answer our research questions and hypotheses, we pair survey measures with free viewing of Facebook stimuli observed using eye tracking technology.

Corneal eye tracking technologies enable scientists to identify what information is entering the visual and attentional screen by using the exact location of eye gaze. Corneal reflection eye trackers are used across academic and commercial domains as a gold-standard measure of visual attention since they enable researchers to examine looking behavior with tens of milliseconds precision (Duchowski, 2002; 2007). Corneal reflection eye trackers use near-infrared light to determine the exact eye position and gaze point on a computer monitor without using invasive head-mounted hardware to identify the information that is entering the visual and attentional streams (Tobii Technology, Sweden).

Eye tracking offers several solutions to existing problems in measuring social media exposure. First, we allow users to navigate multiple areas of interest as they would do in a natural social media environment, shifting attention from story to story without clicking or navigating menus. Second, analyzing dwell time offers insight into the more deliberate attention processes. Finally, eye tracking is robust against many issues that plague survey research: because eye tracking passively measures looking behavior, it is less susceptible to demand characteristics (such as social desirability), but more influenced by habit and salient information entering the visual stream (Graham, Orquin, & Visschers, 2012; Pan et al., 2004, pp. 147–154).

This study used a free-viewing paradigm (e.g., participants controlled the speed at which they viewed the posts) of 120 Facebook posts across 35 pages. Stimuli were all constructed using the same post template to ensure that posts did not differ in size or characteristics other than those of interest. Stimuli were rigorously pretested to ensure they were not perceptual outliers and were perceived within their designated category (see Vraga et al., 2016a) for more information on stimuli pre-testing). Each page contained either 3 or 4 posts to maintain external validity with the way in which Facebook portrayed content at the time of the study. Posts were randomly assigned to the 35 pages, then reviewed to ensure each page had a variety of post types and structures (e.g., no page had 4 political posts, for example). Two versions of the task were created to ensure post-specific contrasts were not driving effects and posts were assigned to the 35 pages in a pseudo-random order so that each post topic appeared with other topics (e.g., so news posts do not receive more visual attention because they are always paired with political posts). The 35 pages were presented in a fully random order to reduce the potential for order effects (e.g., news posts did not receive more visual attention because they occurred first in the feed).

Participants were instructed to look through the posts as if they were browsing their own Facebook feed. Although participants were asked to spend at least 10 s per page of the feed, this instruction was not enforced.²

² This instruction was given to ensure that participants spent adequate time on the task and to avoid click-through of the experiment. However, lab assistants were instructed not to interfere with participants, even if they were progressing through the study at faster than 10 s per page. Post-test analysis suggests participants spent on average 9½ minutes with the task, with only 5 participants spending on average less than 10 s per page. Therefore, we suggest this instruction did not harm the validity of the study.

To ensure accurate tracking of each participant's eyes, the study began with a standard 9-point calibration. The calibration procedure and stimuli were presented using Tobii Studio (Tobii Technology, Sweden). Eye movement data were recorded at 60-Hz using a Tobii X60 (Tobii Technology, Sweden) corneal reflection eye tracker, and stimuli were presented using Eprime 2.0 (Psychology Software Tools, Inc., Sharpsburg, PA). All of these are common programs and practices among researchers using eye tracking methodology.

Eye tracking technology was used to measure visual attention to stimuli using areas of interest (AOIs). Rectangular AOIs were drawn to cover the entirety of each post. AOIs enable the software to distinguish looks directed at stimulus material (Facebook posts) from looks directed at other portions of the screen by determining whether each gaze point was within the pixel range for each AOI. Within each AOI, a total amount of looking time in milliseconds was calculated for each participant, which we report in seconds to facilitate interpretation.

2.2. Protocol and sample

Participants were recruited in the summer of 2014 via fliers posted on campus at a large Mid-Atlantic university and via email from course instructors. Participants first took an online survey about Facebook habits and demographics, and then signed up for an appointment for the eye tracking portion of the study in the Psychology lab at least one day after completing the initial survey (on average, nearly four days later; $M = 3.80$, $Median = 3.00$, $S.D. = 2.71$). After completing the eye tracking task, participants rated whether they “liked” or “disliked” each of the 120 posts they saw before answering a post-test survey. They were then thanked and given a choice of \$20.00 or \$10.00 plus course credit for their participation.

