Scanning the "Fringe" of consciousness: What is felt and what is not felt in intuitions about semantic coherence

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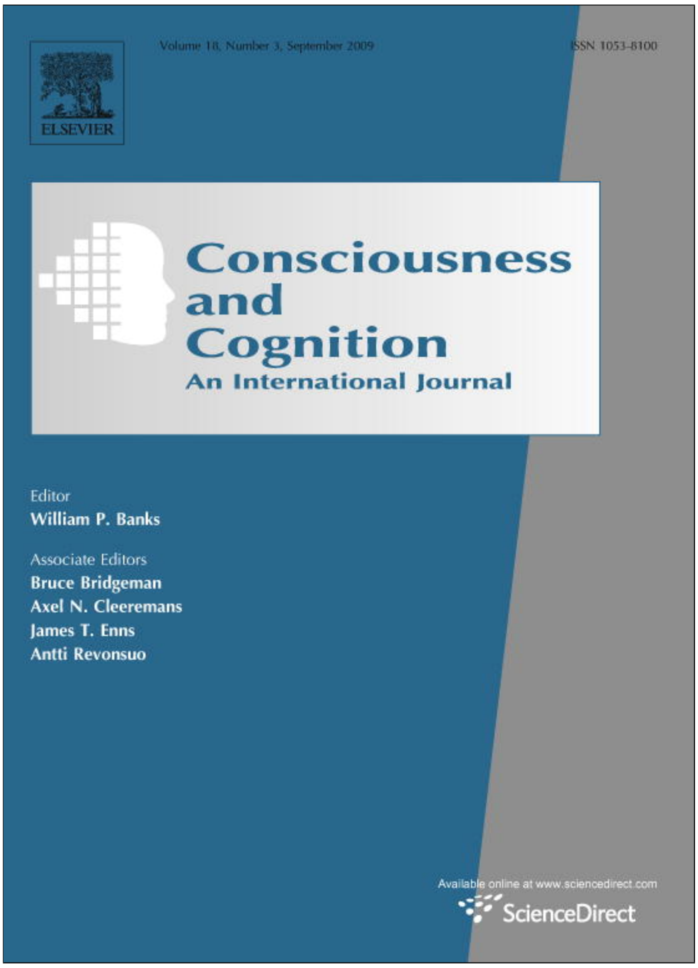
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Scanning the "Fringe" of consciousness: What is felt and what is not felt in intuitions about semantic coherence

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ABSTRACT

In intuitions concerning semantic coherence participants are able to discriminate above chance whether a word triad has a common remote associate (coherent triad) or not (incoherent triad). These intuitions are driven by increased fluency in processing coherent triads compared to incoherent triads, which in turn triggers a brief and short positive affect. The present work investigates which of these internal cues, fluency or positive affect, is the actual cue underlying coherence intuitions. In Experiment 1, participants liked coherent word triads more than incoherent triads, but did not rate them as being more fluent in processing. In Experiment 2, participants could intuitively detect coherence when they misattributed fluency to an external source, but lost this intuitive ability when they misattributed affect. It is concluded that the coherence-induced fluency by itself is not consciously experienced and not used in the coherence intuitions, but the fluency-triggered affective consequences.

1. Introduction

There is broad agreement in literature that 'intuition' occurs with little awareness of the underlying processes (Betsch, 2008; Deutsch & Strack, 2008; Hastie, 2001; Hogarth, 2001; Meyers, 2002; Volz & von Cramon, 2006; Weber & Lindemann, 2008). Intuition has been defined to consist of "...thoughts and preferences that come to mind quickly and without much reflection" (Kahneman, 2003, p. 697) and to be "...the subjective experience of a mostly nonconscious process" (Lieberman, 2000, p. 111). These conceptions are shared by other prominent approaches to intuition (e.g., Bechara, Damasio, Tranel, & Damasio, 1997; Epstein, 1991; Hammond, Hamm, Grassia, & Pearson, 1987; Reber, 1989). Thus, intuition is predominantly seen as a feeling that emerges from processes operating outside of awareness and then enters the individual's experiential awareness.

