Computers in Human Behavior xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

In-class distractions: The role of Facebook and the primary learning task

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ARTICLE INFO

Article history:
Available online xxxx

Keywords:
Facebook
Multitasking
Distraction
Learning
Education
Technology

ABSTRACT

While laptops and other Internet accessible technologies facilitate student learning in the classroom, they also increase opportunities for interruptions from off-task social networking sites such as Facebook (FB). A small number of correlational studies have suggested that FB has a detrimental effect on learning performance, however; these studies had neglected to investigate student-engagement in the primary learning task and how this affects task-switching to goal-irrelevant FB intrusions (distractions); and how purposeful deployment of attention to FB (goal-relevant interruptions) affect lecture comprehension on such tasks. This experiment fills a gap in the literature by manipulating lecture interest-value and controls for duration of FB exposure, time of interruption, FB material and the order of FB posts. One hundred and fifty participants were randomly allocated to one of six conditions: (A) no FB intrusions, high-interest (HI) lecture; (B) no FB intrusions, low-interest (LI) lecture (C) goal-relevant FB intrusions, HI lecture (D) goal-relevant FB intrusions, LI lecture (E) goal-irrelevant FB intrusions, HI lecture (F) goal-irrelevant FB intrusions, LI lecture. As predicted, participants were more susceptible to FB distractions when the primary learning task was of low-interest. The study also found that goal-relevant FB intrusions significantly reduced HI lecture comprehension compared to the control condition (A). The results highlight the need for recourses that will help educators increase student engagement with their learning task. Implications for future research are discussed.

1. Introduction

With the advent and growth in adoption of social technologies over the last decade, social networking on the Internet while working or studying has progressively pervaded many people's daily lives. Time spent multitasking with these activities is particularly significant in the student population: data from one study estimated that students multitask for approximately 42% of class time (Kraushaar, 2010). In particular, Facebook (FB) has become a compelling source of classroom distraction. It has been reported to be the most used multitasking distractor for university students in the classroom than other technologies such as text messaging, MSN and emails (Wood et al., 2012). With more than 90% of FB users being teens and university students (Junco, 2012b), not surprisingly, researchers and academics are interested in understanding how FB interruptions impact students' comprehension of the primary study task. So far, a small number of studies have revealed a negative relationship between FB use and academic performance (Frein, Jones, & Gerow, 2013; Junco, 2012b; Kirschner & Karpinski, 2010).

The present study aims to expand on the theoretical and empirical findings on distractions and multitasking, specifically with FB, by focusing on three questions that remain unanswered: firstly, *how* do FB intrusions distract students? That is, do less engaging primary tasks determine attentional selection of FB distractions? This is important to understand as educators may be able to reduce student susceptibility to distractions in their classroom; by making their material more engaging and/or interactive (Sana, Weston, & Cepeda, 2013). Secondly, which features of FB serve as particularly salient multitask distracters? An answer to this question would help us understand what types of devices or platforms promote greater attention and engagement with the distraction, and hence are more likely to divert students' attention in the lecture theatre. Thirdly, does attention to externally driven FB-interruptions predict performance detriments on learning performance for lectures of high as well as low interest? Research on this issue of multitasking and its negative impact on task performance, as previously suggested (Junco, 2012a; Wood et al., 2012), needs further scrutiny, as this effect may not necessarily apply to; all types of learning tasks, external interruptions (as opposed to internal interruptions) or to students who are frequent, and potentially skilled, multitaskers with FB.

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http://dx.doi.org/10.1016/j.chb.2014.10.022
0747-5632/

1.1. Definitions: interruptions, multitasking and distractions

While listening to a lecture, attention can be directed to the FB newsfeed via external interruptions, such as a FB sound-alert for a notification and the appearance of stimuli on an automatically refreshed newsfeed. Alternatively, interruptions can be internally generated, that is, they can be self-initiated task switching motivated by the propensity to temporarily abandon a task that is no longer rewarding (Adler & Benbunan-Fich, 2013; Cades, Werner, Boehm-Davis, & Arshad, 2010; Payne, Duggan, & Neth, 2007). Regardless of its source, interruptions occur when students stop their current learning activity and shift goals to perform a different task (Mark, Gonzalez, & Harris, 2005), where a goal can be defined as "a mental representation of an intention to accomplish a task,... or take some mental or physical action" (Altmann & Trafton, 2002, p. 39).

Multitasking, specifically dual-tasking, occurs when the FB and learning goals are activated concurrently (Altmann & Trafton, 2002). Although multitasking is synonymous with divided attention, unless a task is automated, multitasking should more accurately be understood as switching attention between concurrent tasks, with only one stimulus attended to at any given time (Jeong & Hwang, 2012). For this reason, it has been argued that multitasking is an imperfect form of attention, as information from one task may be undetected while attending to another and therefore, subject to dual-task slowing (Bowman, Levine, Waite, & Gendron, 2010; Coens, Degryse, Senecaut, Cottyn, & Clarebout, 2011; Junco, 2012a; Sana et al., 2013).