A total of 65 people participated. These participants were younger ($M = 23.31$, $S.D. = 5.22$), more female (54%), and more Democratic (48% Democrat, 30% Independent, 22% Republican) than the U.S. population.³ In this study, we limit our analyses to the 53 participants who had a Facebook account for external validity. The participants who had a Facebook account are similar in age ($M = 22.78$, $S.D. = 4.62$), gender (53%), and party affiliation (46% Democrat, 31% Independent, 23% Republican) to the overall sample.

2.3. Post creation

To create the Facebook stimuli used in this study, researchers developed and classified 120 Facebook posts across 12 categories, combining both post topic and type. We divided the post topic into 5 categories: social, news, political favoring Democrats, political favoring Republicans, or neutral political. These three topics of social media content (e.g., social, news, and political) are included because they are prevalent on social media and often studied for their democratic implications (Boulianne, 2015; Ellison, Steinfeld, & Lampe, 2011; Gil de Zúñiga et al., 2012). To maintain external validity, we included three post styles common to Facebook: status-only, picture, and links to external content. For each topic, participants viewed 10 status-only posts and 10 external link posts. For social and news posts, participants also viewed 10 picture-only posts. We did not create picture-only posts for political content to maintain external validity because we did not think this type would be common on Facebook.

The format of the posts was consistent: all posts were two lines of text and we blurred the picture, user name, social indicators such as likes or shares, and time and date information. Photographs were uniform in size and contained no recognizable faces, and external links were limited to one line of text for the link title, with website

³ This party breakdown resembles the party affiliation of youth ages 18–29 nationally. According to Gallup (2014), in 2013, 53% of American youth were Democrats, 35% were Republicans, and 12% were Independents.

information removed for consistency. Each category included 10 posts so that differences in low-level features of the post – such as vividness or use of color – would not drive attention to the overall category. Given that we wanted posts to be as realistic as possible, these features were not manipulated. However, during stimuli creation extremely bold features, colors, and text in pictures were not permitted.

Social posts focused on personal life, including work, fitness, food, school, and travel. News posts offered public affairs information, or referenced local or national current events, such as sports, science, technology, entertainment, and the economy. Political posts were defined as discussion of political figures or campaigns, usually mentioning prominent political figures (e.g., Barack Obama, Hillary Clinton, John Boehner, Chris Christie) or political parties (e.g., Republican, Democrat) by name. A pre-test confirmed that an independent sample similar to that of the present study⁴ largely agreed with researchers' categorization of the post topics, with the exception of news picture posts.

2.4. Measures

2.4.1. General interest in facebook content

In the pre-task survey, participants rated their interest in three topics on Facebook: they rated their interest in “[their] friends' personal and professional lives” for social posts; in “news and current events” for news posts; and a combination of two items “political events and campaigns” and “national government and politics” ($r = 0.70$, $p < .001$) for political posts.⁵ Please see Table 1 for all descriptive statistics.

[Insert Table 1 here].

2.4.2. Visual attention

During the eye tracking task, we precisely measured how much time each participant spent looking at each individual post in milliseconds. This time was summed for all posts of that topic to create a measure of absolute time, which we report descriptively in terms of seconds per average post for each topic to facilitate comparison in Table 1. For all subsequent analyses, we use the proportion of time looking at posts for each topic, calculated as the time spent on that topic divided by the total time spent looking at any of the posts. This creates a standardized measure of attention by conveying how long a subject spent on a topic while holding constant their individual tendency to spend time on the task, which may include differences outside the interest of this study, such as reading speed.

2.4.3. Close-ended recalled attention

In the post-test survey, which occurred after completing the eye tracking and rating task,⁶ participants reported their recalled level of

⁴ This sample was drawn from the same Mid-Atlantic University in Spring 2014. Participants ($N = 78$) were similar in age ($M = 21.48$) and gender (61.4% female) to the current study.

