Uniting the Tribes of Fluency to Form a Metacognitive Nation

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Abstract

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. We offer the first comprehensive review of such mechanisms and their implications for judgment and decision making. Since every cognition falls along a continuum from effortless to demanding, and generates a corresponding fluency experience, we argue that fluency is a ubiquitous metacognitive cue in reasoning and social judgment.

Keywords: Fluency, Metacognition, Naïve theories

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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 paper, 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 six examples of assertive behavior (an easy task), and others were asked to recall twelve 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. Importantly, 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 & Tofighbakhsh, 2000). Each 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 at 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 non-rhyming phrases. We have expanded and refined this definition, suggesting that linguistic fluency operates at many levels of linguistic processing. For example, some non-word 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: Lowry, 1998); and some symbols are easier to translate into their linguistic meaning ($ome $ymbol$ @re e@$ier; orthographic fluency: Alter et. al, 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.

This review therefore 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); and 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, amongst other dimensions. Schwarz (2004) coined the term naïve theories to label these context-specific interpretations of fluency. Naïve theories, which are learnt 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 papers (e.g. Brinol, Petty, & Tormala, 2006; Unkelbach, 2006; Oppenheimer, 2008; Thomas & Morwitz, 2009; 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 note 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. 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 amongst 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, 2008a, in press; Alter, Oppenheimer, Epley, & Eyre, 2007; Novemsky, Dhar, Schwarz, & Simonson, 2007; Reber & Zupanek, 2002; Simmons & Nelson, 2006), 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, grey, italicized font: sample; or condensed font, like Haettenschweiler or Impact).

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 Laham, Alter, & Goodwin, 2009) presented participants with grey circles against highly or lowly contrasting backgrounds. The darker grey circles against a light background and lighter grey 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 and Cacioppo, 2001; Study 1), participants watched a slideshow containing images of 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 non-matching primes. The 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, from 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. Perceptual fluency manipulations are perhaps the most common, but researchers have also manipulated the fluency of numerous other cognitive processes.

Memory-Based Fluency

Retrieval fluency. Although Tversky and Kahneman (1973) did not use the fluency label in their seminal paper, 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 (1973) 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 study, 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). Since 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.* Though 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 (fluent pairs), or different (disfluent pairs) to 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 learnt 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, to determine 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 (e.g., Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005; Proffitt, 2006; Stepper & Strack, 1993).

**Facial feedback.** Facial expressions convey useful information about the difficulty of cognitive tasks (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 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 non-dominant hand, which demanded greater cognitive effort than writing with their dominant hand. Other researchers (e.g., Ray, 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 similarly nonsensical *SUG*. In one study, Alter & Oppenheimer (2006) found that people experienced disfluency when asked to read unpronounceable ticker codes. Alter and Oppenheimer (2006, 2008a) 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, 2008).

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 non-glide 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 (1998) found that people that non-words that satisfied the standard rules of English word construction (e.g., *hension*) were more often falsely remembered than were non-words that violated the same rules (e.g., *stowfus*).

Using an alternative approach to phonemic fluency, McGlone and Tofighbakhsh (2000) examined the effects of rhyming. They created rhyming and non-rhyming versions of obscure
aphorisms (e.g., *Woes unite foes* vs. *Woes unite enemies*), and argued that rhyming phrases were easier to process than non-rhyming 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 that “Because it's high in fiber and contains no preservatives, BRAN-NEW is a healthy choice for breakfast.” The latter is more difficult to process.

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 GΐzmØ$ 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.

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 fluency affects cognition in at least five of those tasks—conceptual fluency, diagnostic fluency, spatial reasoning, imagery, and decision making.

**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 preceding target words with conceptually-related primes. 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 and 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 group. 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 as little as 16ms.

*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 were 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 in order 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 another successful business student (making success easy to imagine), unsuccessful business students (making failure easy to imagine), or biology students who were successful or unsuccessful (not affecting how easily they could imagine succeeding or failing as business students). In a second study, Petrova 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 paper, 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 six jams (a fluent set). Not surprisingly, shoppers were able to choose amongst the six jams with ease, but they experienced difficulty when forced to choose from amongst 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. Steffel & 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 paper, 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 only consider 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: the tendency for people to adopt domain-specific naïve theories that inform their judgments within particular domains; and 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’s naïve theories (Schwarz, 2004) generally associate fluency with truth and disfluency with untruth, in large part because fluency implies frequency, which in turn implies social consenses (Schwarz, Sanna, Skurnik, & Yoon, 2007). 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 the statements were true when they were written in easy-to-read contrast (e.g., dark blue and red) than when they were written in difficult-to-read contrast (e.g., light blue and yellow).