In contrast, distractions are intended to be ignored. That is, when FB is open in the background and is not an activated goal, the primary learning task can be selectively processed whilst ignoring irrelevant stimuli presented on FB, as intended; however, when the individual allocates limited processing resources to the newsfeed, attention is shifted making FB the onset of the target processing (Parmentier, Ljungberg, Elsley, & Lindkvist, 2011). This inability to reject goal-irrelevant stimuli (irrelevant processing) marks a failure of focused attention and results in distraction (Pool, Koolstra, & Van Der Voort, 2003), causing interruptions to the primary learning task, however brief (Groff, Baron, & Moore, 1983).

1.2. Theories and models of selective attention: how is attention allocated?

In order to understand how students get distracted in the lecture theatre, it is important to understand attention. When attention is focused on a certain location (i.e. a learning task), involuntary (bottom-up) and voluntary (top-down) selection mechanisms are involved in shifting attention to distracting stimuli (Vandierendonck, Demanet, Liefooghe, & Verbruggen, 2012). Specifically, novelty-driven and goal-driven mechanisms are prominent models of attentional selection, which suggest that FB intrusions are selected due to its physical salience and by current selection goals, respectively (Awh, Belopolsky, & Theeuwes, 2012; Theeuwes, 2006).

According to the novelty-driven mechanism of selection, attention may be "captured" by FB stimuli in an involuntary, stimulus-driven manner (Parmentier, Elsley, & Ljungberg, 2010; Parmentier et al., 2011). Neurological studies have advocated that the registration of novel events trigger an automatic novelty-detection response (Picton, Alain, Otten, Ritter, & Achim, 2000), followed by an involuntary re-orientation negativity response (RON), when the participants are engaged in a focal task (Berti & Schroger, 2003, 2004). This novelty distraction mechanism has also been observed when the target and distracter were temporally decoupled and presented in different sensory modalities, specifically, the visual and auditory modalities (Andres, Parmentier, & Escera, 2006). Thus, this model suggests that goal-irrelevant FB intrusions may be selected by attentional mechanisms involuntarily, based on its perceptual properties such as its sudden appearance (Theeuwes, 2006).

On the other hand, goal-irrelevant FB intrusions may be selected based on strategic settings (Mackie, Van Dam, & Fan, 2013). Specifically, Norman and Shallice's (1986) model of attention proposed that attention subserves cognitive control by modulating information processing in a goal-consistent manner. This suggests that attention may be voluntarily sustained to the lecture during FB external interference; or purposefully deployed to FB if it is thought to be temporarily more important than the learning goals. A wealth of research has supported this notion, showing that people can reallocate cognitive resources to support the higher priority task (Horrey, 2006; Levy, 2008). Thus, attention may be strategically oriented to FB based on its priority.

Although these two mechanisms have been well defined in the literature (Chica, 2013), it is still unclear whether goals or salience play the more dominant role in determining which stimulus is selected via attention (Anderson & Folk, 2010; Belopolsky, Schreij, & Theeuwes, 2010; Theeuwes, 2010). Moreover, these models cannot explain all cases of selection biases, for example, why a stimulus associated with reward can capture attention more readily than another equally salient stimulus that does not have a history of association with rewards, even when this selection bias contradicts current selection goals (Awh et al., 2012; Chelazzi, Perlato, Santandrea, & Della Libera, 2013). Therefore, a growing body of literature from recent years have proposed that rewards have a direct influence on the computation of attentional priority that is independent of the novelty-driven and goal-driven mechanisms (Awh et al., 2012; Chelazzi et al., 2013; Engelmann, Damaraju, Padmala, & Pessoa, 2009; Engelmann & Pessoa, 2007; Krebs, Carsten, & Woldorff, 2010) —what Anderson has referred to as 'value-driven attentional selection' (Anderson, 2013).

According to the value-driven mechanism, stimulus selection operates by maximizing rewards and minimizing losses (Anderson, 2013). From an evolutionary perspective such a system is necessary in order to promote the survival and wellbeing of an organism (Anderson, 2013). By modulating information processing in a reward-driven manner, this attentional system allows survival-promoting stimuli to reach awareness and become available to resource-limited cognitive systems, such as working memory and decision-making, so that it can be subsequently acted upon (Anderson, 2013).

This model of selection has been evident in recent research, which have revealed that rewards exert a strong influence on stimulus-processing and response-selection pathways (Engelmann & Pessoa, 2007; Engelmann et al., 2009). In particular, a recent study conducted by Krebs et al. (2010), revealed that participants had lower error rates and faster responses in correctly naming word ink colors in a Stroop task when the ink color was associated with monetary incentives than trials with non-rewarded colors. This finding was further supported by associated increases in neural activity in the reward-anticipation response area of the brain (i.e. the nucleus accumbens) (Krebs, 2011). It was also found that irrelevant reward associations (i.e. word meaning related to reward-predicting ink colors) impaired performance, which suggested a transfer of reward-related saliency to the task-irrelevant dimension, thereby representing the reward-driven nature of attention in selection and stimulus-processing (Krebs, 2011). Further evidence has indicated that individuals are able to rapidly choose items associated with monetary rewards from a brief display containing several distractors, regardless of the type of motor response used to express the choices (Navalpakkam, Koch, Rangel, & Perona, 2010). Overall, these studies suggest that attentional resources have access to the overall priority map and can be systematically

Please cite this article in press as: Gupta, N., & Irwin, J. D. In-class distractions: The role of Facebook and the primary learning task. *Computers in Human Behavior* (2014), http://dx.doi.org/10.1016/j.chb.2014.10.022