In this respect, intuition may be compared to the notion of *fringe consciousness* by William James (1890), who has used this term "...to designate the influence of a faint brain-process upon our thought, as it makes it aware of relations and objects but dimly perceived." (p. 258; see also Dewey, 1925; Mangan, 2001). In recent accounts, fringe consciousness is denoted to feelings that accompany every information processing and provide contextual information about the stimulus that is currently in the focus of attention (see Cook, 1999; Dewey, 1925; Mangan, 1993, 2001). These experiences were called the 'hot fringes of consciousness' by Reber and Schwarz (2001) and refer to a variety of feelings that indicate the ongoing dynamics of processing (Baars & McGovern, 1996), for instance, feelings of knowing (see Koriat, 1993; Koriat, 2000; Mangan, 2000), so-called states of "tip-of-the-tongue" (see Brown, 2000), or the general feeling of fluency that is generated be the ongoing processing of information (Reber, Wurtz, & Zimmermann, 2004). Following Clore et al. (2001), these experiences may also be

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called "cognitive feelings". It is important to note that these feelings continually accompany information processing but stay in the periphery of awareness, being experienced only when attention is drawn to them (Reber, Schwarz, & Winkielman, 2004; see also, Russell, 2003).

The present work is meant to scan the fringe of consciousness by mapping the area between mental operations that are outside of awareness and their outcomes being intuitions. More specifically, we ask at which point the underlying processes turn into an intuition that is consciously experienced. For this purpose, we will simply define consciousness as a psychic quality of which the individual is aware (cf. Bargh, 1994; Moors & De Houwer, 2006) and can thus verbally report different intensities of this quality (cf. Stevens, 1961; but also see Shanks & St John, 1994, and Nelson, 1978, for a critical discussion of verbal reports and awareness), which concerns present Experiment 1. Furthermore, being aware of such a psychic quality should enable the individual to control the influence it exerts on the individual's judgments, for example, by discounting it from a judgment (cf. Fang, Singh, & AhluWalia, 2007; Fazendeiro, Winkielman, Luo, & Lorah, 2005; Winkielman, Zajonc, & Schwarz, 1997), which concerns the present Experiment 2.

To explore the transition from unconscious mental operations to consciously experienced outputs an intuitive process is needed for which the underlying processes are identified and empirically studied. This is the case for judgments of semantic coherence (Bowers, Regehr, Balthazard, & Parker, 1990), which will be introduced in the following.

1.1. Intuitive judgments of semantic coherence

In intuitive judgments of coherence, individuals are asked to discriminate between word triads that either share a common remote associate (e.g., SALT DEEP FOAM implying SEA; coherent triad) or not (e.g., DREAM BALL BOOK; incoherent triad). Confronted with such triads, participants are able to intuitively judge the coherence of a given triad above chance—before and independently of the actual retrieval of the common associate (Baumann & Kuhl, 2002; Bolte, Goschke, & Kuhl, 2003; Bowers et al., 1990; Dorfman, Shames, & Kihlstrom, 1996), even under severe time pressure (Bolte & Goschke, 2005; Topolinski & Strack, 2008). Without knowing the cause, individuals seem to be able to *feel* an existing coherence. This phenomenon fits astonishingly well with James (1890) original notion describing the fringe (1890) as being a process that makes the individual "...aware of relations [...] but dimly perceived." (p. 258)

