Processing Fluency as the Source of Experiences at the Fringe of Consciousness

Rolf Reber<1>
Department of Psychology
University of Bern
Muesmattstrasse 45
CH-3000 Bern 9
SWITZERLAND

rolf.reber@psy.unibe.ch

and

Tedra A. Fazendeiro & Piotr Winkielman
Department of Psychology
University of Denver
2155 S. Race St.
Denver, CO 80208
U.S.A.

tfazendeiro@nova.psy.du.edu
pwinkiel@du.edu

PSYCHE, 8(10), October 2002
http://psyche.cs.monash.edu.au/v8/psyche-8-10-reber.html

KEYWORDS: Fringe, phenomenology, cognitive feelings, processing fluency, familiarity, perception, retrieval, affect, emotion, judgment, implicit cognition.

COMMENTARY ON: B. Mangan (2001). *Sensation's Ghost. The Non-Sensory "Fringe" of Consciousness*, PSYCHE, 7(18).

ABSTRACT: We extend Mangan's account of fringe consciousness by discussing our work on processing experiences. Our research shows that variations in speed at different stages of perceptual processing can jointly contribute to subjective processing ease, supporting Mangan's notion that different mental processes condense into one subjective experience. We also discuss our studies showing that facilitation of perceptual processing

leads to positive affect, supporting Mangan's suggestion that an evaluative component is built into cognitive phenomenology. Finally, we review research demonstrating that people draw on processing experiences to make a variety of judgments, supporting Mangan's emphasis on the functional importance of cognitive feelings.

1. Introduction

In the target article, Mangan (2001) presented an argument for the importance of non-sensory experiences. According to Mangan, non-sensory experiences constitute a basic category of conscious contents and serve an essential function within the cognitive system by representing large amounts of contextual information in a subjectively condensed form. Mangan relates his notion of non-sensory experience to the concept of fringe consciousness. William James (1890) introduced this term to denote vague feelings that provide contextual information about conscious materials that are at the focus of attention. James himself compared the fringe of consciousness to overtones in music: Both do not change the object at the focus of attention, but they do change the perceiver's experience. As Baars and McGovern (1996) and Epstein (2000) pointed out, the fringe, as introduced by James, refers to several kinds of feelings. Examples of such feelings include familiarity, the tip-of-the-tongue state (see Brown, 2000), feelings of knowing (see Koriat, 2000), the sense of connection between words such as "but" or "nevertheless" that connote logical structure of a thought, the sense we have for the overall scheme of a book, a work of art, or a scientific system, the sense of anticipating an incorrect rather than correct word, the sense of being on the right track (see Mangan, 1993, 2001), and processing fluency (see Reber and Schwarz, 2001).

In this article we comment on Mangan's account of fringe consciousness and connect it to our work on processing fluency. First, we introduce the idea that the speed and accuracy of cognitive processing results in an experience of ease (subjective fluency). Specifically, we discuss how fluency depends on objective stimulus attributes and previous experiences of the perceiver, and we show how variations in speed at different stages of perceptual processing condense into a unified experience of ease (Reber & Wurtz, 2001). This research supports Mangan's notion that a single subjective experience can reflect multiple stages of processing. Second, we propose that processing experiences might be hedonically marked, with high fluency leading to positive affect. This hedonic marking of fluency is seen both in self-reports and physiological measures. Our research supports Mangan's notion that fringe consciousness has emotional as well as cognitive overtones. Third, we discuss studies demonstrating that processing fluency influences a variety of perceptual and conceptual judgments, but only when its diagnostic value is not undermined by attribution manipulations. This demonstrates the functional value of experiences at the fringe of consciousness. Fourth, we highlight that some processing experiences, like ease or difficulty of recall, can be used strategically and flexibly as an input into judgments about a variety of domains. This research supports Mangan's notion that processing experiences play an important function within the cognitive system, allowing people to go beyond available mental content.

Our review will also lead us to qualify two of Mangan's notions. First, we question that the feeling of rightness is phenomenologically primary to other cognitive experiences. Instead, we suggest that fluency might lead to different phenomenal experiences depending on the experimental context. Second, we question that cognitive experiences always stay in the processing background. Instead, we suggest that the feeling of ease or difficulty experienced in recall paradigms can occasionally move from the fringe of consciousness to the center, thus allowing for its flexible use in judgments.

2. Processing Fluency and Fringe Consciousness

In this section, we first define what we mean by processing fluency. We then describe determinants of processing fluency that have been identified by psychological research. Finally, we turn to the question of how objective speed of processing relates to the subjective experience of fluency.

2.1. What is Processing Fluency?

Processing of any stimulus can vary on a variety of parameters that are non-specific to its content. One parameter of particular interest to cognitive psychologists is the speed and accuracy of stimulus processing, or "processing fluency." Fluency can characterize mental processes occurring at various levels. Perceptual fluency is the ease of identifying the physical identity of the stimulus and is influenced by variables such as perceptual priming, clarification, presentation duration, repetition, or figure-to-ground contrast (see Reber, Schwarz, & Winkielman, 2002). Conceptual fluency is the ease of mental operations concerned with stimulus meaning and its relation to semantic knowledge structures (e.g., Whittlesea, 1993; Winkielman, Schwarz, Fazendeiro, & Reber, 2002a). Retrieval fluency is the ease with which people can recall contents from memory (see, e.g., Schwarz, 1998; Winkielman, Schwarz, & Belli, 1998). We use the more general term processing fluency to capture these commonalities.

We refer to "objective" fluency if processing is simply characterized by high speed or accuracy. Importantly, objective fluency can lead to a conscious experience of processing ease or "subjective fluency" (for reviews see Clore, 1992; Jacoby, Kelley, & Dywan, 1989; Schwarz & Clore, 1996). If fluency becomes conscious, it is typically experienced at the periphery of conscious awareness, resulting in a vague or "fringe" experience of ease. Accordingly, subjective fluency is rarely studied directly by asking participants about their experience of ease. Instead, as reviewed shortly, the contribution of subjective fluency is usually seen in its influence on judgments such as familiarity, truth, clarity and duration. This "default" contribution of fluency also becomes apparent when participants are provided with alternative explanations for their cognitive experiences and stop relying on fluency in their judgments. It is worth noting that under some conditions, processing fluency can also become a focal experience. As we show later in the paper, tasks

involving retrieval of multiple events from memory, can sometimes generate distinct subjective experiences of recall ease or difficulty.

