

Personality and Social Psychology Review

<http://psr.sagepub.com>

Uniting the Tribes of Fluency to Form a Metacognitive Nation

Adam L. Alter and Daniel M. Oppenheimer

Pers Soc Psychol Rev 2009; 13; 219 originally published online Jul 28, 2009;

DOI: 10.1177/1088868309341564

The online version of this article can be found at:

<http://psr.sagepub.com/cgi/content/abstract/13/3/219>

Published by:



<http://www.sagepublications.com>

On behalf of:



[Society for Personality and Social Psychology, Inc.](#)

Additional services and information for *Personality and Social Psychology Review* can be found at:

Email Alerts: <http://psr.sagepub.com/cgi/alerts>

Subscriptions: <http://psr.sagepub.com/subscriptions>

Reprints: <http://www.sagepub.com/journalsReprints.nav>

Permissions: <http://www.sagepub.com/journalsPermissions.nav>

Citations <http://psr.sagepub.com/cgi/content/refs/13/3/219>

Uniting the Tribes of Fluency to Form a Metacognitive Nation

Adam L. Alter

New York University

Daniel M. Oppenheimer

Princeton University

Processing fluency, or the subjective experience of ease with which people process information, reliably influences people's judgments across a broad range of social dimensions. Experimenters have manipulated processing fluency using a vast array of techniques, which, despite their diversity, produce remarkably similar judgmental consequences. For example, people similarly judge stimuli that are semantically primed (conceptual fluency), visually clear (perceptual fluency), and phonologically simple (linguistic fluency) as more true than their less fluent counterparts. The authors offer the first comprehensive review of such mechanisms and their implications for judgment and decision making. Because every cognition falls along a continuum from effortless to demanding and generates a corresponding fluency experience, the authors argue that fluency is a ubiquitous metacognitive cue in reasoning and social judgment.

Keywords: fluency; metacognition; naïve theories

Human judgment reflects not only the content of our thoughts but also the metacognitive experience of processing those thoughts (e.g., Flavell, 1979; Schwarz et al., 1991; Tversky & Kahneman, 1973). *Processing fluency*, or the subjective experience of ease with which people process information, is one such metacognitive cue that plays an important role in human judgment. In a classic article, Schwarz et al. (1991) showed that fluency affects judgments over and above cognitive content. Before making judgments about their own assertiveness, some participants were asked to recall 6 examples of assertive behavior (an easy task), and others were asked to recall 12 examples (a difficult task). Thus, content and fluency were disambiguated; participants who had

many examples in mind found the process difficult, whereas those who had fewer examples in mind retrieved them more easily. It is important to note that fluency played a greater role than cognitive content in shaping participants' judgments. Participants rated their own assertiveness according to how easily examples of assertive behavior came to mind rather than how many examples of assertiveness they had generated.

Schwarz et al. (1991) showed that fluency influences judgment independently of the retrieved content that accompanies the experience of fluency. If the experience of fluency is important regardless of the associated content, then the ease or difficulty associated with a broad range of cognitive processes should have similar effects on judgment. Indeed, Schwarz (2004) later noted that, "theoretically, any . . . variable that increases processing fluency should have the same effect" (p. 338). Supporting this claim, researchers have manipulated processing fluency using numerous approaches, including semantic priming (e.g., Begg, Anas, & Farinacci, 1992), visual clarity (e.g., Reber & Schwarz, 1999), and phonological priming (e.g., McGlone & Tofigbakhsh, 2000). Each

Authors' Note: The first author was funded by a fellowship in the Woodrow Wilson Society of Scholars at Princeton University and a Charlotte Elizabeth Procter dissertation fellowship. The second author was funded by NSF Grant No. 0518811. The authors thank John Darley, Adele Goldberg, Geoff Goodwin, Joe Simmons, Mary Steffel, and Jeff Zemla for their invaluable assistance and comments on earlier drafts of this review. Please address correspondence to Adam L. Alter, Psychology Department, Princeton University, Princeton, NJ 08544; e-mail: aalter@princeton.edu.

PSPR, Vol. 13 No. 3, August 2009 219-235

DOI: 10.1177/1088868309341564

© 2009 by the Society for Personality and Social Psychology, Inc.

manipulation influences a different proximal cognitive system: Semantic priming induces conceptual fluency, visual clarity induces perceptual fluency, and phonological simplicity induces linguistic fluency. However, all three studies found identical effects: Participants rated fluent stimuli as more true or accurate than similar but less fluent stimuli. Thus, although processing fluency takes many forms, we argue in this review that fluency exerts the same influence on judgments independently of how it is generated (summarized in Table 1).

IDENTIFYING NOVEL INSTANTIATIONS OF FLUENCY

Like many researchers, we believe that fluency takes a wide variety of forms (e.g., Kelley & Rhodes, 2002; Petty, Briñol, Tormala, & Wegener, 2007; Schwarz, 1998, 2004; Skurnik, Schwarz, & Winkielman, 2000; Winkielman, Schwarz, Fazendeiro, & Reber, 2003). Nonetheless, our definition of fluency encompasses a range of metacognitive phenomena that have not been identified as fluency effects before now. For example, McGlone and Tofighbakhsh (2000) suggested that rhyming constitutes a form of “linguistic” processing fluency such that rhyming phrases are easier to process than nonrhyming phrases. We have expanded and refined this definition, suggesting that linguistic fluency operates at many levels of linguistic processing. For example, some nonword strings are easier to pronounce than others (e.g., *Barnings* vs. *Yoalumnix*; phonemic fluency: Alter & Oppenheimer, 2006); some words are simpler alternatives to more complex words (e.g., *use* vs. *utilize*; lexical fluency: Oppenheimer, 2006); some sentences are more syntactically complicated than semantically identical alternatives (e.g., *the cat sat on the mat* vs. *on the mat sat the cat*; syntactic fluency: Lowrey, 1998); and some symbols are easier to translate into their linguistic meaning (*Some \$ymbol\$ @re e@\$ier*; orthographic fluency: Alter, Oppenheimer, Epley, & Eyre, 2007; see Figure 1 for a full range of linguistic and other fluency instantiations).

We recognize that retrospectively classifying existing studies as *fluency effects* requires an important caveat: The independent variables in those studies may not have explicitly manipulated processing ease, so we cannot conclude absolutely that those effects were driven by differential fluency. Nonetheless, in each case, the experimental conditions differed according to how easily participants could, or perceived they could, complete the cognitive processes associated with an assigned task. To clarify how each instantiation of fluency satisfies this criterion of inclusion, we describe each instantiation in turn before examining how those instantiations influence judgment.

Therefore, this review has two major goals: First, we aim to develop a comprehensive catalogue of the various cognitive mechanisms that generate fluency experiences (the tribes of fluency); second, we aim to show that these various instantiations exert consistent effects on judgment (forming a metacognitive nation). We are not suggesting that fluency exerts the same effects on judgment in every situation. As with many phenomena in social cognition, people’s interpretations of fluency depend strongly on the context. For example, in Schwarz et al.’s (1991) study, participants used fluency to answer the question, “How assertive am I?” whereas other researchers have examined the effects of fluency on truth, liking, and confidence judgments, among other dimensions. Schwarz (2004) coined the term *naïve theories* to label these context-specific interpretations of fluency. Naïve theories, which are learned or acquired over time (Briñol, Petty, & Tormala, 2006; Unkelbach, 2006), guide how people apply the experience of fluency to domain-specific judgments. Whereas one naïve theory might imply that a complex—and therefore disfluent—artwork is novel and interesting, a second naïve theory might classify complex, disfluent written prose as clumsy and awkward. Thus, naïve theories bridge the gap between the experience of fluency and its implications for a particular judgment.

The nature of naïve theories and its mediating link between fluency and judgment has been the topic of a number of excellent articles (e.g., Briñol et al., 2006; Oppenheimer, 2008; Thomas & Morwitz, 2009; Unkelbach, 2006; for a review, see Schwarz, 2004). Thus, in this review, our goal is not to explore how fluency leads to judgment but rather to explicate the processes that engender fluency in the first place and show that, despite their diversity, they lead to remarkably uniform judgments across a range of domains (see Figure 2). Whereas earlier research tacitly assumed a direct link between fluency and judgment (a simplified version of Stage 1 and Stage 3), and recent reviews have largely focused on naïve theories and their effects on judgment (Stages 2 and 3), we demonstrate that fluency is a general metacognitive cue that arises from a broad range of cognitive processes (the link between Stages 1 and 2).

THE TRIBES OF FLUENCY

As a rule, every cognitive task can be described along a continuum from *effortless* to *highly effortful*, which produces a corresponding metacognitive experience that ranges from *fluent* to *disfluent*, respectively.¹ Thus, for example, watching a film at the cinema is more visually fluent than watching the same film on a small black and white television from the far end of a large room.