In a fluency-affect account for intuitions we have recently put forward a microanalysis precisely describing the generation of intuitions about semantic coherence (Topolinski & Strack, submitted for publication). We proposed a chain of both cognitive and affective processes that finally produce the intuitive hunch of coherence. More specifically, we assume that reading the triad causes its constituent concepts to be sequentially processed in the associative store. Because the three concepts of a coherent triads converge on a single common associate, semantic spreading converges and activates their common concept while processing the triad, as was demonstrated by Topolinski and Strack (2008); see also Beeman et al., 1994. This increased activation of the common associate in turn facilitates the processing of the whole triad, since its constituents are also associates of the solution word. As a result, the fluency in processing a coherent triad is unexpectedly high (cf. Hansen, Dechêne, & Wänke, 2008; Whittlesea & Williams, 1998; Whittlesea & Williams, 2000; Whittlesea & Williams, 2001a; Whittlesea & Williams, 2001b) because individuals are not used to semantically primed concepts in an apparently random word sequence (cf. Whittlesea, 1993, Experiments 2–5). Following the hedonic marker hypothesis by Winkielman and colleagues (Reber et al., 2004; Winkielman & Cacioppo, 2001; Winkielman, Schwarz, Fazendeiro, & Reber, 2003), high fluency triggers a short and subtle positive affect, which is not necessarily object to experiential awareness (Baumeister, Vohs, DeWall, & Zhang, 2007; Russell, 2003) and can exist without being labeled or interpreted (Russell & Feldman Barrett, 1999; Winkielman & Berridge, 2004). However, if the increase in positive affect is high or rapid enough, it may be experienced (Russell, 2003) as a cognitive feeling of ease (cf. Clore et al., 2001; for reviews see Clore, 1992; Jacoby, Kelley, & Dywan, 1989; Unkelbach, 2004). We deem this to be the case in the processing of coherent word triads. Asked for the coherence of a triad, individuals use the emerging feeling as an internal cue for their judgment of coherence. In processing an incoherent word triad the intuitive chain is not initiated: fluency does not increase and does not trigger any change in affect. Thus, the triad is judged incoherent.

We empirically tested this fluency-affect chain of intuition and were able to identify the following steps (Topolinski & Strack, submitted for publication): *Increased fluency:* in a lexical decision task, coherent triads were semantically processed faster than incoherent triads. *Increased positive affect:* the processing of coherent triads was found to inhibit the execution of subsequent negative evaluations while the processing of incoherent triads had no impact on subsequent evaluations. Also, the mere reading of a coherent triad led to automatic positive facial reactions in participants who were ignorant about the underlying semantic structure (Topolinski, Likowski, Weyers, & Strack, in press). Use of the emerging affect in a judgment: when asked how much they like the given triad, participants liked coherent triads more than incoherent triads (Topolinski & Strack, submitted for publication).

It is noteworthy that these findings were obtained while none of the participants knew about the underlying semantic structure of the triads; and that coherent and incoherent triads did not differ in any dimension that would influence either fluency (e.g., word length) or affect (word valences of triad constituents).

1.2. Aim of the present work

In the present approach, we are trying to identify the quality of those experiences that individuals use as a basis for intuitive judgments of coherence. A first hint is provided by Topolinski and Strack (2008, submitted for publication) who led participants to distrust their affective responses (see below). As a consequence, participants lost their ability to intuitively discriminate above chance between coherent and incoherent triads. However, this manipulation may have led participants to distrust any internal response, including feelings of fluency, and to use no internal cue as basis for their intuition at all (cf. Deutsch & Strack, 2008). Thus, the role the experience of fluency plays in intuition is not yet identified. The present work is meant to address this issue by asking whether fluency is experienced only through the elicited affect or also by itself. Before reviewing the relevant literature, we have to note some general assumptions concerning fluency, and to make some conceptual clarifications.

Generally, it is assumed that the *objective fluency* of processing dynamics (being the objectively measurable speed of processing, Reber, Fazendeiro, & Winkielman, 2002) always triggers subjective experiences as by-products (e.g., Koriat, 1993; Koriat & Goldsmith, 1996), although they usually stay in the periphery of attention (Unkelbach, 2004) and sometimes even escape the attentional focus (Reber et al., 2002). It is further assumed that processing dynamics will particularly lead to conscious experiences of processing ease (''feeling of ease", Clore, 1992; ''subjective fluency", Reber et al., 2002) if the processing dynamics change abruptly or deviate from previous expectancies, that is when processing fluency is unexpectedly high or low (Hansen et al., 2008; Schwarz & Clore, 1983; Whittlesea & Williams, 1998; Whittlesea & Williams, 2000; Whittlesea & Williams, 2001a; Whittlesea & Williams, 2001b). Kelley and Jacoby (1998) called this ''experienced variations in performance".

Furthermore, the processing fluency of different mental operations can be distinguished. In accordance with Reber et al. (2002) we differentiate between three types: (a) *retrieval fluency*, being the ease with which individuals recall contents from memory (e.g., Schwarz & Clore, 1983); (b) *perceptual fluency*, being the processing ease of perceptual processes like identifying the visual properties of a stimulus (e.g., Reber et al., 2004); and (c) *conceptual fluency*, being the ease of processing stimulus meanings and their relations to semantic knowledge structures (e.g., Whittlesea, 1993). It is apparent that the latter applies to coherence intuitions.