2.2. Determinants of Processing Fluency

There are two main categories of determinants of processing fluency. First, there are objective features of a stimulus that may facilitate or inhibit processing. Such objective features include figure-ground contrast, clarity, presentation duration, symmetry, order, simplicity, etc. (see Reber et al., 2002). For example, manipulations of figure-ground contrast influence objective fluency, reflected in recognition speed (Checkosky & Whitlock, 1973), as well as subjective fluency, reflected in judgments of ease (Reber & Wurtz, 2001). In another example, manipulations of visual clarity of a word influence objective fluency, as reflected in recognition speed, as well as subjective fluency, as reflected in judgments of previous occurrence (Whittlesea, Jacoby, & Girard, 1990).

Second, processing fluency is determined by former experiences of the perceiver. For example, several studies using different procedures show a facilitating effect of stimulus repetition on its subsequent processing. Thus, participants identify a tachistoscopically presented word more easily if it is repeated rather than new (Haber & Hershenson, 1965). Backward-masked words are more likely to be identified if they were previously presented on a study list (Jacoby & Dallas, 1981). Similar effects of repetition were observed using a clarification procedure. In this procedure, test words slowly emerge from a pattern mask, becoming more and more readable. In one study, the participants' task was to press a button as soon as they could identify the word (normally after a couple of seconds) and then to write it down. Accurate identification was faster for repeated words than non-repeated words (Feustel, Shiffrin, Salasoo, 1983). Other studies found that processing speed can be increased by repetition of sequences in a serial reaction time task (Nissen & Bullemer, 1987; Perruchet & Amorim, 1992). Interestingly, neuroimaging studies show that facilitation of processing due to repetition leads to a decrease in neural activity in relevant brain areas (Desimone, Miller, Chelazzi, & Lueschow, 1995).

The enhancement of fluency by previous exposure does not necessarily require exact repetition of stimuli or stimulus sequences. For example, A.S. Reber (1967; 1993) found that exposing participants to letter strings constructed in accordance with an artificial grammar resulted in above chance classification of new grammatical and ungrammatical test strings. Using this paradigm, Buchner (1994) showed that learning an artificial grammar could enhance processing fluency for new stimuli constructed according to the same grammar. He first presented grammatical letter strings, which participants were instructed to memorize. After this training phase, new grammatical and ungrammatical strings were presented with the just discussed clarification procedure (Feustel et al., 1983). The participants identified new grammatical letter strings faster than new ungrammatical letter strings. Similarly, exposure to exemplars has been shown to facilitate processing of a never seen visual prototype (Posner & Keele, 1968). Again,

these effects are associated with a decrease in activation in relevant brain areas (Aizenstein et al. 2000; P.J. Reber, Stark, & Squire, 1998).

In sum, both objective features of stimuli and previous experience with a stimulus can influence processing fluency. In a later section, we will discuss how task demands have been used to manipulate processing fluency in recall paradigms (Schwarz et al., 1991).

2.3. Objective Speed, Processing Stages, and Subjective Experience

2.3.1. Processing Speed at Different Stages Condenses Into a Unified Experience

Mangan (2001) discusses the relationship between subjective experiences and underlying mental processes. He proposes that the function of fringe experiences is to serve as a summary signal, a sort of global index of processing quality, which condenses separate mental processes into one subjective feeling. Our work bolsters this proposal. Reber and Wurtz (2001) recently examined the relation between objective speeds at different processing stages and the subjective experience of processing ease. They found that detection of degraded shapes was influenced by figure-ground contrast, but not symmetry of the shapes, whereas discrimination between shapes was influenced by symmetry, but only marginally by figure-ground contrast. These findings suggest that figure-ground contrast and symmetry influence separate processing stages. However, both contrast and symmetry jointly influenced subjective fluency, as reflected in the judgments of ease. Moreover, performance in the detection task was unrelated to the performance in the discrimination task, but both tasks were correlated with the judgments of ease. These findings suggest that processing speed at different stages can indeed condense into a unified experience of fluency.

2.3.2. Do All Processing Stages Contribute to Subjective Experience?

One remaining question is whether there are stages in the perceptual process that do not contribute to subjective fluency. Poldrack and Logan (1997, 1998) discussed this problem in the context of debates about the relation between tasks tapping objective fluency (e.g., lexical decision, naming speed), tasks tapping subjective fluency (e.g., judgments of ease), and tasks tapping familiarity (e.g., judgments of previous occurrence). They suggested that speed at one stage of the perceptual or decision process might contribute to judgments of recognition, whereas speed of other stages might not. In a related vein, there may be stages of perceptual or cognitive processing that do not contribute to a subjective experience of fluency. Even if every stage contributes to subjective fluency, contribution may not be equally distributed, but rather some stages are more important in eliciting a feeling of fluency than others.

2.3.3. Dissociations Between Objective and Subjective Fluency

Another interesting question is whether subjective fluency (the feeling of processing ease) can become dissociated from objective fluency (actual processing speed). Anecdotal reports seem to suggest so. For example, under the influence of alcohol, the feeling of fluency may greatly exceed objective processing speed. However, this example also suggests that a dissociation between objective speed and subjective ease may be an exceptional state, at least for most individuals.