TABLE 1: Catalogue of Fluency Research Showing That Different Instantiations of Fluency Influence Various Judgments and Decisions in a Consistent Manner

<i>Research Article</i>	<i>Judgment Domain</i>	<i>Fluency Manipulation</i>	<i>Basic Finding</i>
Reber & Schwarz (1999) McGlone & Tofigbakhsh (2000)	Truth	Visual ease Linguistic (rhyming)	Fluent statements seem truer than disfluent statements. Rhyming aphorisms seem truer than nonrhyming aphorisms.
Brennan & Williams (1995) Begg, Anas, & Farinacci (1992)		Linguistic (prosody) Retrieval ease	Absence of disfluent speech markers like “uh” or “um” implies truth. Easily retrieved propositions are rated truer than obscured propositions.
Kelley & Lindsay (1993)		Semantic priming	Semantically primed words seem to be better responses to trivia questions.
Bornstein & D’Agostino (1992); Zajonc (1968)	Liking	Retrieval ease	Easily retrieved stimuli are preferred to difficult-to-retrieve stimuli.
Reber, Winkielman, & Schwarz (1998)		Visual ease	Stimuli against highly contrastive backgrounds are preferred to stimuli against less contrastive backgrounds.
Winkielman & Cacioppo (2001)		Visual contour priming	Primed visual contours are preferred to nonprimed visual contours.
Stepper & Strack (1993); Tamir, Robinson, Clore, Martin, & Whitaker (2004)		Embodied cognition	Chosen posters are preferred when chosen with puffed cheeks rather than a furrowed brow.
Iyengar & Lepper (2000)		Decision conflict	Difficult-to-choose items are less preferred than easy-to-choose items.
Petrova & Cialdini (2005); Mandel, Petrova, & Cialdini (2006)		Imagination ease	Easier-to-imagine travel destinations are preferred to difficult-to-imagine destinations.
Day & Gentner (2006); Labroo, Dhar, & Schwarz (2008); Lee & Labroo (2004)		Conceptual priming	A passage of text is preferred when primed with a related passage of text; a product is preferred when primed with related concepts.
Rhodes, Halberstadt, & Brajkovich (2001); Winkielman, Halberstadt, Fazendeiro, & Catty (2006)		Prototypicality	Prototypical faces and dot configurations are preferred to alternatives that deviate substantially from the prototype.
Reder (1987); Schwartz & Metcalfe (1992)	Confidence	Semantic priming	Trivia responses feel more accurate when primed with related concepts.
Alter, Oppenheimer, Epley, & Eyre (2007); Novemsky, Dhar, Schwarz, & Simonson (2007); Simmons & Nelson (2006a, 2006b)		Visual ease	Statements written in easy-to-read font inspire confidence.
Hertzog, Dunlosky, Robinson, & Kidder (2003)		Encoding ease	Independent of accuracy, information seems easier to remember when it is easily encoded.
Kelley & Lindsay (1993)		Retrieval ease	Trivia responses feel more accurate when easily retrieved from memory.
Alter et al. (2007); Stepper & Strack (1993); Tourangeau & Ellsworth (1979)		Embodied cognition	Trivia responses feel more accurate when answered with puffed cheeks rather than a furrowed brow.
Tversky & Kahneman (1973)	Frequency/familiarity	Retrieval ease	Categories with exemplars that are difficult to retrieve seem less populated.
Reber & Zupanek (2002)		Visual ease	Words written in easier-to-read font seem more familiar than words written in difficult-to-read font.
Whittlesea & Williams (1998)		Linguistic (word level)	Nonwords of regular form (e.g., <i>hension</i>) seem more familiar than nonwords of irregular form (e.g., <i>stowfus</i>).
Whittlesea (1993)		Semantic priming	Semantically primed words seem more familiar than nonprimed words. Easier-to-imagine events seem more likely to happen.
Kahneman & Tversky (1982) Jacoby & Dallas (1981)		Retrospective imagery Retrieval ease	Previously exposed words feel as though they are presented for longer during a second presentation.
Oppenheimer (2006)	Intelligence	Visual ease; linguistic (word level); linguistic (sentence level)	Easier to process text seems to have been written by a more intelligent author.

(continued)

TABLE 1: (continued)

Research Article	Judgment Domain	Fluency Manipulation	Basic Finding
Alter & Oppenheimer (2006, 2008b); Borges, Goldstein, Ortmann, & Gigerenzer (1999)	Valuation	Linguistic (phonotactic); retrieval ease	More easily pronounced financial stocks outperform less easily pronounced financial stocks; fluent currency (notes and coins) seems more valuable; recognized stocks outperform unrecognized stocks.
Jacoby, Woloshyn, & Kelley (1989); Strack & Neumann (2000)	Fame	Retrieval ease	Previously presented faces seem more famous than novel faces; faces seem less famous when perceivers furrow their brows.
Goodwin (2006)	Faultiness	Reasoning	Difficult-to-process components of electrical circuits seem more faulty.
Collister & Tversky (2000); Oppenheimer & Frank (2007)	Category typicality	Visual ease; retrieval ease	Visually fluent exemplars seem more typical of a category; common exemplars seem typical, controlling for feature typicality.

NOTE: This table summarizes the research reviewed in this article.

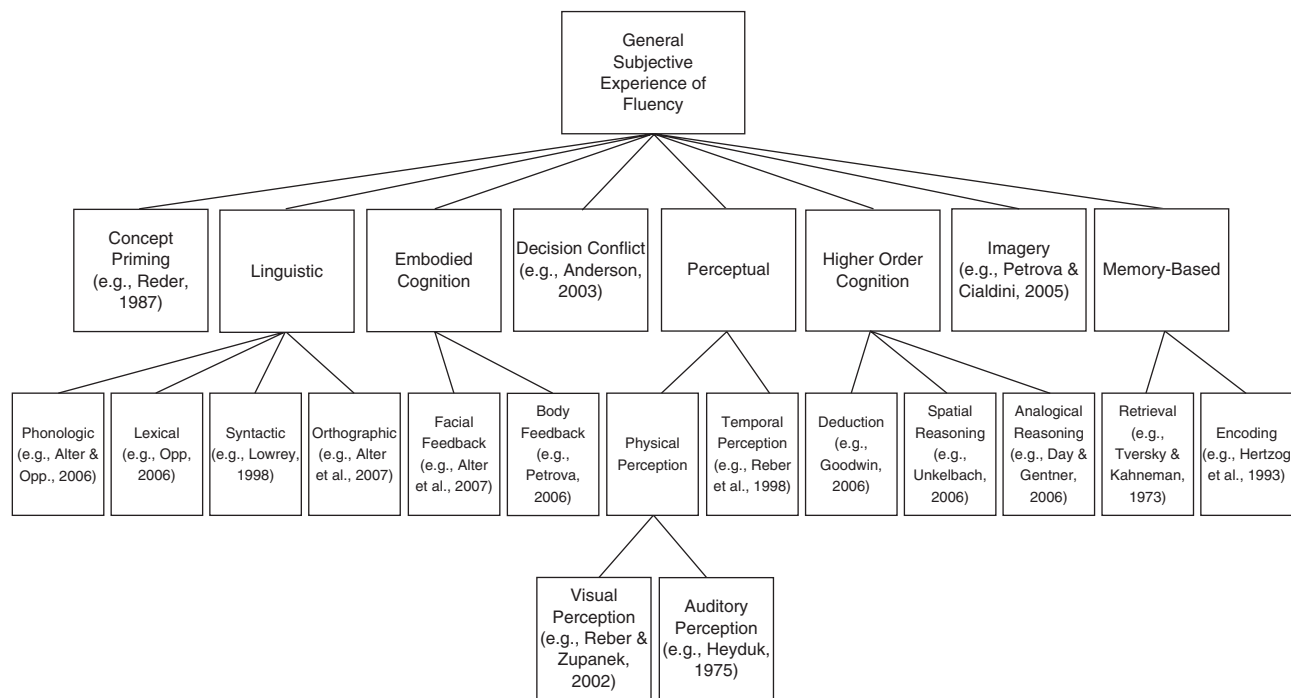


Figure 1 A comprehensive catalogue of the various instantiations of fluency.

NOTE: Each instantiation of fluency contributes to the same general subjective experience of ease that accompanies a particular judgment or decision.

However, visual clarity is only one of many dimensions along which fluency varies. Fluency experiences arise as a byproduct of a wide array of cognitive processes, including but not limited to perception, memory, embodied cognition, linguistic processing, and higher order cognition (see Figure 1 for a summary).

Perceptual Fluency

Physical perceptual fluency. Visual perceptual fluency is a staple among fluency researchers, and many

researchers have manipulated fluency by varying the ease with which participants are able to perceive the target stimuli. Perhaps the most common instantiation is the font manipulation (e.g., Alter & Oppenheimer, 2008b, in press; Alter et al., 2007; Novemsky, Dhar, Schwarz, & Simonson, 2007; Reber & Zupanek, 2002; Simmons & Nelson, 2006a, 2006b), in which questionnaires are printed in either a clear font (e.g., 12-point Times New Roman or Arial) or an unclear font (e.g., a small, gray, italicized font: *sample*, or condensed font like **Haettenschweiler** or **Impact**).

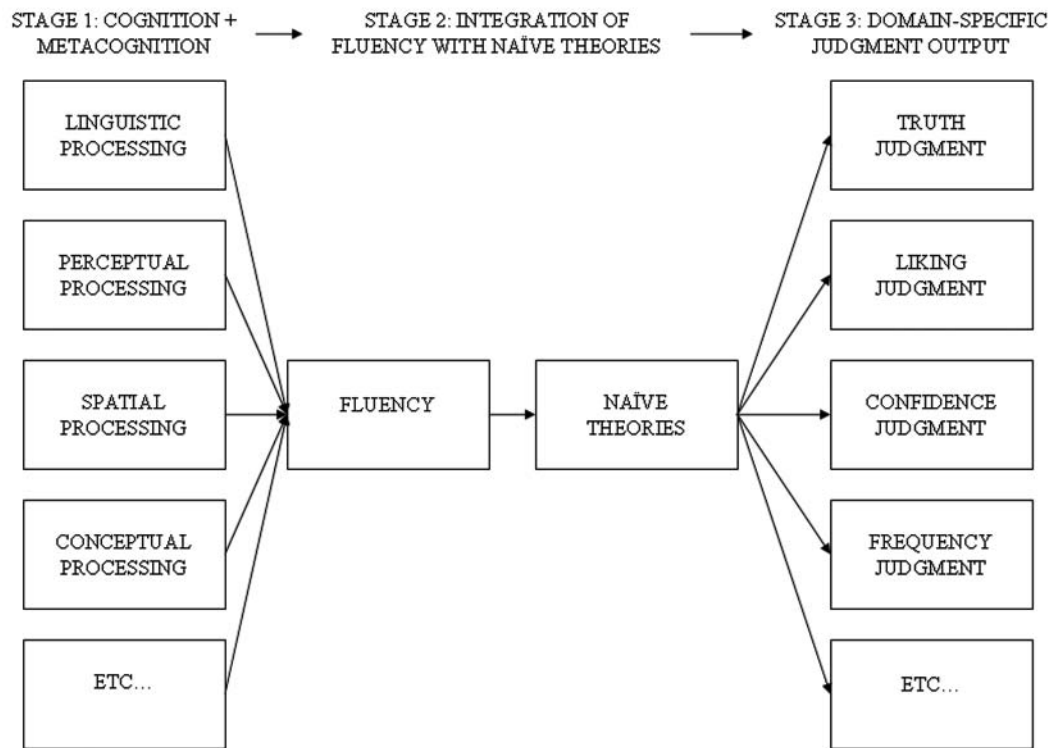


Figure 2 Three-stage process of cognition + metacognition (Stage 1, our focus in this article), integration of fluency and domain-specific naïve theories (Stage 2), and judgment output (Stage 3).