1.3. The subjective experience of conceptual fluency

While it was extensively investigated and empirically established that individuals are aware of differences in retrieval fluency (e.g., Schwarz et al., 1991; Tversky & Kahneman, 1973), the experiential status of conceptual fluency was rarely investigated. Although there are numerous studies on how conceptual fluency affects a variety of judgments (e.g., Jacoby & Whitehouse, 1989; Masson & Caldwell, 1998; Whittlesea, 1993), only few of them ask whether and under which circumstances conceptual fluency itself is consciously experienced. In the following, we will review two experiments that have addressed this issue.

Poldrack and Logan (1998) conducted a study in which one experimental group received words in a study phase that required lexical decisions. In three subsequent testing blocks, the same words were presented again for lexical decisions together with new words. It turned out that lexical decisions for old words were marginally faster than for new words, yielding response-time accelerations of up to 93 ms (Poldrack & Logan, 1998, p. 172). This difference, however, did not reach significance. After each lexical decision, participants were asked to indicate the difficulty. It was found that lexical decisions for old words were more frequently described to be ''easy" than lexical decisions for new words. In additional analyses, it was also found that the probability of rating the lexical decision as easy was actually associated with the objective response time for the preceding lexical decision, indicating that ease judgments were sensitive to objective fluency. These findings give a first clue: inducing response-time gains of up to 93 ms in semantic processing allows conscious experience of increased fluency.

The first systematic investigation of whether conceptual fluency gains are experienced is—to our knowledge—a recent study by Hertwig, Herzog, Schooler, and Reimer (submitted for publication, Experiment 2). In this thorough work, names of US cities, German companies, and music artists (e.g., ''Genesis") were shown in pairs to participants who first had to read each word of the pair separately and then to indicate whether they had recognized the name or not. The response times for these recognition judgments were used as objective indicators of fluency. After the recognition judgment, participants were asked to report for which of the two names of the pair they more quickly arrived the judgment (irrespective of whether they had recognized it or not) to obtain a subjective fluency estimation. Relating the response time of the recognition judgment for each word of a given pair with participants' choices, this method elegantly assesses the relationship between objective semantic fluency and subjective fluency estimations. As a result, response-time differences in recognition of up to 700 ms and more were found. It turned out that the larger objective differences in fluency between words were the better participants were able to discriminate the fluency between the words. However, when recognition time differences between words fell below 100 ms, participants' accuracy dropped to chance level. Concluding from this finding, the authors stated that approximately 100 ms is the ''just noticeable difference" for fluency estimations (cf. Fraisse, 1984).

Concerning the fluency gains induced by semantic coherence, Topolinski and Strack (2008, submitted for publication) obtained an average fluency gain of 57 ms for coherent triads compared to incoherent triads in a lexical decision task. Given the above benchmarks of around 100 ms fluency gain that is needed for fluency to become noticed, it is unlikely that fluency triggered by semantic coherence is directly experienced. However, this question remained an empirical one and was addressed in the present two studies. In Experiment 1, we simply asked participants to estimate fluency as well as affect and related these ratings to objective fluency. In Experiment 2, we used a reattribution paradigm to figure out whether the experience of fluency per se is used in intuitive judgments of coherence.

2. Experiment 1

The simplest way to assess whether something is consciously experienced or not, is to ask individuals to verbally report it (cf. Stevens, 1957; Stevens, 1961; but see also Nisbett & Wilson, 1977). Therefore, we had participants read word triads and rate how fluent their processing was. To obtain a control group, we asked a different sample of participants to indicate their liking of the triads. Previous findings showed that people like coherent triads more than incoherent (Topolinski & Strack, 2008) and respond to coherent triads with incipient smiles (Topolinski et al., in press), indicating that individuals do experience positive affect that is triggered by fluency. To investigate whether fluency detection in the present paradigm is in general sensitive to fluency, we measured the speed of reading the triads as an indicator of objective fluency. We predicted that both fluency and liking judgments would be sensitive to this fluency manipulation, but only the liking judgments would be sensitive to the coherence-triggered fluency differences. To obtain an additional indicator of the intensity of subjectively experienced fluency and affect and to control for guessing, we asked for the confidence in each judgment in both groups.