2.3.4. Subjective Fluency at the Fringe and in the Center

We believe that the feeling of ease -- if present -- normally resides in the background, as part of fringe consciousness. Accordingly, in most cases subjective fluency escapes attentional focus and is detectable only in its influence on judgments, just like Mangan (2001) proposes. However, there are conditions where a person may become acutely aware of fluency or lack thereof. The most obvious case is retrieval difficulty. As discussed later in the paper, when people are asked to retrieve multiple events, like several autobiographical memories, the fluency signal can come to their focus of attention, and can be reported upon, disregarded, used in further inferences, etc. Similarly, people may experience a lack of perceptual fluency in trying to perceive an object or a lack of conceptual fluency trying to parse a complex paragraph, like the famous "kite flying" paragraph (Klein, 1981) or the "washing clothes" paragraph (Bransford & Johnson, 1972). Future research might explore factors that determine when objective fluency results in a subjective experience and when subjective fluency moves from the background into the focus of attention.

3. The Hedonic Quality of Processing Fluency

Mangan (2001) emphasizes the role of emotion in fringe consciousness, suggesting that cognitive and emotional experiences are usually so mingled that they become phenomenologically indistinguishable. In this section, we extend the idea of an emotional fringe of consciousness by reviewing research demonstrating that high fluency is reliably associated with more positive evaluations.

Historically, the observation that cognitive experiences are emotionally tinged dates back at least to James (1890) and Titchener (1910). Titchener noted that familiar objects elicit a "glow of warmth, a sense of ownership, a feeling of intimacy" (p. 411). A more systematic exploration of such phenomena led Zajonc (1968) to posit the existence of a "mere-exposure effect" or the phenomenon that liking for an initially neutral stimulus increases as a result of repetition (for reviews see Bornstein, 1989; Zajonc, 2000).

Several authors have proposed that the mere-exposure effect reflects changes in processing fluency (e.g., Bornstein & D'Agostino, 1994; Jacoby, Kelley, & Dywan, 1989; Seamon, Brody & Kauff, 1983; Whittlesea, 1993). Specifically, repetition increases perceptual fluency, which, in turn, results in more positive affect. Our studies tested this proposal by examining if fluency-enhancing variables other than repetition similarly

result in increased liking, even under conditions of a single exposure. Further, our studies evaluated the precise nature of affective responses elicited by fluency using self-report scales and physiological measurement.

3.1. Self-Reports of Hedonic Responses to Fluency

Several of our studies explored the affective consequences of fluency by using different kinds of self-report scales. Reber, Winkielman, and Schwarz (1998) manipulated perceptual fluency in a single exposure paradigm by varying the presentation duration of simple shapes (longer presentations are more fluent) and by changing the figure-ground contrast (higher contrast is more fluent). Some participants were asked to report their evaluations using positively-worded questions (how much do you like the object?, how pretty is the object?) whereas other participants were asked to report their evaluations using negatively worded questions (how much do you dislike the object?, how ugly is the object?). Regardless of the question wording, objects shown for a longer duration or with higher figure-ground contrast were evaluated more favorably than objects shown for a short duration or with lower figure-ground contrast. These findings clearly support the idea that perceptual fluency manipulated by means other than repetition can influence affective judgments. Further, these findings, along with findings by Seamon, McKenna, and Binder (1998), clearly argue against the idea that perceptual fluency results in an affectively neutral, non-specific activation (Mandler, Nakamura, & Van Zandt, 1987). That is, it appears that perceptual fluency is hedonically marked.

Direct support for the role of perceptual fluency in affective judgments comes from research that manipulated ease of processing through priming procedures. In one study, Reber et al. (1998) presented matched or mismatched subliminal visual primes before target pictures. Consistent with earlier work (Bar & Biederman, 2001) visual primes influenced the speed of target recognition, as reflected in response latencies. More importantly, the same targets were judged more favorably when preceded by matching rather than non-matching primes (see Reber & Schwarz, 2001, for further evidence). Winkielman and Fazendeiro (2001) extended this work by using a cross-modal priming task designed to manipulate conceptual aspects of image processing. Specifically, participants were shown a series of target pictures of common objects and animals. Each picture was preceded by a letter string consisting of either a word or a non-word. Participants were kept from focusing on the word-picture relation by performing two different tasks. First, the participants indicated, as fast as possible, whether or not the letter string was an actual English word. Second, the participants reported their liking for the picture. The letter strings served as the fluency manipulation, resulting in three levels of fluency. At the highest level of fluency, some pictures were preceded by matched words (e.g., word "dog" - picture "dog"). At the medium level of fluency, pictures were preceded by associatively related words (e.g., word "key" - picture "lock"). Finally, at the lowest level of fluency, pictures were preceded by unrelated words (e.g., word "snow" - picture "desk"). The results showed a robust effect of concept priming on participants' evaluations of the target pictures. As expected, pictures preceded by matching words

were liked significantly more than pictures preceded by related words, which, in turn, were liked significantly more than pictures preceded by unrelated words. Follow-up studies indicated that these fluency effects do not require that the word primes immediately precede the target pictures. Instead, the authors obtained the same pattern of effects when participants studied a list of word primes before they were exposed to the pictures.

3.2. Physiological and Attributional Evidence of Hedonic Responses to Fluency

Winkielman and Cacioppo (2001) went beyond self-reports in investigating the affective marking of processing ease. To capture spontaneous, quick and subtle affective responses to fluency, these researchers used facial electromyography (EMG) to monitor electrical activity over participants' "smiling muscle" (zygomaticus major) and "frowning muscle" (corrugator supercilii). Facilitation of stimulus processing with visual priming (Study 1) and presentation duration (Study 2) selectively increased activity over the zygomaticus region, indicating that the resulting affect was more positive (Winkielman & Cacioppo, 2001). Similar EMG findings have been obtained by Harmon-Jones and Allen (2001), who used repetition as a manipulation of fluency.

Theoretically, we assume that the spontaneous affective response observed by Winkielman and Cacioppo (2001) and Harmon-Jones and Allen (2001) mediates the impact of fluency on evaluative judgments. More specifically, we assume that high fluency leads to a positively marked subjective experience. Participants interpret this positive response as their reaction to the stimulus, resulting in more positive evaluations. This assumption is consistent with a more general model of how experiences influence judgments, the so-called "feelings-as-information model." This model holds that feelings serve as a source of information in their own right, unless their perceived informational value for the judgment at hand is undermined through (mis)attribution manipulations (for a review see Schwarz & Clore, 1996).