Other researchers have manipulated visual perceptual fluency using a range of creative techniques. For example, Reber and Schwarz (1999) manipulated the fluency of written statements presented on a computer monitor by varying the contrast between the statements and the white background. Whereas some statements were printed in highly visible dark blue and red fonts, others were printed in more difficult to perceive green, light blue, and yellow fonts.

Using a similar approach, Reber, Winkielman, and Schwarz (1998; see also Hansen, Dechêne, & Wänke, 2008; Laham, Alter, & Goodwin, in press) presented participants with gray circles against highly or lowly contrasting backgrounds. The darker gray circles against a light background and lighter gray circles against a dark background were easier to perceive visually than the same circles presented against similarly shaded backgrounds.

Temporal perceptual fluency. In the instantiations described above, researchers manipulated fluency by altering the physical clarity of the target stimuli. However, stimuli are also easier to perceive when they are visible for longer periods of time or when they are preceded by matching visual primes. In one study (Winkielman & Cacioppo, 2001, Study 1), participants

watched a slideshow containing neutral everyday images. For half the participants, the neutral images were preceded by matching contour primes, whereas for the other half, the images were preceded by nonmatching primes. Prior exposure to the contour produced the experience of processing ease.

In a second study, Winkielman and Cacioppo (2001, Study 2) subtly manipulated how long the same pictures were presented, for between 300ms to 900ms. Using a more nuanced manipulation of temporal presentation, Reber et al. (1998) exposed participants to geometric patterns for 100ms, 200ms, 300ms, or 400ms. Longer exposure led to increased processing fluency.

In sum, perceptual fluency varies according to how easily stimuli are perceived physically, their presentation duration, and whether they have been presented earlier or preceded by similar primes at an earlier stage in the experiment.² Perceptual fluency manipulations are perhaps most common, but researchers have also manipulated the fluency of many other cognitive processes.

Memory-Based Fluency

Retrieval fluency. Although Tversky and Kahneman (1973) did not use the *fluency* label in their seminal

article, the availability heuristic was one of the first demonstrations that retrieval fluency influences judgment. Retrieval fluency is the subjective ease or difficulty with which people bring to mind exemplars that conform to a particular rule. Tversky and Kahneman manipulated retrieval fluency by asking participants to compare the size of categories with exemplars that were either easy or difficult to retrieve from memory. For example, in one study, people retrieved words beginning with the letter K more easily than they could recall words with K as their third letter. In a second related study, Tversky and Kahneman presented participants with lists of names that were very famous (e.g., Richard Nixon) or only moderately famous (e.g., William Fulbright). Because the names of very famous people were more salient than the less famous names, they were easier to retrieve from memory. Schwarz et al. (1991) similarly capitalized on retrieval fluency when they asked participants to recall many or few instances in which they had behaved assertively or unassertively. Participants found it much more difficult to recall many instances than fewer instances.

Encoding fluency. Although fluency is more commonly associated with retrieval ease, researchers have also manipulated the ease with which information can be encoded in memory (Hertzog, Dunlosky, Robinson, & Kidder, 2003; see also Begg, Duft, Lalonde, Melnick, & Sanvito, 1989; Castel, McCabe, & Roediger, 2007). Hertzog et al. (2003) asked participants to remember pairs of concrete nouns by forming an image that linked the two nouns. Once participants formed the image, they pressed a key on the computer and proceeded to the next trial. Hertzog et al. quantified how fluently participants encoded the image of the two nouns by measuring how quickly they pressed the key after the two images appeared on the screen. In a related study, Castel et al. (2007) asked participants to memorize pairs of words that were either identical to (fluent pairs) or different from (disfluent pairs) each other. Participants in these studies therefore experienced greater fluency when they were given more time to encode new information and when they were asked to remember information they had seen earlier in the experiment. These studies suggest that encoding fluency is an important metacognitive cue when people assess how well they have learned new information.

Having considered perceptual- and memory-based origins of processing fluency, we turn to several metacognitive processes that are less commonly associated with fluency. Nonetheless, each process satisfies the definition of fluency as the subjective experience of ease associated with processing information.

Embodied Cognitive Fluency

People appear to use proprioceptive feedback cues, like the configuration of facial features and body posture, to assess the fluency of a task. Known as embodied cognition, the notion that subjective proprioceptive experiences form a distinct and important source of cognition is widely supported in the psychological literature to “Diverse findings in social and cognitive psychology suggest that proprioceptive experiences are distinct and important judgment cues (e.g., Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005; Proffitt, 2006; Stepper & Strack, 1993).

Facial feedback. People tend to associate distinct facial expressions with cognitive ease and cognitive difficulty (e.g., Stepper & Strack, 1993; Tourangeau & Ellsworth, 1979). Difficult tasks that require concentration tend to induce brow furrowing (activation of the corrugator muscle), whereas easy tasks tend to relax the corrugator and activate the zygomaticus major, or “smiling” muscle. Capitalizing on this association, numerous researchers have manipulated the subjective ease of cognitive tasks by asking participants to furrow their brows (activating the corrugator) or puff their cheeks or adopt a light smile (both activating the zygomaticus). For example, Stepper and Strack (1993) asked participants to recall examples of behaviors in their past, while adopting either a light smile or furrowing their brows. Participants who furrowed their brows experienced the task as more difficult and therefore believed that they experienced greater difficulty remembering exemplars. Alter et al. (2007; see also Tamir et al., 2004) similarly found that participants who furrowed their brows experienced greater disfluency than did participants who puffed their cheeks.

Body feedback. Although motor tasks differ according to how physically easy or difficult they are to perform, certain motor tasks also require more mental effort than others. For example, Petrova (2006) asked participants in one study to copy a statement using their nondominant hand, which demanded greater cognitive effort than writing with their dominant hand. Other researchers (e.g., Marks, 1996; Roig & Placakis, 1992) have manipulated cognitive ease by asking participants to trace a given pattern while looking at a mirror image of their hand as it completes the task. Although the process is no more physically taxing than writing in the absence of a mirror image, participants expend cognitive effort correcting for the mirror’s misleading feedback.

Linguistic Fluency

Phonological fluency. Certain letter strings are easier to process than others. For example, English speakers cannot naturally pronounce the string *SBG*, whereas they can quite easily pronounce the equally nonsensical *SUG*. In one study, Alter and Oppenheimer (2006) found that people experienced disfluency when asked to read unpronounceable ticker codes. Alter and Oppenheimer (2006, 2008b) have also used natural variation in the pronounceability of words as a way to manipulate fluency. English speakers struggle to pronounce certain company names (e.g., *Magyar Tavkoslesi Reszvenytarsasag*), and some obscure English words are harder to pronounce than others (*euneirophrenia* vs. *beestings*). The difficulty that participants have pronouncing these names engenders the experience of disfluency (Alter & Oppenheimer, 2008a, 2008b).

A further instantiation of phonemic fluency depends on the ease of transitions between syllables. Some transitions between syllables are more natural for English speakers than others. For example, the glide syllable *ld* is more fluent than a nonglide syllable such as *cd* (e.g., *falden* vs. *facden*). Researchers have taken advantage of these differences to contrast stimuli that roll off the tongue with others that are more difficult to say (Shah & Oppenheimer, 2007; Whittlesea & Williams, 1998). In one study, Whittlesea and Williams presented participants with fluent nonwords that satisfied the standard rules of English word construction (e.g., *hension*) and disfluent nonwords that violated the same rules (e.g., *stowfus*).

Using an alternative instantiation of phonemic fluency, McGlone and Tofiqbakhsh (2000) examined the effects of rhyming. They created rhyming and nonrhyming versions of obscure aphorisms (e.g., *Woes unite foes* vs. *Woes unite enemies*) and argued that rhyming phrases were easier to process than nonrhyming phrases.

Lexical fluency. Words differ according to how easily they are processed and seem to differentially influence judgment. Oppenheimer (2006) systematically varied the complexity of college admission essays, translations of philosophical texts, and dissertation abstracts by replacing simple words with complex alternatives (Study 1) and vice versa (Study 3). Texts that contained words that were more obscure and less familiar were harder to process.

Syntactic fluency. Linguistic processing also varies according to how easily readers can parse different grammatical constructions. Lowrey (1998) presented participants with Bran cereal print advertisements that were either syntactically complex or syntactically simple.

For example, one simple version claimed that “BRAN-NEW is a healthy choice for breakfast, because it’s high in fiber, and it’s preservative-free,” whereas its complex counterpart claimed, “Because it’s high in fiber and contains no preservatives, BRAN-NEW is a healthy choice for breakfast.”

Stromswold, Caplan, Alpert, and Rauch (1996; see also King & Just, 1991) used a second manipulation of syntactic fluency when they presented sentences with identical meaning that were either right-branching or center-embedded. For example, right-branching sentences like, “The child spilled the juice that stained the rug,” are easier to process than center-embedded sentences like, “The juice that the child spilled stained the rug.”

Orthographic fluency. Orthographic fluency is the subjective experience of ease with which people are able to translate written information into comprehensible language. Although people almost always write or type English words using the 26 letters of the English alphabet, there are other ways to express the same information. For example, Alter et al. (2007) used a variety of letter-like symbols to create a disfluent alternative to standard text (e.g., G@dget\$ @nd GïzmØ\$ instead of Gadgets and Gizmos). Steffel (2009) similarly manipulated orthographic fluency by varying the presentation of percentages as, for example, 12% (fluent) versus twelve percent (disfluent). In both cases, perceivers were forced to expend greater cognitive effort to translate the orthographically disfluent written information into a simpler or more familiar form.³

Higher Order Cognitive Fluency

Like language processes, people engage in a broad array of higher order cognitive tasks that fall along a continuum from fluent to disfluent. To date, research has shown that at least five distinct instantiations of fluency influence higher order cognition: conceptual fluency, diagnostic fluency, spatial reasoning fluency, ease of image formation, and decision making ease.

Conceptual fluency. Researchers have facilitated processing by priming participants with semantically related concepts. For example, Reder (1987) primed participants with the domain of golf by presenting the terms *golf* and *par*, which made it easier to process the question, “What is the term in golf for scoring one under par?” Schwartz and Metcalfe (1992) similarly asked people to solve arithmetic problems after components of those problems were exposed in an earlier phase of the study, making it easier to process the items.