2.1. Method

2.1.1. Participants

Fifty (30 female) undergraduate psychology students participated in the study for a small candy gift.

2.1.2. Materials and procedure

The 36 coherent and 36 incoherent word triads in German language from a stimulus pool created by Bolte and Goschke (2005); (see also Topolinski & Strack, 2008) were used. The triads were presented in random order on a PC screen. Participants were not informed about the hidden semantic coherence but were rather told that they had to rate groups of words for later implementations in other experiments. For both the fluency rating and the liking-rating group, participants were asked to read each presented triad and to press the space bar on the computer keyboard as soon as they had accomplished reading. After this response, participants in the *fluency-rating group* were asked to rate how fluent their processing of the triad had been by typing in a number correspondent to their estimate on an 10-point Likert-scale ranging from 1 (“Very slow, hard, halting”) to 10 (“Very fast, easy, fluent.”). Participants in the *liking group* were asked to spontaneously indicate how much they liked the word triads after reading them. They were explicitly asked not to assess the valence of the single constituents, but rather to indicate how much they liked “the word triple as a whole”. They were asked to type in a number correspondent to their liking on an 10-point Likert-scale ranging from 1 (“I do not like it at all.”) to 10 (“I like it very much.”). After each fluency, or liking rating, respectively, both groups were asked to estimate their confidence in their judgment on a scale ranging from 1 (“Not at all confident.”) to 10 (“Very confident.”). After the experimental session, participants were debriefed and asked for any conspicuity. Then, they were asked whether they had detected any systematic relationships within the word triads. Two participants in the liking group indicated relevant suspicions concerning the hidden semantic coherence. Their data were dropped. Furthermore, the data of two participants were lost due to failed data recording. In the analyses remained $N = 24$ in the fluency-rating group, and $N = 22$ in the liking-rating group.

2.2. Results

2.2.1. Subject-level analyses

At first, the data were analyzed on a subject level in order to investigate whether coherence affected fluency and liking ratings.

2.2.2. Response latencies for reading

Response latencies exceeding 3000 ms were excluded from all further analyses, which was true for 5.2% of the data set. Mean response latencies for reading did not differ between the fluency group ($M = 1185$, $SD = 157$) and the liking group ($M = 1218$, $SD = 191$), $t < 0.7$. Independently of judgment, coherent word triads ($M = 1172$, $SD = 183$) were read faster than incoherent triads ($M = 1230$, $SD = 182$); $t(45) = 3.37$, $p < .002$. This is reflected in a 2 (Coherence: coherent triads, incoherent triads) $\times$ 2 (Judgment: fluency rating, liking rating) mixed analysis of variance (ANOVA) with the last being a between subjects factor, in which only the main effect of Coherence is reliable, $F(1,44) = 11.14$, $p > .002$, ${\eta_p}^2 = .20$, but not the interaction, $F < 0.01$.

2.2.3. Fluency and liking ratings

The average level of ratings differed between groups. Average fluency ratings ($M = 6.23$, $SD = 0.40$) were higher than liking ratings ($M = 5.67$, $SD = 0.31$), $t(44) = 5.34$, $p < .001$. For the fluency ratings, no difference was found between coherent ($M = 6.24$, $SD = 0.41$) and incoherent triads ($M = 6.23$, $SD = 0.44$), $t < 0.2$. However, a reliable difference was found for the liking ratings in the way that coherent triads ($M = 5.87$, $SD = 0.53$) were liked more than incoherent triads ($M = 5.47$, $SD = 0.40$), $t(21) = 2.73$, $p < .02$. This pattern constitutes a main effect of Coherence, $F(1,44) = 7.06$, $p > .01$, $\eta_p^2 = .14$, and a significant interaction between Coherence and Judgment, $F(1,44) = 6.54$, $p > .01$, $\eta_p^2 = .13$.

Table 1
Pearson correlations on a trial-level between response latencies in reading, ratings, and confidence in judgments, for the fluency-rating, and the liking-rating group, respectively.