This reasoning was explicitly tested in a recent series of studies by Winkielman and Fazendeiro (2001). These researchers again used the conceptual priming manipulation described earlier but added a misattribution manipulation. Specifically, some participants were told that their reactions to the stimuli might be influenced by music playing in the background, whereas other participants did not receive any information about the background music. The "no-attribution" condition replicated the earlier effect of fluency on liking. That is, participants judged new pictures as more likeable when they were preceded by related rather than by unrelated word primes. However, attributing the affective reaction to the music eliminated this effect. That is, participants who were informed that the music might influence their affective feelings no longer judged new pictures as more likeable when they were preceded by related rather than by unrelated word primes. This pattern of results is consistent with our theoretical assumption that processing facilitation elicits a positive affective reaction that is "by default" attributed to

the judged target. This interpretation is consistent with other research into the use of moods (e.g., Schwarz & Clore, 1983) as well as with evidence that fluency manipulations such as mere exposure can lead to changes in self-reports of mood (Monahan, Murphy and Zajonc, 2000).<2>

3.3. Functions of Affective Marking of Fluency

Findings that we just described clearly suggest that high fluency is associated with positive affect. But why is this? We assume that processing fluency provides cues to the state of affairs either in the world or within the cognitive system (see Winkielman et al., 2002a, for a detailed discussion). Let us briefly discuss two such cues.

First, fluency may indicate that the particular stimulus or a general situation is known. As discussed by Mangan (2001), fringe experiences, such as the feeling of familiarity, provide a quick and early signal about the oldness/newness of the incoming stimulus. Therefore, an organism that monitors processing fluency (for us, the basis of the feeling of familiarity) may be able to detect stimulus' oldness/newness, respectively, even before the organism can fully decode stimulus content (see Curran, 2000; Lewenstein & Nowak, 1989; Norman & O'Reilly, in press; Smith, 2000; Winkielman, Schwarz, & Nowak, 2002b for discussions of these mechanisms). The connection between detection of familiarity and positive valence may be grounded in a biological predisposition for caution in encounters with novel, and thus potentially harmful objects (Zajonc, 1998). Such instinctual "fear of the unknown" has been observed in a variety of species with a range of different stimuli (for a review see Hill, 1978).

Second, fluency may indicate the quality of cognitive progressing. Mangan (2001) noted that in "monitoring, when the flow of contents or the trajectory of consciousness is going well, we feel rightness; when flow or trajectory is going ill, we feel wrongness." Accordingly, fluency may trigger an affective response because it provides feedback about the ongoing flow of information. Specifically, highly fluent processing reflects error-free operations, good progress towards recognition, and high likelihood of successful interpretation of the target (Bush, Luu, & Posner, 2000; Carver & Scheier, 1990; Simon, 1967; Vallacher & Nowak, 1999). If such progress is experienced as rewarding, it may motivate bringing the cognitive activity to completion.<3>

As an aside, it is worth noting that the notion of fluency as an indicator of cognitive progress may provide a parsimonious account for a variety of preference phenomena, such as preference for familiarity, symmetry, prototypicality, high figure-ground contrast, and many others. In this account, all these phenomena occur because the respective variable facilitates processing and thereby triggers positive affect.

In summary, the findings reviewed in this section contribute to a growing body of psychological research suggesting a tight connection between cognitive processing and

affect. To paraphrase James: It is well possible that there is no cognitive melody without affective overtones.

4. Processing Fluency and Non-Affective Judgments

4.1. Perceptual and Conceptual Judgments

A number of studies show that people draw on processing fluency to make a variety of perceptual and conceptual judgments. Thus, variables that enhance fluency, such as repetition or priming, lead to higher estimates of physical features, such as loudness (e.g., Jacoby, Allan, Collins, & Larwill, 1988), clarity (e.g., Whittlesea et al. 1990), and duration (e.g., Witherspoon & Allen, 1985). Further, the same variables also increase judgments of previous occurrence (e.g., Whittlesea, 1993) and even judgments of fame, i.e. the false fame effect (Jacoby, Kelley, Brown, & Jasechko, 1989). All of these effects can be understood by assuming a two-step process by which a variable like repetition first enhances fluency, which is then misattributed to loudness, clarity, duration, familiarity, or fame. Consistent with this interpretation, these effects disappear when participants are informed about the true source of fluency (Jacoby, Kelly, & Dywan, 1989).

As the "false fame effect" makes clear, fluency can influence fairly high-level conceptual judgments, which on the surface have little to do with the ease of information processing. Probably the best-known example of this influence is the "false truth effect" where unobtrusively repeated statements are judged as more true than statements not presented previously (Hasher, Goldstein, & Toppino, 1977). Begg, Anas, and Farinacci (1992) postulated that, just like the "mere-exposure effect", the "false truth effect" is mediated by simple changes in fluency due to statement repetition. Reber and Schwarz (1999) tested this hypothesis directly. Specifically, they presented statements such as "Osorno is in Chile", and manipulated processing fluency by subtly varying the contrast of the background against which the statements appeared. Participants were instructed to judge whether each statement was true or not. In accordance with the perceptual fluency account, participants judged a statement as more likely to be true when it was presented with higher contrast. McGlone and Tofighbakhsh (2000) obtained a similar result in a study that presented statements in a rhyming rather than non-rhyming form. A rhyming form enhances the fluency with which statements are understood (e.g., Meyer, Schvanefeldt, & Ruddy, 1975). They found that participants judged the same proverb-like statements to be more accurate when presented in a rhyming rather than a non-rhyming form.