⁵ Moreover, we perceive moderate correlations among these interests: interest in news is moderately correlated with interest in both social ($r = 0.47$, $p < .001$) and political ($r = 0.51$, $p < .001$) topics, while interest in social topics is not correlated with interest in political content ($r = 0.20$, $p = .15$).

⁶ It is possible that viewing the posts a second time between the eye tracking portion of the experiment and the post-test survey skewed self-reported attention to the posts. We believe this risk is minimal. First, participants were asked to report their attention to the “Facebook feed,” distinguishing it from the rating task. Second, in reviewing all 120 posts, participants are unlikely to remember their response to a category of posts. Third, the results for social and political posts are similar, despite large differences in the favorability of the topics (social: $M = 7.97$, $SD = 1.84$; political: $M = 3.22$, $SD = 2.03$; news: $M = 6.16$, $SD = 2.04$). Future research should test these relationships without including a rating task to validate this assumption. Please contact the lead author for more details on the rating task.

Table 1
Descriptive statistics.

	Mean	S.D.	Min	Max
<i>General Interest in Facebook Content</i>				
Social posts	4.38	1.67	1	7
News posts	3.91	1.73	1	6
Political posts	2.41	1.40	1	6
<i>Visual attention Per Post (in seconds)</i>				
Social posts	4.97	1.81	1.54	9.75
News posts	5.46	2.06	1.40	11.06
Political posts	4.35	1.77	1.09	9.44
<i>Close-ended Recalled Attention</i>				
Social posts	4.58	1.43	1	7
News posts	4.21	1.38	1	7
Political posts	2.66	1.19	1	5
<i>Open-ended Recalled Attention</i>				
Social posts	35.9% mentioned paying attention to social posts			
News posts	43.4% mentioned paying attention to news posts			
Political posts	37.8% mentioned political posts			
More attention	9.4% said they paid more attention			
Less attention	26.4% said they paid less attention			

interest and attention during the task of the three post topics using a single-item indicator for “posts about people’s personal and professional lives,” “posts about news and current events,” and “posts about politics,” with response options on a seven-point scale ranging from “no attention” to “a great deal of attention.”

2.4.4. Open-ended recalled attention

After reporting their recalled attention via close-ended items, participants were asked a series of open-ended questions about the posts that they found most interesting and that they paid attention to. In this paper, we report on the open-ended responses to the question that specifically asked participants to explain which post(s) they paid the most attention to and why. We coded this question based on our operationalization of political posts (explicitly mentioning politics, political figures, issues or campaigns), news posts that referenced either local or national current events (including both hard soft news, including sports, science, technology, and nature but excluding political content), and social posts (about personal or professional life, such as fitness, food, and personal travel) above. While we recognize that “political” posts could often also be classified as “news,” we coded political posts separately to distinguish them from other types of news, which allowed us to more closely focus on the political aspects of the data.

For political posts, we coded whether participants said they paid more or less attention to these posts, and use the “more attention” category in analyses.⁷ Two coders achieved reliability in coding the open-ended responses; Krippendorff’s alpha exceeded .79 for each category.

3. Results

3.1. Visual attention

To test our first research question about the relationship between general interest in a topic and visual attention to that topic, we

⁷ For both social and news posts, participants only mentioned these posts in a positive sense. However, many participants explicitly excluded political posts when mentioning what they paid attention to (e.g., “posts with pictures that did NOT involve politics”), making this distinction necessary. For example, one response coded as “more attention” stated, “I paid close attention to the political posts solely because I don’t really understand a lot about politics so it takes me a little longer to read those and understand what the person is talking about.” Conversely, we coded a response stating, “Majority of the posts that I paid attention were the ones that include Science. Less attention paid on politics (which was majority of them)” as “less attention” for political posts.

considered a series of bivariate correlations. These results provide an answer to our first research question: in no case was general interest in a topic significantly correlated with visual attention to that topic (see Table 2). Visual attention to posts about news, politics, and social interactions operates independently from expressed interest in those topics, providing little evidence for topical selective exposure on Facebook.