Whittlesea (1993) manipulated conceptual fluency by presenting prime words before conceptually-related

target words. In these studies, Whittlesea relied on the notion that people can be semantically primed to think about certain concepts, which makes them more fluent (e.g., Collins & Loftus, 1975; Collister & Tversky, 2000). For example, the word *doctor* primes *nurse* strongly and, more weakly, other professions that are semantically more distant from the original prime. Although priming necessarily makes certain concepts more fluent than others, Whittlesea was the first to frame this effect as conceptual fluency. He showed that an incomplete sentence that led to a particular expectation, like "The stormy seas tossed the [boat]," made related concepts more fluent than an incomplete sentence that primed a number of outcomes, like "He saved up his money and bought a [boat]." Lee and Labroo (2004) similarly manipulated conceptual fluency by asking participants to evaluate consumer products after reading conceptually related or conceptually unrelated advertisements (e.g., an advertisement of a man walking into a bar makes it easier to think about beer).

A further series of studies showed that conceptual analogies make subsequent information easier to process. Day and Gentner (2006) manipulated analogical fluency by presenting participants with a passage of text that was either related or unrelated to a subsequent target passage. For example, participants with little expertise in genetics found it easier to process an abstruse passage on genetic coding when they first read an analogous passage on computer data storage. Referring to a similar mechanism, Topolinski and Strack (2009) coined the term *semantic coherence* to describe the ease with which people process target stimuli that follow conceptually related primes.

Just as concepts are more fluent when primed semantically, prototypical stimuli are inherently more fluent because they are the simplest exemplars of the target category. Researchers have manipulated prototypicality by combining a series of faces to form a prototypical *average* face (e.g., Rhodes, Halberstadt, & Brajkovich, 2001) and varying the degree to which a pattern of scattered dots replicates a prototypical configuration shown earlier in the experiment (e.g., Winkielman, Halberstadt, Fazendeiro, & Catty, 2006). In both cases, the prototypical stimuli were processed more easily than less prototypical stimuli.

Finally, conceptual priming also has the potential to facilitate perceptual processing. For example, in one study, priming people with the concept of a frog led them to process a wine bottle with a frog on its label more readily than a wine bottle without a frog on its label (e.g., Labroo, Dhar, & Schwarz, 2008). This effect persisted even when the two wine bottles were presented for only 16 ms.

Diagnostic fluency. In a deductive reasoning exercise, Goodwin (2006) asked participants to diagnose faults in simple Boolean networks by asking them to identify the faulty node that produced an unexpected output. There were three types of nodes: nodes that were activated when both of two input signals were active (the AND node), nodes that were activated when at least one of two input signals was active (the OR node), and nodes that were activated when one but not both of two input signals was active (the OR-ELSE node). Although other mechanisms may have played a role as well, Goodwin suggested that participants struggled to parse the OR-ELSE nodes, making the experience relatively more disfluent than parsing the simpler AND and OR nodes.

Spatial reasoning. Using a spatial reasoning task, Unkelbach (2006, Study 2) has also shown that the fluency of higher order reasoning processes influences judgment. Participants in Unkelbach's study mentally rotated two pictures depicting three-dimensional shapes to determine whether the depicted shapes were identical. Adopting stimuli from a study by Shepard and Metzler (1971), some of the pictures were difficult to align mentally, whereas others required little rotation before their similarity or difference became obvious. The subjective experience of rotating the latter shapes was more fluent than the subjective experience of rotating the former shapes, which demanded greater cognitive effort.

Imagery fluency. Hypothetical events vary according to how easy they are to imagine, and several researchers have explicitly manipulated how easily participants are able to imagine hypothetical scenarios that have not yet happened. For example, Mandel, Petrova, and Cialdini (2006) varied how easily business school students could imagine future success or failure by asking them to read a story about a successful business student (making success easy to imagine), an unsuccessful business student (making failure easy to imagine), or a biology student who was successful or unsuccessful (not affecting how easily they could imagine succeeding or failing as business students). In a second study, Mandel et al. manipulated imagery fluency by changing whether a fellow business major achieved success plausibly or implausibly. When success was implausible (e.g., selling a business for a higher profit than business students could imagine achieving), it was generally more difficult to imagine achieving success as a business student. In contrast, participants were able to fluently imagine achieving success when they read about a fellow business student who achieved a plausible level of success. In a second article, Petrova and Cialdini (2005) showed that participants responded more readily to advertisements that appealed

to visual imagery (e.g., advertisements asking participants to imagine a vacation destination) the higher they scored on a visual imagery vividness questionnaire.

Decision fluency. Although researchers exploring decision conflict have not traditionally identified decision conflict as an instantiation of fluency, there is good reason to construe the concept in this way. Decision conflict, the study of how the difficulty of making a decision influences people's decision-making patterns, maps neatly onto other fluency manipulations, which similarly vary the subjective ease of completing a cognitive task.

For example, Iyengar and Lepper (2000) varied decision fluency by varying the size of the choice set. In one classic study, they presented shoppers with either 24 exotic jams (the disfluent choice set) or a subset of only 6 jams (a fluent set). It is not surprising that shoppers were able to choose among the 6 jams with ease, but they experienced difficulty when forced to choose from among the full set of 24 jams. In addition to the difficulty engendered by having a large number of options from which to choose, researchers have manipulated decision conflict by manipulating how easily the options can be differentiated from one another (e.g., Steffell & Shafir, 2009; see also Anderson, 2003, for a review). For example, people assume that others will almost unanimously prefer a slightly expensive camera with superior picture resolution, zoom capability, and battery life, whereas they struggle to decide what others will choose when the more expensive camera is dominant on some but not all feature dimensions.

FORMING A METACOGNITIVE NATION

We have now introduced the tribes of fluency, from the better recognized instantiations (e.g., perceptual and memory fluency) to their lesser recognized counterparts (e.g., embodied cognitive, linguistic, and higher order cognitive fluency). For the remainder of this article, we describe the remarkably uniform effects that these diverse instantiations of fluency have on judgment. Our analysis suggests that, within each judgment context, people interpret fluency uniformly regardless of how it is instantiated. Of course, the fact that two independent processes produce the same outcome does not guarantee that those processes are operating through the same mechanism; however, the degree to which diverse instantiations of fluency converge to produce consistent outcomes across a diverse set of domains most parsimoniously implies that they share a common mechanism.

The purpose of this review is not to exhaustively describe the judgments that are influenced by fluency, so for illustrative purposes, we consider only three

representative domains in which different instantiations of fluency exert uniform effects on judgment: truth judgments, liking judgments, and confidence judgments. Finally, we turn to two further sources of evidence for the uniformity of fluency effects: (a) the tendency for people to adopt domain-specific naïve theories that inform their judgments within particular domains and (b) the tendency for people to discount fluency, regardless of its source, as an informative cue when its source is obviously irrelevant to the judgment at hand.

Truth Judgments

In the absence of objective knowledge, people are forced to evaluate truth using other cues that imply truth or fallacy. People tend to associate fluency with truth and disfluency with untruth (Schwarz, 2004), in large part because fluency implies frequency, which in turn implies social consenses (Schwarz, Sanna, Skurnik, & Yoon, 2007).⁴ Reber and Schwarz (1999; see also Begg et al., 1992) asked participants whether statements like "Lima is in Peru" and "Osorno is in Chile" were true and manipulated the contrast between the text of each question and the white background of the computer screen. As they expected, participants were more likely to believe that the statements were true when they were easy to read against the white background (e.g., dark blue and red) than when they were difficult to read against the white background (e.g., light blue and yellow)."

Whereas Reber and Schwarz manipulated the visual format of their questions, McGlone and Tofiqbakhsh (2000) found similar results when they manipulated the linguistic fluency of a series of aphorisms. Participants in their studies judged rhyming aphorisms as truer than nonrhyming aphorisms with identical meaning. McGlone and Tofiqbakhsh argued that the phonological linguistic fluency associated with the rhyming aphorisms created the impression of truth.

Begg et al. (1992) similarly argued that people represent easily retrieved propositions as truer than propositions that are difficult to draw from memory. Participants read statements that were labeled as true or false and later attempted to categorize both old and novel statements as true or false. As they expected, participants under cognitive load frequently recalled the old statements as true regardless of whether they were true or false. Begg et al. suggested that these easily retrieved stimuli were imbued with a sense of truthfulness.

There is also evidence to suggest that the experience of processing ease associated with semantic priming functions like other forms of processing fluency. Kelley and Lindsay (1993) manipulated ease of processing by semantically priming certain words that were either accurate (e.g., Austin) or inaccurate responses (e.g., Dallas) to a

question (e.g., What is the capital of Texas?). Regardless of whether the primed word correctly answered the question, people were more likely to respond with that word than with plausible alternatives. This finding suggests that the experience of fluency made the primed word seem like a truer or more accurate response to the question.

The uniformity of these findings suggests that fluency is a general mechanism that influences truth judgments independently of how it is instantiated. Whether a stimulus is easy to perceive visually (Reber & Schwarz, 1999), easy to process linguistically (McGlone & Tofighbakhsh, 2000), easy to retrieve from memory (Begg et al., 1992), or semantically activated (Kelley & Lindsay, 1993), people believe that it is truer than its less fluently processed counterparts.

Liking Judgments

As with judgments of truth, various instantiations of fluency also appear to have a uniform influence on judgments of liking. Zajonc (1968) provided early evidence that fluency influences liking judgments, when he showed that people prefer familiar stimuli to similar but novel alternatives. This *mere exposure effect* refers to the finding that people prefer already-seen stimuli to novel stimuli that are otherwise identical. Bornstein and D'Agostino (1992, 1994; Bornstein, 1989) later formalized the link between mere exposure and fluency. According to their *processing fluency/attribution model*, people are more easily able to retrieve stimuli from memory after repeated exposure, which induces feelings of positivity.