4.2. Fluency, Familiarity, and Rightness

Mangan (2001) notes that psychologists tend to discuss fringe consciousness in terms of familiarity when it is more appropriate to discuss it in terms of rightness. For example,

when discussing the tip-of-the-tongue (TOT) phenomenon, Mangan notes, "the familiarity datum is quite orthogonal to the cognitive aim of resolving a TOT. A relatively unfamiliar word can still feel right when it fills the gap, and an extremely familiar word can feel quite wrong". Similarly, in discussing Whittlesea's work (e.g., Whittlesea and Williams, 2000; Whittlesea & Price, 2001), Mangan proposes that the experience of coherent processing (James' sense of "right direction in the thought") has more to do with an assessment of rightness than with the assessment of familiarity.

We agree with Mangan that familiarity is unlikely to be a "phenomenological primitive," a dominant quality in fringe experiences. However, few cognitive researchers actually give familiarity any special status. Instead, they propose that familiarity is just one of many subjective experiences (including rightness) that can emerge as a result of rudimentary processing changes and available contextual cues (Jacoby, Kelley, & Dywan, 1989; Whittlesea, in press). On this view, there is also no reason to give the feeling of "rightness" a status of a proto-experience from which all others derive. If anything deserves such a status, it would be the plain and simple experience of processing ease.

Importantly, the fact that processing ease can underlie different experiences does not mean that it has no inherent phenomenal qualities. Our work suggests that fluency usually feels positive. In a similar fashion, fluent processing may usually come with a "tinge" of familiarity and rightness. After all, fluent processing conveys a signal to an individual that his or her interaction with the environment is going smoothly and predictably (resulting in the feeling of rightness) and that the situation is generally known (resulting in a feeling of familiarity). Future research may address these subtle issues.

Another important question is what specific aspects of processing dynamics underlie subjective experiences such as "rightness" and "familiarity." Mangan does not explicitly consider fluency, but instead focuses on coherence (do various aspects of processing fit together?). Whittlesea (in press) proposes that some experiences are based on fluency while others are based on coherence. The reason we emphasize fluency is because this variable can parsimoniously explain most of the available findings, as reviewed above. However, we recognize that there is more to processing than just fluency. Thus, we look forward to studies that will demonstrate the unique contribution of coherence to phenomenology and judgment.

Last but not least, it is worth keeping in mind that in some cases judgments of familiarity, rightness, tip-of-tongue, and imminence, do not reflect underlying feelings, but are simply judgments. Such a non-phenomenological approach would suggest that these judgments are like the previously discussed judgments of fame and truth -- inferences from rudimentary changes in processing fluency.

4.3. Retrieval Difficulty as a Processing Experience

One line of research that deserves a special discussion in the context of Mangan's thesis is our work and that of our colleagues on the processing experiences associated with retrieval of multiple events from memory. This work is relevant here for two reasons. First, this research provides compelling evidence that processing experiences provide a unique source of information that is independent of the retrieved content. Accordingly, this research fits very well with Mangan's emphasis on the unique status of processing experiences. Second, this research suggests that processing experience can be used as input in complex inferences. Accordingly, this research further supports Mangan's emphasis on the functional value of processing experiences.

The notion that people draw on processing experiences in their judgments is most associated with research on the availability heuristic. Tversky and Kahneman (1973) concluded from their studies that participants estimate the frequency of an event, or the probability of its occurrence, "by the ease with which instances or associations could be brought to mind" (Tversky and Kahneman 1973, p. 208). Presumably, participants infer that a given class of events is frequent when relevant instances come to mind easily, but rare when instances come to mind with difficulty.

Remarkably, it was not until fairly recently that psychologists were able to demonstrate the unique contribution of processing experiences while controlling for retrieved content. Note that classical studies on the availability heuristic confounded the ease of recall with the amount of recall. That is, in classical studies, people who easily recalled the material simultaneously recalled a lot of it (see Schwarz 1998 for a detailed discussion). In order to disentangle this confound, Schwarz et al. (1991) pit the implications of recalling many events against the effort involved in recalling those events. For example, in one study, some participants had to recall six self-assertive behaviors whereas other participants had to recall twelve such behaviors. Note that this recall task puts the ease of recall in opposition to the amount of recall. It is much easier to recall six than twelve events. After the recall phase, participants were instructed to judge their assertiveness. If judgments were based on the ease of recall, participants who recalled six events should rate themselves as more assertive than participants who recalled twelve events. If, on the other hand, judgments were based on the amount of recall, participants who recalled twelve self-assertive behaviors should judge themselves as more assertive than participants who recalled six self-assertive behaviors. Schwarz et al. (1991) found clear support for the idea that people rely on recall ease, not recall amount -- participants judged themselves to be more assertive if they recalled six events (easy task) rather than twelve events (difficult task).

Since the original 1991 demonstration by Schwarz and colleagues, researchers documented similar effects in many other domains. Several studies explored the unique contribution of recall experiences to frequency judgments (Reber & Zupanek, 2002; Waenke, Schwarz and Bless, 1995). Other studies showed similar effects on risk judgments (Rothman & Schwarz, 1998), judgments of attitude strength (Haddock, Rothman, Reber, & Schwarz, 1999), consumer preferences (Waenke, Bohner, & Jurkowitsch, 1997), and judgments of one's own memory (Winkielman et al., 1998). It is worth noting that many of the above studies, including the original Schwarz et al. (1991)

study, included misattribution conditions where participants were given an alternative explanation for their processing experience. Under such conditions, participants no longer drew on their ease or difficulty, again showing that "by default" people consider processing experience a reliable cue to judgment.

Recent work has also emphasized the importance of naive beliefs in linking the experience or recall ease and difficulty to the judgmental domain (Skurnik, Schwarz, & Winkielman, 2000). For example, Winkielman and Schwarz (2001) showed that the same experience of ease or difficulty in recalling childhood events can lead to opposite judgments, depending on participants' "theory" about the meaning of the subjective experience. Specifically, these researchers first manipulated recall experience by asking participants to recall few or many childhood events. Then, they manipulated participants' naive theories about the reason for their specific recall experiences (recall can be difficult because pleasant or unpleasant childhood events, respectively, fade from memory). As expected, participants reached opposite conclusions about their childhood happiness when the same recall experience was suggested to have different causes.

