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The font-size effect on judgments of learning: Does it exemplify fluency effects or reflect people's beliefs about memory?

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ABSTRACT

Evidence suggests that processing fluency affects many kinds of judgments. For instance, when words are presented either in large (48 point) or smaller (18 point) font sizes during study, people's judgments of learning (JOLs) are higher for the words presented in the larger font size. This *font-size effect* presumably arises because items presented in a larger font size are easier to process at study, which in turn leads to higher JOLs. In the present studies, we evaluated this fluency hypothesis against an alternative one that the font-size effect occurs because people believe that words printed in a large font size are better remembered. In Experiments 1 and 2, we measured differences in processing fluency during study to evaluate whether fluency could account for any of the relationship between font size and JOLs. In Experiments 3a and 3b, college students read about the font-size experiment and then predicted whether hypothetical particpiants would better remember the large or smaller words. In Experiment 4, we evaluated whether the effect occurred for prestudy JOLs, which are made prior to studying the to-be-learned words and hence cannot be affected by processing fluency. Surprisingly, the evidence across experiments supported the belief hypothesis and did not support the fluency hypothesis. Thus, the font-size effect does not exemplify the effect of fluency on JOLs, and more generally, these outcomes suggest that measuring processing fluency is essential for establishing its role in people's judgments and decision making.

Introduction

For over four decades, researchers have investigated how people make judgments of learning (i.e., predictions about the likelihood of remembering recently studied information), partly because people use their judgments of learning (JOLs) to make decisions about how to regulate their study time (Metcalfe & Finn, 2008; for reviews, see Dunlosky & Ariel, 2011; Son & Metcalfe, 2000). Unfortunately, people's JOLs can suffer from metacognitive illusions, such as when they are influenced by a cue that has no impact on memory, which in turn can lead to inappropriate regulation of study (e.g., Castel, McCabe, & Roediger, 2007; Rhodes & Castel, 2009). Researchers have identified many cues that lead to metacognitive illusions wherein a cue influences JOLs but does not influence memory performance. For instance, JOLs are greater for words presented in larger (vs. smaller) font sizes during study (McDonough & Gallo, 2012; Rhodes & Castel, 2008), words spoken more loudly (vs. softly) at study (Rhodes & Castel, 2009), and words that are associated with a greater (vs. lesser) physical weight during study (Alban & Kelley, 2013), to name a few. Despite the discovery of a host of cues that produce such metacognitive illusions (for a review, see Bjork, Dunlosky, & Kornell, 2013), little is known about why any particular cue influences JOLs and hence specifically why metacognitive illusions occur.

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A main goal of the present research is to provide a more complete understanding of how people construct JOLs by empirically scrutinizing how one particular cue – font size – influences JOLs. This *font-size effect* was first reported by Rhodes and Castel (2008). In their research, participants studied individual words that were presented either in a large font size (48 point font) or in a smaller font size (18 point font). JOLs were higher for words presented in a large than smaller font size, even though font size had no impact on final recall performance. This metacognitive illusion is robust and has occurred when participants completed two study-test trials, when participants also studied related and unrelated word pairs as a more diagnostic cue during study, and when judgments were framed in terms of forgetting (vs. learning). The effect of font size on JOLs could potentially be mediated by two factors, processing fluency or beliefs about memory (e.g., Begg, Duft, Lalonde, Melnick, & Sanvito, 1989; Benjamin, Bjork, & Schwartz, 1998; Dunlosky & Matvey, 2001; Koriat, Bjork, Sheffer, & Bar, 2004). We consider each factor in turn and how they presumably mediate the effects of any given cue on JOLs, and then we discuss in detail how they may mediate the font-size effect.

The construct of fluency and its relation to memory judgments has been instantiated in different ways. Larry Jacoby and his colleagues (Jacoby & Dallas, 1981; Jacoby & Witherspoon, 1982; for a review, see Jacoby, Kelley, & Dywan, 1989) argued that fluency has a direct influence on people's memory judgments. For instance, when judging whether a word presented on a test had been presented during study, the fluent processing of the word leads to a subjective experience of familiarity that in turn is unconsciously attributed to the word having been presented at study. In this case, the absolute level of fluency is causal, with greater ease of processing leading to higher levels of familiarity that influences memory judgments. By contrast, Whittlesea and Leboe (2002; see also, Whittlesea, 2002; Whittlesea & Williams, 2000) proposed that fluency leads to a subjective experience of familiarity only when the fluency of processing of an item is inconsistent with one's expectations. According to this discrepancy-attribution account (Whittlesea, 2002), when processing fluency is discrepant with expectations, the discrepancy causes surprise that leads to the subjective experience of familiarity, which in turn influences people's judgments.