Perceptual fluency manipulations similarly induce liking. For example, people rate visually fluent stimuli against strongly contrastive backgrounds as more aesthetically pleasing than identical stimuli against less contrastive backgrounds (Reber et al., 1998). Testing a similar hypothesis, Winkielman and Cacioppo (2001, Experiment 1) showed participants line drawings of everyday objects that were preceded by matching or non-matching contour primes and measured the resulting activity of various facial muscles. Participants' facial expressions suggested that they reacted more positively to the drawings that were more fluent.

For the same reason that people prefer stimuli that are easier to remember and perceive, they appear to favor stimuli that are exposed for a longer period of time (Reber et al., 1998; Winkielman & Cacioppo, 2001). Reber et al. (1998, Experiment 3) found that people preferred pictures that were presented for 400 ms to similar pictures that were presented for 100 ms. Winkielman and Cacioppo (2001, Experiment 2) also found a positive linear relationship between presentation duration and activation of muscles associated with positive affect. The persistence of this effect in different domains led Reber and his colleagues (Reber, Schwarz,

& Winkielman, 2004) to coin the *hedonic fluency hypothesis*, which encapsulates the general principle that people prefer easily processed stimuli.

People also appear to use proprioceptive feedback to determine whether they like a target. For example, Tamir, Robinson, Clore, Martin, and Whitaker (2004) found that participants relied on their facial expressions as a cue when deciding whether they liked graphic posters. Participants who were asked to furrow their brows assumed they disliked the chosen poster when the task was easy. In similar decision research, Iyengar and Lepper (2000; for a review, see Anderson, 2003) found that difficult choices—those in which participants selected among an overwhelming array of options—induced less liking for the ultimate choice.⁵ Finally, also in the consumer choice literature, people appear to prefer travel destinations that they can imagine fluently (Petrova & Cialdini, 2005) and luxury products when they can easily imagine being successful in the future (Mandel et al., 2006).

Other research has shown that obscure primed texts are preferred to obscured unprimed texts. For example, Day and Gentner (2006) found that participants preferred an arcane passage on genetics when they had earlier read a structurally similar passage on computer information storage. This so-called conceptual priming makes subsequent information both easier to process and more likable. Lee and Labroo (2004) similarly found that participants preferred consumer products when they followed conceptually related primes (e.g., ketchup following an advertisement for mayonnaise), and Labroo et al. (2008) showed that people prefer products that are perceived more easily (e.g., a bottle of wine with a frog on its label) because they are primed with a semantically related concept (e.g., a frog). These novel effects are particularly important because they demonstrate that fluency induced at higher levels of cognition has the same effect on liking as do the lower order perceptual fluency effects that dominate the literature.

Thus, research suggests that perceptual fluency, linguistic fluency, embodied fluency, decision fluency, prospective imagery fluency, and conceptual fluency facilitate liking. Although the many manipulations described here seem quite diverse, they share two common properties: They influence the ease with which people process stimuli in the environment and also how positively or negatively people evaluate those stimuli. A similarly broad range of fluency manipulations appears to engender feelings of confidence.

Confidence Judgments

People generally feel greater confidence in their performance when a task is fluent than when it is disfluent (Kelley & Lindsay, 1993; Koriati, 1993). For example,

people who are primed to attend to a semantic domain are more confident about their subsequent responses to questions in that domain. Specifically, participants are more confident in their responses to trivia questions when earlier primed with related components of the entire question (e.g., Reder, 1987; Schwartz & Metcalfe, 1992).

People are also more confident when the instructions and content of a task are easier to read. Alter et al. (2007) showed that participants were more confident in their ability to answer various types of logic problems and to understand consumer reviews when those problems, and the preceding instructions, were printed in an easily perceived font and in an orthographically fluent font rather than a series of less standard letter-like symbols. These results converged with their results in more than a dozen other studies to suggest that perceptual disfluency weakens people's confidence in their judgments (e.g., Gill, Swann, & Silvera, 1998; Kelley & Lindsay, 1993; Simmons & Nelson, 2006a, 2006b; Swann & Gill, 1997).

As with perceptual processing, people are more confident about remembering new information that is easier to encode (e.g., Begg et al., 1989; Castel et al., 2007; Hertzog et al., 2003; Koriatic & Ma'ayan, 2005; Thiede & Dunlosky, 1999). For example, participants were more confident about their ability to recall word pairs when given more time to learn those pairs (Hertzog et al., 2003) and when the pairs of words were similar or identical (Castel et al., 2007). Similarly, people appear to be more confident in the accuracy of trivia responses that are more easily retrieved from memory (Kelley & Lindsay, 1993). It is important to note that the feelings of confidence that arise from both encoding ease and retrieval ease are not necessarily accompanied by greater accuracy, suggesting that fluency artificially inflates self-assessments of accuracy and competence. These studies therefore suggest that encoding and retrieval fluency are important metacognitive cues when people assess how well they have learned and remembered information.

Fluency derived from facial expressions similarly influences how confident people feel about their judgments. In one recent study (Alter et al., 2007; see also Stepper & Strack, 1993; Tourangeau & Ellsworth, 1979), participants answered a series of trivia questions while furrowing their brows (implying disfluency) or puffing their cheeks (implying fluency). Although they were equally accurate in both conditions, participants were more confident of having answered the questions correctly when they puffed their cheeks.

As with judgments of truth, and liking, cognitive fluency arising from a vast array of cognitive processes seems to uniformly influence confidence judgments.

People experience greater confidence when the target attributes are primed (e.g., Reder, 1987), easier to see (e.g., Simmons & Nelson, 2006), orthographically fluent (e.g., Alter et al., 2007), easy to encode in memory (e.g., Castel et al., 2007), easier to retrieve from memory (Kelley & Lindsay, 1993), and associated with relaxed facial expressions (e.g., Stepper & Strack, 1993).

In sum, different manipulations of fluency based on different proximal cognitive systems have uniform effects on judgments in several distinct domains including truth, liking, and confidence. Although these are perhaps the most widely investigated domains, fluency also affects other judgments. Although an exhaustive catalogue is beyond the scope of this article, we briefly note several illustrative instances below (for related reviews, see Kelley & Rhodes, 2002; Schwarz, 2004; Skurnik et al., 2000; Winkielman et al., 2003).

SITUATION-SPECIFIC AND PERSONALITY-BASED NAÏVE THEORIES

Noting that fluency variously implies truth, liking, and confidence, researchers have turned to consider how people decide what fluency means in a particular context. As Skurnik et al. (2000; see also Schwarz, 2004) suggested, people implement naïve theories about what fluency means depending on the nature of the context and depending on the outcomes they have learned to associated with subjective ease (Briñol et al., 2006; Oppenheimer, 2008; Schwarz, 2004; Unkelbach, 2006; Winkielman et al., 2003). For example, when asked to judge whether they have seen a face before, people naïvely assume that previously seen faces will be easier to process than novel faces. In this context, fluency implies prior exposure. In a different context, the same experience of fluency might imply any of a range of possible conclusions—that the person was seen recently, is a friend rather than a foe, or is more attractive. It is beyond the scope of this article to exhaustively review the nature of naïve theories. However, given that people interpret fluency through the lens of domain-specific naïve theories, it is worth noting that within each domain, people appear to draw the same conclusions from different instantiations of fluency.

For example, in one set of studies, Oppenheimer (2006) showed that three distinct manipulations of fluency (visual perceptual fluency, lexical linguistic fluency, and syntactic linguistic fluency) influenced judgments of intelligence. Alter and Oppenheimer (2006, 2008a) used three different instantiations of fluency—phonemic linguistic fluency, visual perceptual fluency, and familiarity-based retrieval fluency to show that the general construct of fluency affects judgments of value (see also Borges,

Goldstein, Ortmann, & Gigerenzer, 1999, for additional examples of retrieval fluency affecting value judgments). Similarly, researchers have induced the illusion that novel stimuli are famous or common by presenting those stimuli earlier in the experiment (Jacoby, Woloshyn, & Kelley, 1989), by asking perceivers to adopt fluent facial expressions (Strack & Neumann, 2000), by presenting those stimuli in a fluent font (Reber & Zupanek, 2002), or by making those novel stimuli superficially similar to stimuli that occur commonly in the environment (e.g., Whittlesea, 1993; Whittlesea & Williams, 1998). Judgments of category membership are similarly susceptible to both visual perceptual fluency (Oppenheimer & Frank, 2007) and familiarity-based retrieval fluency (Collister & Tversky, 2000).

Although this is hardly an exhaustive list of fluency effects, it is worth noting that within each judgment domain, different instantiations of fluency induce similar judgments. Despite the wide range of cognitive processes that experimenters manipulated to create feelings of ease and difficulty, within each domain, the experience of fluency led to remarkably uniform effects.

Although people who occupy the same judgment context typically share the same naïve theories, individual differences sometimes produce more than one interpretation of fluency within a particular context. In one representative example, Winkielman and Schwarz (2001) asked 100 undergraduates whether they believed that “a pleasant childhood is difficult to remember” or “an unpleasant childhood is difficult to remember” (p. 177). Although the two statements proposed contradictory naïve theories, 51% of the sample endorsed the former theory, and 49% endorsed the latter theory. Note, however, that although there are individual differences in how people interpret fluency experiences, these differences do not depend on how fluency was manipulated (e.g., linguistically, perceptually, etc.). That is, people may endorse different naïve theories, but those naïve theories will operate consistently across a range of fluency instantiations.

Further evidence for a common mechanism underpinning the effects of fluency on judgment resides in the research on attributional or causal discounting effects. When people recognize the true source of fluency (e.g., when an experimenter’s font manipulation is too heavy handed), they tend to cease using it as an informative cue—a process known as discounting. Researchers have shown evidence for discounting using a wide array of fluency manipulations. Simply, people attribute fluency to the most obvious and available cause regardless of how it is induced.

DISCOUNTING FLUENCY AS AN INFORMATIVE CUE

People prefer to attribute an event to one rather than multiple plausible causes (Einhorn & Hogarth, 1986; Kelley, 1973). Thus, once they attribute fluency to a source irrelevant to the judgment at hand, the experience of fluency no longer influences their judgment. This logic explains why people use subjective experiences like mood, emotions, and bodily sensations as a useful judgmental cue, unless they become aware that the subjective experience might be driven by an irrelevant external cause (for a review, see Schwarz & Clore, 2007). In addition to mood, emotions, and bodily sensations, this effect also tends to occur across a wide variety of fluency instantiations, further suggesting that fluency is a general metacognitive cue that behaves similarly regardless of how it is engendered. For example, Schwarz et al. (1991; see also Simmons & Nelson, 2006a, 2006b) found that people used retrieval fluency to guide their self-assertiveness judgments, unless the experimenter drew their attention to distracting background music. Participants then attributed the disfluency of retrieving many examples of assertiveness to the music rather than to a lack of assertiveness, so their judgments were no longer influenced by retrieval fluency. As a consequence, instead of relying on retrieval ease to assess their assertiveness, participants relied on the number of instances of assertiveness or unassertiveness they had generated. Thus, when metacognitive experiences are no longer informative, people turn to other available cues like cognitive content to form evaluative judgments.