In sum, the above work on recall fluency supports Mangan's position that subjective experiences can be a unique source of information that is independent of the amount of information that comes to mind. This work also supports Mangan's emphasis on the functional value of processing experience and its contribution to many kinds of judgments. However, it is worth highlighting an apparent, but yet unexplored, difference between the just discussed studies that manipulated processing experience using recall demands and the previously discussed studies that manipulated processing experience using manipulations such as repetition and priming. In studies using manipulations such as repetition and priming, the fluency experience tends to be weak and stays in the background, just like Mangan suggests. On the other hand, in studies using manipulations such as retrieval of multiple events, participants report experiences of ease or difficulty to be quite strong and distinct, moving from the fringe of consciousness to the center of attention. Future work may explore the differences between these different kinds of fluency.

5. Conclusion

Mangan (2001) noted that the problem with contemporary research in cognition is its "remarkably thin phenomenology". We agree, but suggest that our work and the work of our colleagues have gone some way to "take phenomenology seriously," without compromising the experimental methodology. In reviewing this work, we focused primarily on phenomenal experiences that are based on processing fluency, or the speed with which information is mentally processed. First, we discussed how variation in processing fluency at different stages of the perceptual process can condense into a joint subjective experience of processing ease. Second, we discussed how changes in processing fluency influence affective experience. Third, we showed how processing fluency influences a variety of perceptual and conceptual judgments. Fourth, we

discussed how under some conditions people strategically draw on processing experiences, such as recall ease or difficulty, to draw inferences about a variety of judgmental targets. Moreover, we questioned Mangan's notions that the feeling of rightness is phenomenologically primary to other cognitive experiences, and that cognitive experiences always stay in the processing background.

In conclusion, sensation, perception, thinking, and memory are not only about the transformation of object representations, deprived from any subjective experience (see Merleau-Ponty, 1978). People's mental universe also includes non-sensory experiences.<4> These experiences enrich their subjective world and provide valuable guides to judgments and decisions. People do not know much about the sources of their processing experiences, but usually trust them and use them in judgments. However, people are also flexible. They can think about what these experiences mean and use them strategically. Further, once people become aware of alternative causes of their subjective experience, they can switch to other bases for judgments. Obviously, there are many remaining questions about the nature and operation of subjective experiences. However, it seems clear that without an understanding of fringe consciousness, our knowledge of how people deal with the world will remain fragmentary.

Notes

<1>. Rolf Reber was supported by the Swiss National Science Foundation (grant no. 61-57881.99). Piotr Winkielman was supported by the United States National Science Foundation (grant BCS-0217294).

<2>. This is also shown by studies where people are led to notice that their processing experiences may be "corrupted". For example, Van den Bergh and Vrana (1998) observed that repeated exposure increased liking up to nine exposures. After 27 exposures, liking increased if the salience of the repetition scheme was low, but decreased if the salience was high.

<3>. Ramashandran and Hirnstein (1999) draw on this notion in their analysis of Capgrass Syndrome. i.e., a lack of the ability to integrate successive encounters with the same persons into a stable person representation. They suggest that this deficit may be due to amygdala damage that prevents Capgrass patients from experiencing "a warm fuzzy emotional response" to a familiar face. Ramashandran and Hirnstein (1999) propose that "in the absence of limbic activation -- the 'glow' of recognition -- there is no incentive for the brain to link successive views of a face, so that the patient treats a single person as several people" (p. 31).

<4>. Our focus on processing fluency should not occlude that similar processes have been observed with other experiences, such as moods (see Schwarz & Clore, 1996) and bodily sensations (e.g., Friedman & Foerster, 2000; Neumann & Strack, 2000).

References

Aizenstein, H. J., MacDonald, A. W., Stenger, V. A., Nebes, R. D., Larson, J.K., Ursu, S., & Carter, C. S. (2000). Complementary category learning systems identified using event-related functional MRI. *Journal of Cognitive Neuroscience, 12,* 977-987.

Baars, B. J., & McGovern, K. (1996). Cognitive views of consciousness: What are the facts? How can we explain them. In M. Velmans (Ed.), *The science of consciousness: Psychological, neuropsychological and clinical reviews* (pp. 63-95). London: Routledge.

Bar, M., & Biederman, I. (1998). Subliminal visual priming. *Psychological Science, 9,* 464-469.

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.

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. (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.

Bransford, J. D., & Johnson, M. K. (1972). Contextual prerequisites for understanding: Some investigations of comprehension and recall. *Journal of Verbal Learning and Verbal Behavior, 11,* 717-726.

Brown, S. R. (2000). Tip-of-the-Tongue phenomena: An introductory phenomenological analysis. *Consciousness and Cognition, 9,* 516-537.

Buchner, A. (1994). Indirect effects of synthetic grammar learning in an identification task. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20,* 550-566.

Bush, G., Luu, P., & Posner, M. I. (2000). Cognitive and emotional influences in anterior cingulate cortex. *Trends in Cognitive Sciences, 4,* 215-222

Carver, C. S., & Scheier, M. F. (1990). Origins and functions of positive and negative affect: A control-process view. *Psychological Review, 97,* 19-35.

Checkosky, S. F., & Whitlock, D. (1973). The effects of pattern goodness on recognition time in a memory search task. *Journal of Experimental Psychology, 100,* 341-348.

Clore, G. L. (1992). Cognitive phenomenology: Feelings and the construction of judgment. In L. L. Martin & A. Tesser (Eds.), *The construction of social judgments* (pp. 133-163). Hillsdale, NJ: Erlbaum.

Curran, T. (2000). Brain potentials of recollection and familiarity. *Memory and Cognition, 28,* 923-938.

Desimone, R., Miller, E.K., Chelazzi, L., & Lueschow, A. (1995). Multiple memory systems in the visual cortex. In M. S. Gazzaniga (Ed.), *The cognitive neurosciences.* (pp. 475-490). Cambridge, MA: MIT Press.

Epstein, R. (2000). A neural-cognitive basis of the Jamesian stream of thought. *Consciousness and Cognition, 9,* 550-575.