Whereas Reber and Schwarz manipulated the visual form of their questions, McGlone and Tofighbakhsh (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 non-rhyming aphorisms with identical meaning. McGlone and Tofighbakhsh 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 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 it correctly answered the question, people were more likely to respond with the primed word than with other 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 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. Early evidence that fluency influences liking judgments came from Zajonc (1968), who found that people prefer familiar stimuli. This so-
called *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, Winkielman, & Schwarz, 1998). Testing a similar hypothesis, Winkielman & 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 had more positive reactions 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 400ms to similar pictures that were presented for 100ms. 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 et al. (2004) found that participants consulted their facial expressions 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 amongst an overwhelming array of options—induced less liking for the ultimate choice. 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 future (Mandel, Petrova, & Cialdini, 2006).

Other research has shown that obscure primed texts are preferred to obscure unprimed texts (Day & Gentner, 2006). 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 appear 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; Koriat, 1993). For example, people who are primed with 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 over a dozen other studies to suggest that perceptual disfluency weakens people’s confidence in their judgments (e.g., Kelley & Lindsay, 1993; Gill, Swann, & Silvera, 1998; Simmons & Nelson, 2006; Swann & Gill, 1997).

As with perceptual processing, people are more confident about remembering new information that is easier to encode (e.g., Begg, Duft, Lalonde, Melnick, & Sanvito, 1989; Castel, McCabe, & Roediger, 2007; Hertzog, Dunlosky, Robertson, & Kidder, 2003; Koriat & 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). Importantly, the feelings of confidence that
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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 learnt 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 upon 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. While an exhaustive catalogue is beyond the scope of this paper, 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 learnt to associated with subjective ease (Briñol, Petty, & Tormala, 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 paper 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 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, 2008b) used phonemic linguistic fluency, visual perceptual fluency, and familiarity-based retrieval fluency affects judgments of value (see also Borges, Goldstein, Ortmann, and 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
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While 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.

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, that 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 which behaves similarly regardless of how it is engendered. For example, Schwarz et al. (1991; also see 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. Consequently, 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 5ms, but not when they are presented for 500ms. 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 originates from a peripheral source. Crucially, 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 non-famous 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 why those names should be available. Thus, participants systematically underestimated the commonness of the famous names relative to the non-famous names because they over-corrected for the influence of fame in the 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 a further 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 et al., 1995; Petrova & Cialdinin, 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 judgmental consequences. 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. 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 (2008a) similarly manipulated perceptual-, conceptual-, 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 judgmental consequences that arise from fluent or disfluent experiences 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, all influence 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 impact of fluency-related confounds.

The practical consequences of variations in fluency are similarly significant. In one paper, we (Alter and 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 first 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 (c.f. 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 documents a broad array of fluency instantiations that map onto the vast set of cognitive operations that people perform every day. Notable, 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.
References