Soon after Schwarz et al. documented this discounting effect, Bornstein and D’Agostino (1992, 1994; but see Newell & Shanks, 2007) devised the *perceptual fluency/attribution* model to explain why mere exposure effects tend to be stronger when participants are not aware that they have already seen the pre-exposed stimuli. They found that people prefer previously seen stimuli over novel stimuli when those stimuli are presented for 5 ms but not when they are presented for 500 ms. According to their model, once participants could attribute perceptual fluency to prior exposure, they were less likely to use processing ease as a proxy for liking.

One important distinction between these findings is that Schwarz et al. had to encourage participants to discount fluency as a metacognitive cue by providing an irrelevant alternative source of processing difficulty (i.e., music), whereas participants in Bornstein and D’Agostino’s studies appeared to discount the role of fluency spontaneously. Oppenheimer (2004) formalized this distinction by coining the term *spontaneous discounting*,

according to which people will automatically discount the informativeness of fluency when they recognize that it emanates from an irrelevant source. It is crucial that, regardless of whether discounting is spontaneous or directed, people will discount fluency as a diagnostic cue once they explicitly or implicitly recognize that it stems from an irrelevant source.

In one demonstration of spontaneous discounting, Oppenheimer (2004) found that participants underestimated the prevalence of surnames like Bush and Clinton relative to similarly common but nonfamous names like Stevenson and Woodall. Oppenheimer argued that people discount the role of name availability as a cue for frequency when there is an obvious reason that those names should be mentally available. Thus, participants systematically underestimated the commonness of the famous names relative to the nonfamous names because they overcorrected for the influence of fame in the mental availability of the famous names.

In a separate study, Oppenheimer (2006; see also Oppenheimer & Frank, 2007) used a perceptual fluency manipulation to elicit spontaneous discounting. In one study, Oppenheimer asked participants to indicate the intelligence of authors whose written work had been printed with an almost-empty toner cartridge. Although participants rated authors of disfluent prose as less intelligent in four earlier studies, the effect disappeared in this case because participants attributed the experience of disfluency to the toner cartridge rather than to the author's poor communication skills. When the font was difficult to read for less salient reasons, however, participants persisted in judging the author as less intelligent.

Adopting a different approach, Whittlesea and Williams (1998) found evidence for spontaneous discounting by manipulating the obviousness of linguistic disfluency. During the first phase of the experiment, they exposed participants to a mixture of real words (e.g., *daisy*), regular nonwords (e.g., *hension*), and irregular nonwords (e.g., *stowfus*). In the second phase, they asked participants to indicate whether they remembered seeing words from each of the three categories during the exposure phase. Participants tended to misremember having seen the regular nonwords but not the real words or irregular nonwords. Whittlesea and Williams argued that participants used processing fluency as a proxy for prior exposure, except when they had a good reason to discount fluency as a valid cue. Although participants read the real words very fluently, they discounted processing fluency as a cue because they had encountered those words outside the context of the experiment. Thus, participants spontaneously discounted the role of processing fluency when it could be attributed to prior exposure outside of the experimental context.

Novemsky et al. (2007) found evidence for discounting using yet another manipulation of fluency. They found that participants who were told that a decision would be difficult for extraneous reasons (e.g., poor font) made identical decisions to participants who made the decision with ease. Specifically, they were less likely to defer a decision or to choose a compromise option than participants who were not led to attribute the experience of disfluency to an external source.

These results show that discounting effects are quite nuanced and situation specific. Whereas people sometimes disregard fluency altogether (e.g., Schwarz et al., 1991), at other times, they overcorrect in an attempt to uncontaminate their judgments (Oppenheimer, 2004; see also Wilson & Brekke, 1994). At other times, they rely on other available diagnostic information that leads them to form similar conclusions (e.g., Novemsky et al., 2007) or opposing conclusions (e.g., Schwarz et al., 1991). The outcome of attributional discounting therefore depends on whether other cues are available and, if so, whether those cues imply similar outcomes or outcomes that oppose the discounted metacognitive cue.

Regardless of whether discounting occurs spontaneously or in response to explicit cues, the process of discounting appears to be consistent across numerous forms of fluency. When participants attribute fluency to an irrelevant source, they discount its role as a useful metacognitive cue regardless of how it is generated. Whereas the preceding studies show that this effect holds for perceptual, linguistic, retrieval, and decision fluency, the effect is likely to extend to other forms of fluency. Of course, superficial forms of fluency like font clarity and retrieval ease are easier to attribute to a particular source, so they are more likely to lead to discounting. Nonetheless, researchers might consider the role of discounting in other forms of judgments that arise from processing fluency, like fault diagnosis (Goodwin, 2006) and image formation (Medvec, Madey, & Gilovich, 1995; Petrova & Cialdini, 2005). In those cases, the experimenter could induce discounting by highlighting the difficulty of processing the more complex nodes and imagining the target outcome, respectively.

IMPLICATIONS

This review shows that numerous fluency instantiations generate strikingly uniform cognitions and judgments. These findings are of obvious benefit to researchers who seek to replicate surprising or counterintuitive fluency effects using a variety of methodological approaches. As Figure 1 demonstrates, there are roughly 20 options in the fluency instantiation toolbox,

which gives researchers significant room for choice.⁶ Some researchers have already taken advantage of the uniformity of fluency as a metacognitive cue. For example, Novemsky et al. (2007) manipulated decision conflict by altering the font in which the choices were presented and the number of reasons that people had to give for their chosen product. Alter et al. (2007) and Alter and Oppenheimer (2008b) similarly manipulated perceptual fluency, conceptual fluency, and facial feedback fluency, to converge on the same behavioral and cognitive outcomes.

This review also demonstrates that fluency is a ubiquitous metacognitive cue that accompanies cognition across the full spectrum of cognitive processes. Researchers who fail to recognize the effects of fluent or disfluent experiences on cognition might unwittingly introduce confounds into their studies, undermining the phenomena they seek to identify. Questionnaires, a fundamental tool in cognitive and social scientists' arsenal, necessarily vary according to how easy or difficult they are to process. For example, the ease with which people can understand the words and sentences used in a questionnaire's instructions, read the font on the questionnaire, or write with the pen or pencil supplied influences how they might respond. Similarly, computer-based studies vary according to how easy they are to process. Basic issues like how easily participants can find the keys to enter each response, the color and contrast of the font and background, or whether the monitor is dirty or smudged might alter responses. Regardless of a study's content, the findings in this review suggest that fluent studies are more likely to engender confidence, positivity, and perceptions of truth. Confidence, positivity, and truth are inextricably linked to the evaluative judgments that pervade cognitive and social psychology, so researchers stand to benefit if they minimize the effect of fluency-related confounds.

The practical consequences of variations in fluency are similarly significant. In one article, we (Alter & Oppenheimer, 2006) showed that, in the short term, stocks with names and ticker codes that are easy to pronounce outperform those with names that are difficult to pronounce. For example, we calculated the performance of roughly 700 stocks on the New York Stock Exchange between 1990 and 2004. In the 1st day of trading, the 10 stocks with the simplest names earned 11% more than the 10 stocks with the most complex names, and this difference increased to 33% across the course of a year of trading. This research suggests that the initial decision of whether to label new companies with names like Barnings Incorporated or Xagibdan Incorporated carries more practical weight than most entrepreneurs realize. In addition to the pronounceability

of a stock's names, the ease with which each company can be brought to mind (cf. Borges et al., 1999) and how easily one can imagine the company achieving profitably might similarly influence how likely people are to invest in the stock.

Fluency has similar practical consequences for medical and legal decision making. Goodwin (2006) suggested that, just as laypeople diagnose faults in the least fluent nodes of complex networks, doctors might unwittingly rely on fluency when settling difficult diagnoses. Given the complexity of some medical diagnoses, all else being equal, doctors might unwittingly endorse a simpler or more easily pronounced diagnosis. Likewise, legal decision makers might be swayed by the advocate who tells the most fluent story (e.g., Pennington & Hastie, 1992) rather than the party with the most clinically compelling legal argument. Indeed, given the vast range of fluency instantiations, it is difficult to imagine how one might prevent fluency from influencing judgment and decision making in almost any situation. Nonetheless, perhaps medical and legal practitioners who are educated about the effects of fluency might be better placed to recognize when processing ease exerts undue effects on their judgments.

CONCLUSION

This review documented a broad array of fluency instantiations that map onto the vast set of cognitive operations that people perform every day. It is notable that regardless of how fluency is instantiated, it seems to produce remarkably uniform judgments within each judgmental domain. The common effects of fluency from lower to higher order cognition suggest that people have the capacity to integrate and process fluency independently of how it is generated. This is the first review to consider a comprehensive spectrum of cognitive processes that engender fluency—identifying for the first time, for example, higher order cognitive fluency and decision conflict fluency—and to thereby demonstrate the breadth and uniformity of fluency as a monolithic metacognitive cue. As we have shown in Figure 2, there appear to be several stages from information acquisition to judgment formation. This review highlights the importance of Stage 1, in which fluency is generated, and to a lesser extent Stage 2, in which people integrate fluency and their naïve or learned theories. Above all, this review demonstrates people's ability to extract source-independent metacognitive information from the environment—information that can profoundly influence fine-grained domain-specific judgments.

NOTES

1. People vary widely in their expertise and familiarity with different cognitive tasks, so the same task might be subjectively more difficult for one person than for another. We are more concerned with this subjective experience of ease than with the objective ease of one task relative to another, because fluency influences judgment at an idiographic level (see Oppenheimer, 2008, Box 1, for further discussion of this issue). In addition, our classification of the instantiations is to some extent a matter of interpretation. Some forms of fluency draw on more than one cognitive process, so for simplicity, we assign each form to one cognitive process rather than introducing unnecessary redundancy. The important point is that fluency at large arises from many different sources rather than which particular cognitive process drives any one particular fluency experience.