Feustel, T. C., Shiffrin, R. M., & Salasoo, A. (1983). Episodic and lexical contributions to the repetition effect in word identification. *Journal of Experimental Psychology: General, 112,* 309-346.

Friedman, R. S., & Foerster, J. (2000). The effects of approach and avoidance motor actions on the elements of creative insight. *Journal of Personality and Social Psychology, 79,* 477-492.

Haber, R. N., & Hershenson, M. (1965). The effects of repeated brief exposures on growth of a percept. *Journal of Experimental Psychology, 69,* 40-46.

Haddock, G., Rothman, A. J., Reber, R., & Schwarz, N. (1999). Forming judgments of attitude certainty, intensity, and importance: The role of subjective experiences. *Personality and Social Psychology Bulletin, 25,* 771-782.

Harmon-Jones, E., & Allen, J. J. B. (2001). The role of affect in the mere exposure effect: Evidence from psychophysiological and individual differences approaches. *Personality and Social Psychology Bulletin, 27,* 889-898.

Hasher, L., Goldstein, D., & Toppino, T. (1977). Frequency and the conference of referential validity. *Journal of Verbal Learning and Verbal Behavior, 16,* 107-112.

Hill, W. F. (1978). Effects of mere exposure on preferences in nonhuman mammals. *Psychological Bulletin, 85,* 1177-1198.

Jacoby, L. L., Allan, L. G., Collins, J. C., Larwill, L. K. (1988). Memory influences subjective experience: Noise judgments. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 14,* 240-247.

Jacoby, L. L., & Dallas, M. (1981). On the relationship between autobiographical memory and perceptual learning. *Journal of Experimental Psychology: General, 110,* 306-340.

Jacoby, L. L., Kelley, C. M., Brown, J., & Jasechko, J. (1989). Becoming famous overnight: Limits on the ability to avoid unconscious influences of the past. *Journal of Personality and Social Psychology, 56,* 326-338.

Jacoby, L. L., Kelley, C. M., & Dywan, J. (1989). Memory attributions. In H.L. Roediger, & F.I.M. Craik (Eds.), *Varieties of memory and consciousness: Essays in honour of Endel Tulving,* (pp. 391-422). Hillsdale, NJ: Erlbaum.

James, W. (1890). *The principles of psychology.* New York: Holt.

Klein, M. (1981). Context and memory. In L. T. Benjamin, Jr. & K. D. Lowman (Eds.), *Activities handbook for the teaching of psychology* (p. 83). Washington, DC: American Psychological Association.

Koriat, A. (2000). The feeling of knowing: Some metatheoretical implications for consciousness and control. *Consciousness and Cognition, 9,* 149-171.

Lewenstein, M., & Nowak, A. (1989). Recognition with self-control in neural networks. *Physical Review, 40,* 4652-4664.

Mandler, G., Nakamura, Y., & Van Zandt, B. J. S. (1987). Nonspecific effects of exposure on stimuli that cannot be recognized. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 15,* 646-648.

Mangan, B. (1993). Taking phenomenology seriously: The "fringe" and its implications for cognitive research. *Consciousness and Cognition, 2,* 89-108.

Mangan, B. (2001). Sensation's ghost: The non-sensory "fringe" of consciousness. *Psyche, 7(18).* Available: http:psyche.cs.monash.edu.au/v7/psyche-7-18-mangan.html

McGlone, M. S., & Tofighbakhsh, J. (2000). Birds of a feather flock conjointly (?): Rhyme as reason in aphorisms. *Psychological Science, 11,* 424-428.

Merleau-Ponty, M. (1978). *Phenomenology of perception.* Trans. Colin Smith. London: Routledge Kegan & Paul (orig. 1945).

Meyer, D. E., Schwaneveldt, R. W., & Ruddy, M. G. (1975). Loci of contextual effects on visual word recognition. In P. M. Rabbit & S. Dornic (Eds.), *Attention and Performance, Vol. V* (pp. 98-118). London: Academic Press.

Monahan, J. L., Murphy, S. T., Zajonc, R. B. (2000). Subliminal mere exposure: Specific, general, and diffuse effects. *Psychological Science, 11,* 462-466.

Neumann, R., & Strack, F. (2000). Experiential and nonexperiential routes of motor influence on affect and evaluation. In H. Bless & J.P. Forgas (Eds.), *The message within:*

The role of subjective experience in social cognition and behavior (pp. 52-68). Philadelphia: Psychology Press.

Nissen, M. J., & Bullemer, P. (1987). Attentional requirements of learning: Evidence from performance measures. *Cognitive Psychology, 19,* 1-32.

Norman, K. A. & O'Reilly, R. C. (in press). Modeling hippocampal and neocortical contributions to recognition memory: A complementary learning systems approach. *Psychological Review.*

Perruchet, P., & Amorim, M. (1992). Conscious knowledge and changes in performance in sequence learning: Evidence against dissociation. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 18,* 785-800.

Poldrack, R. A., & Logan, G. D. (1997). Fluency and response speed in recognition judgments. *Memory & Cognition, 25,* 1-10.

Poldrack, R. A., & Logan, G. D. (1998). What is the mechanism for fluency in successive recognition? *Acta Psychologica, 98,* 167-181.

Posner, M.I., & Keele S. W. (1968). On the genesis of abstract ideas. *Journal of Experimental Psychology, 77,* 353-363.

Ramachandran, V. S., & Hirstein, W. (1999). The science of art: A neurological theory of aesthetic experience. *Journal of Consciousness Studies, 6,* 15-51.

Reber, A. S. (1967). *Implicit learning of artificial grammars. Journal of Verbal Learning and Verbal Behavior, 6,* 855-863.

Reber, A. S. (1993). *Implicit learning and tacit knowledge: An essay on the cognitive unconscious.* New York: Oxford University Press.

Reber, P. J., Stark, C. E. L., & Squire, L. R. (1998). Cortical areas supporting catetory learning identified using functional MRI. *Proceedings of the National Academy of Science USA, 95,* 747-740.