Author Note and Acknowledgements

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Footnotes

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, since 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 varied 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. Astute readers will note 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, though existing research
suggests that these stimuli might be perceived as less attractive, frequent, truthful, etc.,
when the perceiver is distracted.
Figure 1. A comprehensive catalogue of the various instantiations of fluency. Each instantiation of fluency contributes to the same general subjective experience of ease that accompanies a particular judgment or decision.
Figure 2. Three-stage process of cognition + metacognition (Stage 1; our focus in this paper), integration of fluency and domain-specific naïve theories (Stage 2), and judgment output (Stage 3).
<table>
<thead>
<tr>
<th>Research Article</th>
<th>Judgmental Domain</th>
<th>Fluency Manipulation</th>
<th>Basic Finding</th>
</tr>
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<tbody>
<tr>
<td>Reber &amp; Schwarz (1999)</td>
<td></td>
<td>Visual ease</td>
<td>Fluent statements seem truer than disfluent statements</td>
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<tr>
<td>McGlone &amp; Tofighbakhsh (2000)</td>
<td></td>
<td>Linguistic (rhyming)</td>
<td>Rhyming aphorisms seem truer than non-rhyming aphorisms</td>
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<td>Brennan &amp; Williams (1995)</td>
<td>Truth</td>
<td>Linguistic (prosody)</td>
<td>Absence of disfluent speech markers like “uh” or “um” implies truth</td>
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<tr>
<td>Begg et al. (1992)</td>
<td></td>
<td>Retrieval ease</td>
<td>Easily retrieved propositions are rated truer than obscured propositions</td>
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<tr>
<td>Kelley &amp; Lindsay (1993)</td>
<td></td>
<td>Semantic priming</td>
<td>Semantically primed words seem better responses to trivia questions</td>
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<tr>
<td>Zajonc (1968)</td>
<td></td>
<td>Retrieval ease</td>
<td>Easily retrieved stimuli are preferred to difficult-to-retrieve stimuli</td>
</tr>
<tr>
<td>Bornstein &amp; D’Agostino (1992)</td>
<td></td>
<td>Visual ease</td>
<td>Stimuli against highly contrastive backgrounds are preferred to stimuli against less contrastive backgrounds</td>
</tr>
<tr>
<td>Reber et al. (1998)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Winkielman &amp; Cacioppo (2001)</td>
<td></td>
<td>Visual contour priming</td>
<td>Primed visual contours are preferred to non-primed visual contours</td>
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<tr>
<td>Stepper &amp; Strack (1993)</td>
<td></td>
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<td>Tamir et al. (2004)</td>
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<td>Iyengar &amp; Lepper (2000)</td>
<td>Liking</td>
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<td>Petrova &amp; Cialdini (2005)</td>
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<td>Mandel et al. (2006)</td>
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<td>Day &amp; Gentner (2006)</td>
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<td>Lee &amp; Labroo (2006)</td>
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<td>Labroo et al. (2008)</td>
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<td>Rhodes et al. (2001)</td>
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<td>Winkielman et al. (2006)</td>
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<tr>
<td>Reder (1987)</td>
<td></td>
<td>Semantic priming</td>
<td>Trivia responses feel more accurate when primed with related concepts</td>
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<tr>
<td>Schwartz &amp; Metcalfe (1992)</td>
<td></td>
<td>Visual ease</td>
<td>Statements written in easy-to-read font inspire confidence</td>
</tr>
<tr>
<td>Alter et al. (2007)</td>
<td></td>
<td></td>
<td>Independently of accuracy, information seems easier to remember when it is easily encoded</td>
</tr>
<tr>
<td>Novemsky et al. (2007)</td>
<td></td>
<td>Retrieval ease</td>
<td>Trivia responses feel more accurate when easily retrieved from memory.</td>
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<tr>
<td>Hertzog et al. (2003)</td>
<td></td>
<td>Embodied cognition</td>
<td>Trivia responses feel more accurate when answered with puffed cheeks rather than a furrowed brow</td>
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<td>Kelley &amp; Lindsay (1993)</td>
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<td>Alter et al. (2007)</td>
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<td>Stepper &amp; Strack (1993)</td>
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<td>Tourangeau &amp; Ellsworth (1979)</td>
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<td>Research Article</td>
<td>Judgmental Domain</td>
<td>Fluency Manipulation</td>
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<td>Tversky &amp; Kahneman (1973)</td>
<td>Frequency/Familiarity</td>
<td>Retrieval ease</td>
<td>Categories with exemplars that are difficult to retrieve seem less populated</td>
</tr>
<tr>
<td>Reber &amp; Zupanek (2002)</td>
<td></td>
<td>Visual ease</td>
<td>Words written in easier-to-read font seem more familiar than words written in difficult-to-read font</td>
</tr>
<tr>
<td>Whittlesea &amp; Williams (1998)</td>
<td></td>
<td>Linguistic (word-level)</td>
<td>Nonwords of regular form (e.g., hension) seem more familiar than nonwords of irregular form (e.g., stowfus)</td>
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<tr>
<td>Whittlesea (1993)</td>
<td></td>
<td>Semantic priming</td>
<td>Semantically primed words seem more familiar than non-primed words</td>
</tr>
<tr>
<td>Whittlesea &amp; Williams (1998)</td>
<td></td>
<td>Retrieval ease</td>
<td>Easier to imagine events seem more likely to happen</td>
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<tr>
<td>Kahneman &amp; Tversky (1982)</td>
<td></td>
<td>Retrieval ease</td>
<td>Previously exposed words feel as though they are presented for longer during a second presentation</td>
</tr>
<tr>
<td>Jacoby &amp; Dallas (1981)</td>
<td></td>
<td>Linguistic (word-level)</td>
<td>Easier to process text seems to have been written by a more intelligent author</td>
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<td></td>
<td></td>
<td>Linguistic (sentence-level)</td>
<td>More easily pronounced financially stocks outperform less easily pronounced financial stocks</td>
</tr>
<tr>
<td>Alter &amp; Oppenheimer (2006)</td>
<td>Valuation</td>
<td>Linguistic (phonotactic)</td>
<td>Fluent currency (notes and coins) seems more valuable</td>
</tr>
<tr>
<td>Alter &amp; Oppenheimer (2008b)</td>
<td></td>
<td>Retrieval ease</td>
<td>Recognized stocks outperform unrecognized stocks</td>
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<td>Borges et al. (1999)</td>
<td></td>
<td>Retrieval ease</td>
<td></td>
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<td>Jacoby et al. (1989)</td>
<td>Fame</td>
<td>Retrieval ease</td>
<td>Previously presented faces seem more famous than novel faces</td>
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<td>Strack &amp; Neumann (2000)</td>
<td></td>
<td>Retrieval ease</td>
<td>Faces seem less famous when perceivers furrow their brows</td>
</tr>
<tr>
<td>Oppenheimer &amp; Frank (2007)</td>
<td>Category Typicality</td>
<td>Visual ease</td>
<td>Visually fluent exemplars seem more typical of a category</td>
</tr>
<tr>
<td>Collister &amp; Tversky (2000)</td>
<td></td>
<td>Retrieval ease</td>
<td>Commoner exemplars seem typical, controlling for feature typicality</td>
</tr>
</tbody>
</table>

Table 1. A catalogue of fluency research showing that different instantiations of fluency influence various judgments and decisions in a consistent manner. This table summarizes the research reviewed in this paper.