2. Although the previous examples examine visual perceptual fluency, there is also limited and somewhat speculative evidence that other forms of perceptual fluency induce liking. For example, repeated exposure to auditory stimuli appears to induce liking (Heingartner & Hall, 1974; Heyduk, 1975).

3. Although researchers have not yet manipulated prosodic or pragmatic fluency, these are other levels of linguistic processing that fall along the same fluency continuum. For example, unnaturally syncopated speech (prosodically disfluent) might be perceived differently from naturally paced speech (prosodically fluent). Related research indeed suggests that speech seems truer when uttered without pauses for “ah” and “um” (e.g., Clark & Fox Tree, 2002; Fox Tree, 2002; Fox Tree & Clark, 1997). Language also varies according to how easily perceivers can make sense of its underlying practical meaning (pragmatic fluency), and people might respond differently to pragmatically fluent and disfluent language that otherwise conveys the same meaning.

4. Although Unkelbach (2007) found evidence for the same naïve association between fluency and truth, he also induced one group of participants to associate *disfluency* with truth in two experiments. Unkelbach's results suggest that people endorse the fluency–truth association by default but readily adopt a disfluency–truth association when situational cues suggest this alternative relationship.

5. There is an apparent discrepancy between Brehm's (1956) classic post-decisional dissonance findings and those of Iyengar and Lepper (2000); whereas Brehm found greater liking for chosen alternatives after difficult choices, Iyengar and Lepper found the reverse. One important difference between these studies is the method with which the researchers varied choice difficulty. Iyengar and Lepper induced difficulty by enlarging the choice set, whereas participants in Brehm's studies chose between two alternatives that varied in their relative attractiveness. Brehm's participants were therefore able to alleviate post-decisional regret by emphasizing their chosen product's strong points and downplaying its weak points relative to the alternative product. Iyengar and Lepper's participants did not have this luxury, because they were faced with too many alternatives against which to compare their chosen product. Thus, Brehm's participants were able to diffuse the discomfort that arose when they made a difficult choice, whereas Iyengar and Lepper's participants were left wondering whether they had left an insufficiently considered, superior alternative on the table.

6. Existing research arguably fails to capitalize on the full range of potential fluency instantiations. One example is attentional fluency—the ease with which people can attend to a target stimulus. We are not aware of research showing that attentional distractions influence evaluative judgments of a focal target, although existing research suggests that these stimuli might be perceived as less attractive, frequent, truthful, and so on when the perceiver is distracted.

REFERENCES

- Alter, A. L., & Oppenheimer, D. M. (2006). Predicting short-term stock fluctuations by using processing fluency. *Proceedings of the National Academy of Sciences*, 103, 9369-9372.
- Alter, A. L., & Oppenheimer, D. M. (2008a). Easy on the mind, easy on the wallet: The roles of familiarity and processing fluency in valuation judgments. *Psychonomic Bulletin and Review*, 15, 985-990.
- Alter, A. L., & Oppenheimer, D. M. (2008b). Effects of fluency on psychological distance and mental construal (or why New York is a large city, but *New York* is a civilized jungle). *Psychological Science*, 19, 161-167.
- Alter, A. L., & Oppenheimer, D. M. (in press). Suppressing secrecy through metacognitive ease: Cognitive fluency encourages self-disclosure. *Psychological Science*.
- Alter, A. L., Oppenheimer, D. M., Epley, N., & Eyre, R. N. (2007). Overcoming intuition: Metacognitive difficulty activates analytic reasoning. *Journal of Experimental Psychology: General*, 136, 569-576.
- Anderson, C. J. (2003). The psychology of doing nothing: Forms of decision avoidance result from reason and emotion. *Psychological Bulletin*, 129, 139-167.
- Begg, I. M., Anas, A., & Farinacci, S. (1992). Dissociation of processes in belief: Source recollection, statement familiarity, and the illusion of truth. *Journal of Experimental Psychology: General*, 121, 446-458.
- Begg, I., Duft, S., Lalonde, P., Melnick, R., & Sanvito, J. (1989). Memory predictions are based on ease of processing. *Journal of Memory and Language*, 28, 610-632.
- Borges, B., Goldstein, D. G., Ortmann, A., & Gigerenzer, G. (1999). Can ignorance beat the stock market? In G. Gigerenzer, P. M. Todd, & the ABC Research Group (Eds.), *Simple heuristics that make us smart* (pp. 59-72). New York: Oxford University Press.
- Bornstein, R. F. (1989). Exposure and affect: Overview and meta-analysis of research, 1968-1987. *Psychological Bulletin*, 106, 265-289.
- Bornstein, R. F., & D'Agostino, P. R. (1992). Stimulus recognition and the mere exposure effect. *Journal of Personality and Social Psychology*, 63, 545-552.
- Bornstein, R. F., & D'Agostino, P. R. (1994). The attribution and discounting of perceptual fluency: Preliminary tests of a perceptual fluency/attributional model of the mere exposure effect. *Social Cognition*, 12, 103-128.
- Brehm, J. (1956). Post-decision changes in desirability of alternatives. *Journal of Abnormal and Social Psychology*, 52, 384-389.
- Brennan, S. E., & Williams, M. (1995). The feeling of another's knowing: Prosody and filled pauses as cues to listeners about the metacognitive states of speakers. *Journal of Memory and Language*, 34, 383-398.
- Briñol, P., Petty, R. E., & Tormala, Z. L. (2006). The malleable meaning of subjective ease. *Psychological Science*, 17, 200-206.
- Castel, A. D., McCabe, D. P., & Roediger, H. L., III. (2007). Illusions of competence and overestimation of associative memory for identical items: Evidence from judgments of learning. *Psychonomic Bulletin and Review*, 14, 107-111.
- Clark, H. H., & Fox Tree, J. E. (2002). Using uh and um in spontaneous speaking. *Cognition*, 84, 73-111.
- Collins, A. M., & Loftus, E. F. (1975). A spreading-activation theory of semantic processing. *Psychological Review*, 82, 407-428.
- Collister, D., & Tversky, B. (2000). Familiarity and categorical inference. *Abstracts from XXII Annual Conference of the Cognitive Science Society*.
- Day, S., & Gentner, D. (2006). *Processing fluency for relational structures*. Manuscript in preparation.
- Einhorn, H., & Hogarth, R. (1986). Judging probable cause. *Psychological Bulletin*, 99, 3-19.
- Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. *American Psychologist*, 34, 906-911.
- Fox Tree, J. E. (2002). Interpretations of pauses and ums at turn exchanges. *Discourse Processes*, 34, 37-55.
- Fox Tree, J. E., & Clark, H. H. (1997). Pronouncing “the” as “thee” to signal problems in speaking. *Cognition*, 62, 151-167.
- Gill, M. J., Swann, W. B., Jr., & Silvera, D. H. (1998). On the genesis of confidence. *Journal of Personality and Social Psychology*, 75, 1101-1114.
- Goodwin, G. P. (2006). *How individuals learn simple Boolean systems and diagnose their faults*. Unpublished doctoral dissertation, Princeton University.