3.2. Close-ended and open-ended recalled attention

Next, regression analyses were performed to test our expectations that self-reported recalled attention to a topic responds to both general interest in a topic and to visual attention. These analyses test the effects of general interest in a topic versus visual attention to a topic as predictors of close-ended and open-ended recalled attention. Each regression controls for the relationship between open-ended and close-ended recalled attention (see Table 3).

Overall, we find strong support for H1a, which predicted that general interest in a topic would explain close-ended recalled attention. We find a significant positive relationship between interest and close-ended recalled attention for all three topics – political, news, and social posts – suggesting that people who express more interest in the topic self-report paying attention to posts of that topic when answering close-ended questions. H1b – which predicted that visual attention would be associated with close-ended recalled attention – is supported for political and social posts, but not news posts. Thus, close-ended recalled attention reflects both general interest in a topic and visual attention for political and social posts, but only reflects interest for news posts.

In contrast, we find limited support for H2, which tested these relationships when considering open-ended recalled attention. H2a is not supported, as general interest in the topic does not explain open-ended recalled attention for any of the topics examined. Additionally, H2b is only supported for political posts, whereby people who paid more visual attention to political posts also reported paying more attention to political posts using an open-ended measure.⁸ This relationship did not emerge for news or social posts.

3.3. General summary

Our results present a nuanced picture of the relationship between general interest in a topic, visual attention as measured by the eye tracking, close-ended recalled attention, and open-ended recalled attention for social, news, and political posts. In contrast to selective exposure theories, general interest is not associated with visual attention for any type of post. In other words, people did not pay more attention to topics they said they preferred seeing on Facebook.

Close-ended recalled attention to topical posts appears to be responsive to both general interest in that topic and visual attention. General interest is associated with close-ended recalled attention to a topic across all three domains. But while close-ended recalled attention to posts may be inflated by general interest, it also related to visual attention patterns for social and political posts, but not news posts.

Only for political posts is open-ended recalled attention associated with visual attention – and this was not influenced by interest in the

⁸ A supplemental analysis explored whether visual attention to congruent versus incongruent political posts separately explained open-ended and close-ended attention. This analysis excludes Independents and defines congruence as posts that match a participant’s party affiliation (e.g., posts that praise Democrats or attack Republicans as congruent for Democrats and incongruent for Republicans). The small sample size ($N = 36$) reduces our confidence in these effects, but we find no relationship between interest in political posts and visual attention to either congruent or incongruent political posts. Moreover, neither congruent nor incongruent visual attention is related to open-ended and close-ended recalled attention. Please see the supplemental appendix for more details.

Table 2
Bi-variate correlations.

	General interest	Visual attention	Close-ended recalled attention	Open-ended recalled attention
<i>Social Posts</i>				
General interest	1	-.11	.37 ^b	.15
Visual attention	–	1	.27 ^b	.13
Close-ended recalled attention	–	–	1	.19
Open-ended recalled attention	–	–	–	–
<i>News Posts</i>				
General interest	1	.05	.36 ^c	.18
Visual attention	–	1	-.07	.11
Close-ended recalled attention	–	–	1	.09
Open-ended recalled attention	–	–	–	–
<i>Political Posts</i>				
General interest	1	.16	.31 ^b	.07
Visual attention	–	1	.39 ^c	.25 ^a
Close-ended recalled attention	–	–	1	-.13
Open-ended recalled attention	–	–	–	–

*** $p \leq .001$.
^a $p \leq .10$.
^b $p \leq .05$.
^c $p \leq .01$.

Table 3
Regression analyses for close-ended and open-ended recalled attention.

	Political		News		Social	
	Close-ended	Open-ended	Close-ended	Open-ended	Close-ended	Open-ended
General interest	.26*	.10	.36*	.17	.39**	.14
Visual attention	.41**	.35*	-.09	.10	.32*	.14
Close-ended recalled attention	–	-.30 +	–	.04	–	.08
Open-ended recalled attention	-.25 +	–	.04	–	.06	–
<i>Adjusted R-squared</i>	.227**	.080 +	.085 +	.00	.198**	.00

topic. For social and news posts, open-ended recalled attention is not related either to general interest or to visual attention. These results suggest that the methods of measuring attention – either using behavioral measures through eye tracking designs or through close-ended versus open-ended measures of *recalled attention* – meaningfully influence the anticipated outcomes.