Reber, R., & Schwarz, N. (1999). Effects of perceptual fluency on judgments of truth. *Consciousness and Cognition, 8,* 338-342.

Reber, R., & Schwarz, N. (2001) The Hot Fringes of Consciousness: Perceptual Fluency and Affect. *Consciousness and Emotion, 2,* 223-231.

Reber, R., Schwarz, N., & Winkielman, P. (2002). *Processing fluency and aesthetic pleasure: Is beauty in the perceiver's processing experience?* Manuscript, submitted for publication.

Reber, R., Winkielman, P., & Schwarz, N. (1998). Effects of perceptual fluency on affective judgments. *Psychological Science, 9,* 45-48.

Reber, R., & Wurtz, P. (2001). *Exploring "fringe" consciousness: The case of perceptual fluency.* Manuscript, submitted for publication.

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: Oxford University Press.

Rothman, A. J., & Schwarz, N. (1998). Constructing perceptions of vulnerability: Personal relevance and the use of experiential information in health judgments. *Personality and Social Psychology Bulletin, 24,* 1053-1064.

Schwarz, N. (1998). Accessible content and accessibility experiences: The interplay of declarative and experiential information in judgment. *Personality and Social Psychology Review, 2,* 87-99.

Schwarz, 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.

Schwarz, N., & Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology, 45,* 513 - 523.

Schwarz, N., & Clore, G. L. (1996). Feelings and phenomenal experience. In E. T. Higgins, & A. W. Kruglanski (Eds.), *Social psychology: handbook of basic principles* (pp. 433-465). New York: Guilford.

Seamon, J. G., Brody, N., & Kauff, D. M. (1983). Affective discrimination of stimuli that are not recognized: Effects of shadowing, masking, and central laterality. *Journal of Experimental Psychology: Learning, Memory and Cognition, 9,* 544-555.

Seamon, J. G., McKenna, P. A., & Binder, N. (1998). The mere exposure effect is differentially sensitive to different judgment tasks. *Consciousness and Cognition, 7,* 85-102.

Simon, H. A. (1967). Motivational and emotional controls of cognition. *Psychological Review, 74,* 29-39.

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: Psychology Press.

Smith, E. R. (2000). Subjective experience of familiarity: Functional basis in connectionist memory. In H. Bless & J. P. Forgas (Eds.), *The message within: The role of subjective experience in social cognition and behavior* (pp. 109-124). Philadelphia: Psychology Press.

Titchener, E.B. (1910). *A textbook of psychology.* New York: Macmillan.

Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology, 5,* 207-232.

Vallacher, R. R., & Nowak, A. (1999). The dynamics of self-regulation. In R. S. Jr. Wyer (Ed.), *Perspectives on behavioral self-regulation* (pp. 241-259). Mahwah: Lawrence Erlbaum Associates.

Van den Bergh, O., & Vrana, S. R. (1998). Repetition and boredom in a perceptual fluency/attributional model of affective judgments. *Cognition and Emotion, 12,* 533-553.

Waenke, M., Bohner, G., & Jurkowitsch, A. (1997). There are many reasons to drive a BMW: Does imagined ease of argument generation influence attitudes? *Journal of Consumer Research, 24,* 170-177.

Waenke, M., Schwarz, N., & Bless, H. (1995). The availability heuristic revisited: Experienced ease of retrieval in mundane frequency estimates. Acta Psychologica, 89, 83-90.

Whittlesea, B. W. A. (1993). Illusions of familiarity. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19,* 1235-1253.

Whittlesea, B. W. A. (in press). On the construction of behavior and subjective experience: The production and evaluation of performance. In J. Bowers & C. Marsolek (Eds.), *Rethinking Implicit Memory.* Oxford University Press; Oxford.

Whittlesea, B. W. A., Jacoby, L. L., & Girard, K. (1990). Illusions of immediate memory: Evidence of an attributional basis for feelings of familiarity and perceptual quality. *Journal of Memory and Language, 29,* 716-732.

Whittlesea, B. & Price, J. (2001). Implicit/explicit memory versus analytic/nonanalytic processing: Rethinking the mere exposure effect." *Memory and Cognition, 29,* 234-246.

Whittlesea, B. W. A., & Williams, L. D. (2000). The source of feelings of familiarity: The discrepancy-attribution hypothesis. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 26,* 547-565.

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., & Fazendeiro, T. (2001). *Effects of conceptual fluency on memory and liking.* Manuscript in preparation.

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., & Belli, R. F. (1998). The role of ease of retrieval and attribution in memory judgments: Judging your memory as worse despite recalling more events. *Psychological Science, 9,* 124-126.

Winkielman, P., Schwarz, N., Fazendeiro, T., & Reber, R. (2002a). The Hedonic Marking of Processing Fluency: Implications for Evaluative Judgment. To appear in: J. Musch & K.C. Klauer (Eds.), *The psychology of evaluation: Affective processes in cognition and emotion.* (pp. 189-217). Mahwah, NJ: Lawrence Erlbaum.

Winkielman, P., Schwarz, N., & Nowak, A. (2002b). Affect and processing dynamics: Perceptual fluency enhances evaluations. In S. Moore & M. Oaksford (Eds.), *Emotional Cognition: From brain to behaviour.* (pp. 111-136). Amsterdam, NL: John Benjamins

Witherspoon, D., & Allan, L. G. (1985). The effects of a prior presentation on temporal judgments in a perceptual identification task. *Memory & Cognition, 13,* 103-111.

Zajonc, R.B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology: Monograph Supplement, 9,* 1-27.

Zajonc, R. B. (1998). Emotions. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *The Handbook of Social Psychology* (pp. 591-632). Boston, MA: McGraw-Hill.

Zajonc, R. B. (2000). Feeling and thinking: Closing the debate over the independence of affect. In J. P. Forgas (Ed). *Feeling and thinking: The role of affect in social cognition* (pp. 31-58). New York: Cambridge.