- Hansen, J., Dechêne, A., & Wänke, M. (2008). Discrepant fluency increases subjective truth. *Journal of Experimental Social Psychology*, 44, 687-691.
- Heingartner, A., & Hall, J. V. (1974). Affective consequences in adults and children of repeated exposure to auditory stimuli. *Journal of Personality and Social Psychology*, 29, 719-723.
- Hertzog, C., Dunlosky, J., Robinson, E. A., & Kidder, D. P. (2003). Encoding fluency is a cue used for judgments about learning. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 29, 22-34.
- Heyduk, R. G. (1975). Rated preference for musical compositions as it relates to preference and exposure frequency. *Perception and Psychophysics*, 17, 84-91.
- Iyengar, S., & Lepper, M. (2000). When choice is demotivating: Can one desire too much of a good thing? *Journal of Personality and Social Psychology*, 76, 995-1010.
- Jacoby, L. L., & Dallas, M. (1981). On the relationship between autobiographical memory and perceptual learning. *Journal of Experimental Psychology: General*, 116, 26-37.
- Jacoby, L. L., Woloshyn, V., & Kelley, C. M. (1989). Becoming famous without being recognized: Unconscious influences of memory produced by dividing attention. *Journal of Experimental Psychology: General*, 118, 115-125.
- Kahneman, D., & Tversky, A. (1982). The simulation heuristic. In D. Kahneman, P. Slovic, & A. Tversky (Eds.), *Judgement under uncertainty: Heuristics and biases* (pp. 201-208). New York: Cambridge University Press.
- Kelley, C. M., & Lindsay, D. S. (1993). Remembering mistaken for knowing: Ease of retrieval as a basis for confidence in answers to general knowledge questions. *Journal of Memory and Language*, 32, 1-24.
- Kelley, C. M., & Rhodes, M. G. (2002). Making sense and nonsense of experience: Attributions in memory and judgment. *The Psychology of Learning and Motivation*, 41, 295-320.
- Kelley, H. H. (1973). The process of causal attribution. *American Psychologist*, 28, 107-128.
- King, J., & Just, M. A. (1991). Individual differences in sentence processing: The role of working memory. *Journal of Memory and Language*, 30, 580-602.
- Koriat, A. (1993). How do we know that we know? The accessibility model of the feeling of knowing. *Psychological Review*, 100, 609-639.
- Koriat, A., & Ma'ayan, H. (2005). The effects of encoding fluency and retrieval fluency on judgments of learning. *Journal of Memory and Language*, 52, 478-492.
- Labroo, A. A., Dhar, R., & Schwarz, N. (2008). Of frowning watches and frog wines: Semantic priming, perceptual fluency, and brand evaluation. *Journal of Consumer Research*, 34, 819-831.
- Laham, S., Alter, A. L., & Goodwin, G. P. (in press). Easy on the mind, easy on the wrongdoer: Discrepantly fluent moral violations are deemed less wrongful. *Cognition*.
- Lee, A. Y., & Labroo, A. (2004). Effects of conceptual and perceptual fluency on affective judgment. *Journal of Marketing Research*, 41, 151-165.
- Lowrey, T. M. (1998). The effects of syntactic complexity on advertising persuasiveness. *Journal of Consumer Psychology*, 7, 187-206.
- Mandel, N., Petrova, P. K., & Cialdini, R. B. (2006). Images of success and the preference for luxury brands. *Journal of Consumer Psychology*, 16, 57-69.
- Marks, R. (1996). Ipsilateral and contralateral skill acquisition following random practice of unilateral mirror-drawing. *Perceptual & Motor Skills*, 83, 715-722.
- McGlone, M. S., & Tofigbakhsh, J. (2000). Birds of a feather flock conjointly (?): Rhyme as reason in aphorisms. *Psychological Science*, 11, 424-428.
- Medvec, V. H., Madey, S. E., & Gilovich, T. (1995). When less is more: Counterfactual thinking and satisfaction among Olympic athletes. *Journal of Personality and Social Psychology*, 69, 603-610.
- Newell, B. R., & Shanks, D. R. (2007). Recognising what you like: Examining the relationship between the mere-exposure effect and recognition. *European Journal of Cognitive Psychology*, 19, 103-118.
- Niedenthal, P. M., Barsalou, L. W., Winkielman, P., Krauth-Gruber, S., & Ric, F. (2005). Embodiment in attitudes, social perception, and emotion. *Personality and Social Psychology Review*, 9, 184-211.
- Novemsky, N., Dhar, R., Schwarz, N., & Simonson, I. (2007). Preference fluency and consumer choice. *Journal of Marketing Research*, 44, 347-356.
- Oppenheimer, D. M. (2004). Spontaneous discounting of availability in frequency judgment tasks. *Psychological Science*, 15, 100-105.
- Oppenheimer, D. M. (2006). Consequences of erudite vernacular utilized irrespective of necessity: Problems with using long words needlessly. *Applied Cognitive Psychology*, 20, 139-156.
- Oppenheimer, D. M. (2008). The secret life of fluency. *Trends in Cognitive Science*, 12, 237-241.
- Oppenheimer, D. M., & Frank, M. C. (2007). A rose in any other font wouldn't smell as sweet: Fluency effects in categorization. *Cognition*, 106, 1178-1194.
- Pennington, N., & Hastie, R. (1992). Explaining the evidence: Tests of the story model for juror decision making. *Journal of Personality and Social Psychology*, 62, 189-206.
- Petrova, P. K., & Cialdini, R. B. (2005). Fluency of consumption imagery and the backfire effects of imagery appeals. *Journal of Consumer Research*, 32, 442-452.
- Petrova, P. K. (2006). *Fluency effects: New domains and consequences for persuasion*. Doctoral dissertation, Arizona State University.
- Petty, R. E., Briñol, P., Tormala, Z. L., & Wegener, D. T. (2007). The role of meta-cognition in social psychology. In E. T. Higgins & A. W. Kruglanski (Eds.), *Social psychology: A handbook of basic principles* (2nd ed., pp. 254-284). New York: Guilford.
- Proffitt, D. R. (2006). Embodied perception and the economy of action. *Perspectives on Psychological Science*, 1, 110-122.
- Reber, R., & Schwarz, N. (1999). Effects of perceptual fluency on judgments of truth. *Consciousness and Cognition*, 8, 338-342.
- Reber, R., Schwarz, N., & Winkielman, P. (2004). Processing fluency and aesthetic pleasure: Is beauty in the perceiver's processing experience? *Personality and Social Psychology Review*, 8, 364-382.
- Reber, R., Winkielman, P., & Schwarz, N. (1998). Effects of perceptual fluency on affective judgments. *Psychological Science*, 9, 45-48.
- Reber, R., & Zupanek, N. (2002). Effects of processing fluency on estimates of probability and frequency. In P. Sedlmeier & T. Betsch (Eds.), *Frequency processing and cognition* (pp. 175-188). Oxford, UK: Oxford University Press.
- Reder, L. M. (1987). Strategy selection in question answering. *Cognitive Psychology*, 19, 111-138.
- Rhodes, G., Halberstadt, J., & Brajkovich, G. (2001). Generalization of mere exposure effects to average composite faces. *Social Cognition*, 19, 57-70.
- Roig, M., & Placakis, N. (1992). Hemisphericity style, sex, and performance on a mirror-tracing task. *Perceptual & Motor Skills*, 74, 1143-1147.
- Schwartz, B. L., & Metcalfe, J. (1992). Cue familiarity but not target retrievability enhances feeling-of-knowledge judgments. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 18, 1074-1083.
- Schwartz, N. (1998). Accessible content and accessibility experiences: The interplay of declarative and experiential information in judgment. *Personality and Social Psychology Review*, 2, 87-99.
- Schwartz, N. (2004). Metacognitive experiences in consumer judgment and decision making. *Journal of Consumer Psychology*, 14, 332-348.
- Schwartz, N., Bless, H., Strack, F., Klumpp, G., Rittenauer-Schatka, H., & Simons, A. (1991). Ease of retrieval as information: Another look at the availability heuristic. *Journal of Personality and Social Psychology*, 61, 195-202.
- Schwartz, N., & Clore, G. L. (2007). Feelings and phenomenal experiences. In E. T. Higgins & A. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (2nd ed., pp. 385-407). New York: Guilford.
- Schwartz, N., Sanna, L. J., Skurnik, I., & Yoon, C. (2007). Metacognitive experiences and the intricacies of setting people straight: Implications for debiasing and public information campaigns. *Advances in Experimental Social Psychology*, 39, 127-161.

- Shah, A. K., & Oppenheimer, D. M. (2007). Easy does it: The role of fluency in cue weighting. *Judgement and Decision Making*, 2, 371-379.
- Shepard, R. N., & Metzler, J. (1971). Mental rotation of three-dimensional objects. *Science*, 171, 701-703.
- Simmons, J. P., & Nelson, L. D. (2006a). Intuitive confidence: Choosing between intuitive and nonintuitive alternatives. *Journal of Experimental Psychology: General*, 135, 409-428.
- Simmons, J. P., & Nelson, L. D. (2006b). *Intuitive confidence and the prominence effect: When consumer choices are sensitive to matching prices*. Manuscript in preparation.
- Skurnik, I., Schwarz, N., & Winkielman, P. (2000). Drawing inferences from feelings: The role of naive beliefs. In H. Bless & J. P. Forgas (Eds.), *The message within: The role of subjective experience in social cognition and behavior* (pp. 162-175). Philadelphia: Taylor & Francis.
- Steffel, M. (2009). *The impact of choice difficulty on self and social inferences*. Unpublished dissertation.
- Steffel, M., & Shafir, E. (2009). *Decision conflict as a heuristic for predicting preferences*. Manuscript in preparation.
- Stepper, S., & Strack, F. (1993). Proprioceptive determinants of emotional and nonemotional feelings. *Journal of Personality and Social Psychology*, 64, 211-220.
- Strack, F., & Neumann, R. (2000). Furrowing the brow may undermine perceived fame: The role of facial feedback in judgments of celebrity. *Personality and Social Psychology Bulletin*, 26, 762-768.
- Stromswold, K., Caplan, D., Alpert, N., & Rauch, S. (1996). Localization of syntactic comprehension by positron emission tomography. *Brain and Language*, 52, 452-473.
- Swann, W. B., Jr., & Gill, M. J. (1997). Confidence and accuracy in person perception: Do we know what we think we know about our relationship partners? *Journal of Personality and Social Psychology*, 73, 747-757.
- Tamir, M., Robinson, M. D., Clore, G. L., Martin, L. L., & Whitaker, D. J. (2004). Are we puppets on a string? The contextual meaning of unconscious expressive cues. *Personality and Social Psychology Bulletin*, 30, 237-249.
- Thiede, K. W., & Dunlosky, J. (1999). Toward a general model of self-regulated study: An analysis of selection of items for study and self-paced study time. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 25, 1024-1037.
- Thomas, M., & Morwitz, V. G. (2009). The ease of computation effect: The interplay of metacognitive experiences and naive theories in judgments of price difference. *Journal of Marketing Research*, 46, 81-91.
- Topolinski, S., & Strack, F. (2009). The architecture of intuition: Fluency and affect determine intuitive judgments of semantic and visual coherence, and of grammaticality in artificial grammar learning. *Journal of Experimental Psychology: General*, 138, 39-63.
- Tourangeau, R., & Ellsworth, P. (1979). The role of the face in the experience of emotion. *Journal of Personality and Social Psychology*, 37, 1519-1531.
- Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology*, 5, 207-232.
- Unkelbach, C. (2006). The learned interpretation of cognitive fluency. *Psychological Science*, 17, 339-345.
- Unkelbach, C. (2007). Reversing the truth effect: Learning the interpretation of processing fluency in judgments of truth. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 33, 219-230.
- Whittlesea, B.W.A. (1993). Illusions of familiarity. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 19, 1235-1253.
- Whittlesea, B.W.A., & Williams, L. D. (1998). Why do strangers feel familiar, but friends don't? The unexpected basis of feelings of familiarity. *Acta Psychologica*, 98, 141-166.
- Wilson, T. D., & Brekke, N. (1994). Mental contamination and mental correction: Unwanted influences on judgments and evaluations. *Psychological Bulletin*, 116, 117-142.
- Winkielman, P., & Cacioppo, J. T. (2001). Mind at ease puts a smile on the face: Psychophysiological evidence that processing facilitation leads to positive affect. *Journal of Personality and Social Psychology*, 81, 989-1000.
- Winkielman, P., Halberstadt, J., Fazendeiro, T., & Catty, S. (2006). Prototypes are attractive because they are easy on the mind. *Psychological Science*, 17, 799-806.
- Winkielman, P., & Schwarz, N. (2001). How pleasant was your childhood? Beliefs about memory shape inferences from experienced difficulty of recall. *Psychological Science*, 12, 176-179.
- Winkielman, P., Schwarz, N., Fazendeiro, T. A., & Reber, R. (2003). The hedonic marking of processing fluency: Implications for evaluative judgment. In J. Musch & K. C. Klauer (Eds.), *The psychology of evaluation: Affective processes in cognition and emotion* (pp. 189-217). Mahwah, NJ: Lawrence Erlbaum.
- Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology*, 9, 1-27.