4. Discussion

As Facebook becomes an increasingly important part of the social, news, and political landscape (Pew, 2015), interest in deciphering patterns of attention to social media content and their democratic implications has grown (Barberá et al., 2015; Bode, 2016a; Gil de Zúñiga et al., 2012; Vitak et al., 2011). In this study, we engage with two distinct lines of inquiry regarding social media: (1) the debate between selective exposure and incidental exposure in explaining visual attention patterns and (2) the accuracy of two types of self-reported measures of attention (close-ended versus open-ended recalled attention) as compared to visual attention. Our results provide insight for both theoretical and methodological concerns.

Our results indicate that general interest in the topic is not associated with visual attention patterns on Facebook for social, news, or political posts. This suggests that not only is incidental *exposure* high on Facebook (Bode, 2016a; Kim et al., 2013), but that it results in at least some attention to content seen inadvertently. Even when individuals engage in skipping over content they dislike or uninterested in (e.g., Bode et al., 2017), it first requires some level of engagement with the post, and skipping such content may be more difficult in the aggregate than when clear signals about its content are provided. In contrast, selective exposure tendencies driven by interest (or disinterest) in a particular topic (e.g., Arceneaux et al., 2013; Prior, 2005; Skovsgaard & Stromback, 2016) may be less powerful in explaining behaviors on

social media sites.

Several factors may explain why interest was not associated with visual attention on Facebook. First, it may be that other content features – like whether the post is a status, photo, or link – better explain attention than interest in a topic (Strekalova & Krieger, 2015; Vraga et al., 2016b), although additional analyses suggest that interest is not correlated with visual attention for any post structure (see the supplemental appendices). This may also suggest that either situational interest is a more powerful driver of attention in this context than individual interest, or that interest in these topics were not as well-established as expected (Hidi & Renninger, 2006), a question that future research should explore. Second, selective *exposure* and selective *avoidance* are not inherently linked (Garrett, 2009), leading people to engage with content they may not otherwise enjoy on social media, especially given the little effort required to attend to such content (as opposed to deliberately seeking it out as often tested in selective exposure research).

Third, our more nuanced measures of selective *attention* (rather than exposure) may provide a clearer picture of behavior than self-report measures (Prior, 2013). If attention to non-preferred content occurs frequently on Facebook for a variety of topics as this study suggests, it supports the argument that social media offer new spaces for individuals to be exposed to news and political information (Bode, 2016a; Valenzuela, 2013). Fourth, our research design allows us to examine attention when content is co-mingled in the same space, making selection a less deliberate choice. This may explain why we find little evidence for selective exposure or avoidance based on interest. Finally, it may be the use of a simulated feed and a small sample results among in null relationships, as we discuss among our limitations below. We believe these findings, or lack thereof, to be suggestive of an important research agenda, but not definitive.

Methodologically, we tested the factors that explain self-reported

Table 4
Top posts mentioned in the open-ended recalled attention responses.

Post Text	Post Type	Open-ended recalled attention
You expect me to be OK with a legless lizard? Sorry. Still sounds like a snake to me. <i>Legless Lizard Discovered Near LAX (and No, It's Not a Snake)</i> http://www.latimes.com/science/sciencenow/la-sci-sn-the-kooky-animal-stories-2013-201312-002-photo.html	News link	7.5% N = 4
Definitely on board with the idea of tilt-a-whirl planets, as long as Earth doesn't decide to join the party. <i>Astronomers Discover Strange Tilt-a-Whirl Planets</i> http://www.nbcnews.com/science/space/tilt-whirl-planets-throw-astronomers-loop-f8C11416067	News link	7.5% N = 4
Breaking research on testing for schizophrenia. I have a few relatives they can test it on. <i>How Can a Blood Test Tell If You're Schizophrenic?</i> http://www.slate.com/articles/video/video/2014/03/blood_test_for_schizophrenia_new_diagnosis_method_could_launch_in_2015_or.html	News link	7.5% N = 4
Stoked to hear that more color races are coming to the DC area this summer. Let the training begin! "Need for compromise"	News picture Independent statuses and links	7.5% N = 4 5.7% N = 3
<ul style="list-style-type: none"> • Domestic abuse bill just passed Congress without a problem. Good to know both parties can work together when it counts. • Why can't there be more compromise in Congress? It seems like both sides have really good ideas but refuse to listen to each other • This is what we need in Congress. More compromise and working together to achieve goals that benefit everyone. <i>Compromise in Arizona Defers a Solar Power Fight</i> http://www.nytimes.com/2013/11/16/business/energy-environment/compromise-in-arizonadefers-a-solar-power-fight.html		