Although both instantiations of fluency have been empirically supported, in the present research we focus on the degree to which absolute changes in processing fluency can mediate cue effects on JOLs. Our focus was on absolute fluency for two reasons. First, theories of JOLs have exclusively viewed fluency as having a direct and unmediated influence on how people make JOLs (Koriat & Bjork, 2006). The claim is that fluently processing an item at study leads to the subjective experience of familiarity that is unconsciously attributed to memorability. And, as argued by Koriat et al. (2004), "JOLs are based predominantly—perhaps exclusively—on the subjective experience associated with processing fluency" (p. 653). Second, and as important, evidence indicates that processing fluency of individual items is related to JOLs, with more fluent processing leading to higher JOLs (e.g., Hertzog, Dunlosky, Robinson, & Kidder, 2003; Koriat, 2008; Matvey, Dunlosky, & Guttentag, 2001; Undorf & Erdfelder, 2011). Thus, one of our key questions in the present research is, "Does the cue of font size produce differences in processing fluency across items, which then mediates its effect on JOLs?"

Font size may also influence JOLs because people have a belief about how this cue affects memory and it is this belief that mediates the font-size effect. Such a belief about memory may be developed prior to the experiment and then applied in the experimental context, or it may be developed on-line as people consider how the cue could potentially influence memory. For an instance of the latter case, explicit instructions to predict future memory performance may trigger an analytic problem-solving mode in which people attempt to identify cues that will allow them to reduce uncertainty in their predictions. Research using multiple-trial methods has firmly established that people's beliefs can mediate the effects of some cues on JOLs (e.g., Bieman-Copland & Charness, 1994; Dunlosky & Hertzog, 2000; Hertzog et al., 2009; Tauber & Rhodes, 2010). For instance, Tauber and Rhodes (2010) had participants study face-noun pairs and make a JOL for each one. Some faces were associated with a name (Mr. Baker) whereas others were associated with an occupation (baker). After studying and making JOLs, the faces were presented and participants had to recall the corresponding name or occupation for each one. During an initial study-test trial, this cue (name vs. occupation) did not influence JOLs, although recall was better for occupations than for names. On a second study-test trial with new face-noun pairs, JOLs were greater for face-occupation pairs than for face-name pairs. Thus, participants learned from task experience during the initial test trial that occupations were better remembered, and this new knowledge influenced JOLs on the second trial. That is, a belief was developed on-line during the experiment and subsequently mediated the effect of this cue on JOLs.

Despite the intuitive plausibility that these factors – fluency and beliefs – contribute to the effects of cues on JOLs, the degree to which they actually mediate any cue-JOL relations has rarely been directly investigated (for exceptions, see Besken & Mulligan, 2013; Castel, 2008; Mueller, Tauber, & Dunlosky, 2013), and no research has evaluated their contribution to the font-size effect. We were particularly interested in the font-size effect because the prevailing interpretation is that it is mediated by fluency (e.g., Alter & Oppenheimer, 2009; Bjork et al., 2013; Carpenter, Wilford, Kornell, & Mullaney, 2013; Diemand-Yauman, Oppenheimer, & Vaughan, 2011; Greifeneder & Unkelbach, 2012; Kornell, Rhodes, Castel, & Tauber, 2011; Rhodes & Castel, 2008; Schwartz & Efklides, 2012). For example, Diemand-Yauman et al. (2011) claimed that "Rhodes and Castel (2008) demonstrated biases in metacognition by manipulating fluency via font size" (p. 114). And more recently, Bjork et al. (2013) note that "metacognitive judgments tend to be higher for items with greater perceptual fluency – that is, items that are subjectively easier to process at a perceptual level... [e.g.,] larger fonts have been incorrectly judged to be memorable" (p. 432). In some circumstances, researchers assumed that the font-size