Note: The status is in regular text, the link text is italicized with a hyperlink. Open-ended recalled attention indicates the percentage and number of participants who mentioned paying attention that that specific post.

measures of recalled attention to Facebook content, comparing close-ended versus open-ended question formats. Our results suggest close-ended and open-ended recalled attention tap into different constructs, with close-ended recalled attention more accurately reflecting visual attention patterns, to a point.

Despite the difficulties associated with self-reports of media use, our study suggests that close-ended self-report measures of recalled attention within social media reflect visual attention, at least in part. For social and political posts, visual attention was positively related to close-ended recalled attention, which bodes well for using these measures for these types of content. Moreover, the strength of these relationships echoes research by Guess et al. (2018), who find a correlation of 0.32 between reported and identified political posts on Facebook.

However, visual attention is only one component of close-ended recalled attention. Indeed, general interest in the topic is consistently associated with close-ended recalled attention to the topic across all three topics and is roughly equal in strength to visual attention for political and social posts. Similar to other media habits, when asked to self-report Facebook use patterns, people are likely inferring their behaviors from their attitudes, not simply recalling actual attention (Bradburn et al., 1987; Prior, 2009a). Self-reports are more accurate the more proximately the behavior occurred (Bradburn et al., 1987; Staddon et al., 2013), but in this study, people were moderately accurate in self-reporting recalled attention to diverse content topics on Facebook using close-ended measures directly following exposure.

The inability of individuals to accurately report on their visual attention to news posts using close-ended recalled attention measures deserves special attention. Unlike social and political posts, visual attention was not associated with close-ended recalled attention for news posts. Individuals hold a broader definition of news content on social media, making it harder to categorize (Vraga et al., 2016a). This limits the accuracy of self-reports, which depend on shared definitions (Schwarz & Oyserman, 2001; Tourangeau & Rasinski, 1988). Alternatively, it may be that news posts are more palatable (e.g., Vraga et al., 2016b), leading news posts to garner similar amounts of visual attention from participants and hindering the ability to accurately report close-ended recalled attention.

Open-ended measures of recalled attention present yet a different picture of attention. Recalled attention to news posts dominates open-ended responses, with 45% of people mentioning paying attention to these posts – in contrast with close-ended recalled attention, which

found social posts received the most attention. Moreover, the top four specific posts mentioned were all news posts (see Table 4). However, open-ended recalled attention was not responsive to either interest or attention for news or social posts. Instead, this relationship only emerged between visual attention and open-ended recalled attention for political posts. Political posts may be different given their salience as a disliked component of Facebook (Pew, 2016). It may also occur because the feed had more political posts than the average feed, making them especially noteworthy, or easy to remember. We suspect the higher barrier for self-report in open-ended questions increases the number of elements that affect recall of specific posts, including humor (Cline & Kellaris, 2007), emotion (Lang, 2000; Searles & Mattes, 2015), and mood (Isen, 1987).⁹ For these reasons, we do not recommend this type of measure as a reliable measure of visual or recalled attention to content on social media, although studies interested in salient content types may find these measures useful.

Our research offers practical guidelines for researchers interested in attention to Facebook content. Despite the prominence of self-reports in survey research, such self-reports must be interpreted cautiously. Our analyses suggest that while measures of close-ended recalled attention to social and political posts on Facebook are responsive to visual attention patterns, they are also reactive to expressed interest in that topic. Moreover, close-ended recalled attention to news posts was not related to visual attention, only expressed interest. Of course, measures of recalled attention may not be superior to those of interest, depending on the outcome being studied. If individuals are considering reasoning and reflection about the content as part of "attention" to content (see Lang, 2000; Shah et al., 2007), it may explain why visual attention does not perfectly align with close-ended recalled attention.

Our measure of open-ended recalled attention suggests the posts people freely retrieve from memory may be different yet. Pairing these methods with a qualitative approach to understand what attention means to participants and the forces that drive visual and self-reported recalled attention (both close and open-ended) would be a valuable next step.

This study is limited by its convenience sample of college

⁹ Follow-up analyses of the open-ended question support this argument. People reported whether specific posts made them angry, agree, disagree, laugh, or want to share. The top news posts tended to make people laugh or want to share, whereas the top political post prompted agreement.

undergraduates, who may have different experiences with Facebook and differing abilities to self-report recalled attention (Prior, 2009b). This concern is mitigated because many researchers focus on undergraduate populations when investigating Facebook use (Boulianne, 2015; Ellison et al., 2011; Vitak et al., 2011). Our sample, though small, is typical for laboratory-based research using eye tracking (e.g., Guzzano, Yoneki, & Gronchi, 2015; Junco, 2013; Marquart et al., 2016), and a post-hoc sensitivity analysis suggests that our analyses were sensitive enough to detect medium effects (Field, 2013).¹⁰ Therefore, it is possible that there is a relationship between interest in a topic and visual attention to that topic, but such a relationship is likely to be small. This may especially be true for political posts, where the bivariate correlations between political interest and attention are larger but still do not achieve statistical significance. However, this increases our confidence that relationships we do observe between interest, visual attention, and close-ended measures of recalled attention are relatively robust. Supplemental research indicates that these relationships may function differently for statuses, pictures, and links (see Appendix A3), suggesting interesting potential relationships between attention, post structure, and recall. Future research should investigate these processes with a larger and more diverse sample.

Additionally, participants were participating in a laboratory setting, and were exposed to a simulated Facebook feed rather than their own native content, undermining the goal of external validity. We would expect that perceptions of the individual posting the content or its social status (e.g., likes and shares) could intersect with visual attention patterns or affect accuracy of self-report measures of attention. However, we also expect these social cues to weaken the relationship between general interest in a topic and attention to that topic on social media. Therefore, this study represents a conservative test of the ability of self-reports to reflect attention, given that participants were not influenced by social cues and were aware their attention was being monitored. Finally, this study focuses on a single social media platform and cannot be generalized to other online spaces where attention processes may differ, depending on the affordances of those platforms (Bode & Vraga, 2018; Evans, Pearce, Vitak, & Treem, 2017).

Ultimately, this study offers four main contributions to the literature. First, we find that general interest was not associated with visual attention on Facebook, suggesting that there may be meaningful attention paid to content seen inadvertently. If Facebook is indeed not an easy place to entirely “opt out” of news and political information based on content preferences, it emphasizes its potential democratic value. Second, this study reinforces the need for scholars to define whether they are examining *interest*, *exposure*, *attention*, or *recalled attention* to content online, as patterns and effects may be quite different. Third, our study confirms that some skepticism towards self-report measures of recalled attention to content on social media is merited, given that such measures may conflate attention and interest. However, close-ended recalled attention does track with visual attention, suggesting these measures are not without merit (see also Guess et al., 2018). Fourth, open-ended and close-ended measures of recalled attention produce quite different patterns of attention, which may be differentially related to democratic outcomes. The research community must recognize the limitations of current understandings of attention patterns online and continue to reflect on the measures that most appropriately represent the behaviors they are interested in studying on social media.

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¹⁰ We performed a post-hoc power analysis using G*Power. With an alpha of .05 and a beta of 0.80 (as recommended by Field, 2013), we find that our tests are sensitive to f^2 value of 0.15, which Field (2013) terms a medium effect.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.chb.2019.05.017>.

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