Judgement group	2	3
Fluency	−.46**	.06*
1. Response latency	–	.17**
2. Fluency rating	–	–
3. Confidence in rating		
Liking	−.10**	.05
1. Response latency	–	.10**
2. Fluency rating	–	–
3. Confidence in rating		

Note. $N = 1666$ for each cell in the fluency condition, and $N = 1398$ for each cell in the liking condition, respectively.
*$p < .05$; **$p < .01$; tested two-sided.

2.2.4. Confidence in judgment

Participants were more confident in their fluency judgments ($M = 7.83$, $SD = 0.49$) than in their liking judgments ($M = 7.44$, $SD = 0.32$), $t(44) = 3.12$, $p < .003$. No effects of coherence were found, $F < 1$.

2.2.5. Single-trial-based analyses

We found that although coherence increased reading fluency, participants' fluency ratings were not sensitive to coherence. This might be caused by participants' general insensitivity for fluency variations, i.e., the variations in response latencies. On the level of single trials, it should be investigated whether this was true by predicting fluency ratings with response latencies as an indicator of objective fluency. As can be seen in Table 1, the trial-based correlation between response latencies and fluency ratings are large and negative, Pearson's $r = -.46$, indicating that the faster a triad was read the more fluent it was rated. This suggests that participants who rated fluency were indeed sensitive to objective fluency variations in general, however, not to the coherence-triggered fluency gains. In contrast, as was found on the subject level, participants rating their liking of the triads were sensitive to coherence. To provide more evidence for this pattern, we wanted to predict the fluency, or liking-rating, respectively, with the response latency of reading as well as with coherence of the given triad on a trial-level. Therefore, we conducted separate ANCOVAs on the fluency, and liking ratings, respectively, with Coherence (coherent vs. incoherent triads) as the independent variable and response latency in reading as the covariate. Concerning the fluency ratings, response latencies reliably predicted the rated fluency, $F(1,1663) = 440.24$, $p > .001$, $\eta_p^2 = .21$, however, Coherence did not ($F < 1.1$). In contrast, concerning the liking ratings, both response latencies, $F(1,1395) = 12.23$, $p > .001$, $\eta_p^2 = .01$, and Coherence, $F(1,1395) = 6.88$, $p > .001$, $\eta_p^2 = .01$, reliably predicted the liking of the triads.[1] The latter finding shows that, although it is small, there was a reliable influence of objective fluency on liking, as it is also reflected in the small negative correlation between response latencies and liking ratings (see Table 1) indicating that the faster a triad was read, the more it was liked.

2.2.6. Rating and confidence

On the trial-level, the confidence in the particular rating was weakly positively related to the size of the rating itself, both in the fluency and the liking group (see Table 1).

2.3. Discussion

We let participants read coherent and incoherent word triads and asked one group to subsequently rate the fluency of processing the triad, and the other group to rate their liking of the triad. In both groups, we found that coherent word triads were read faster than incoherent word triads, because—as we argued—through reading the triads, the common associate of the triads becomes partially activated and in turn facilitates the processing of the word triads. Note that this is a conceptual replication of Topolinski and Strack (2008) finding that coherent word triads are lexically judged faster than incoherent triads. Participants rating the fluency of processing the triads were sensitive to objective fluency (rated trials in which they had read the triad faster as being more fluent), but not to coherence-induced fluency gains (rated trials containing coherent and incoherent triads as equally fluent). In contrast, participants rating their liking of the triads were sensitive to both the general reading fluency (liked faster triads more than slower) and the coherence of triads (liked coherent triads more than incoherent). This pattern is even more interesting given the fact that participants were more confident in rating the fluency than rating their liking. This renders it unlikely that missing coherence-sensitivity of fluency ratings are due to guessing. Together with the fact that fluency ratings were in general sensitive to fluency variations (as reflected in the high negative correlation between reading latency and fluency ratings), this pattern suggests that the missing sensitivity of fluency ratings to coherence is not caused by a general insensitivity to fluency variations. One could even conclude the following from this pattern: participants did not experience the coherence-triggered fluency gains, and they were very sure about that.

[1] A regression analysis using z-standardized response latencies and coherence as a dummy-coded variable to predict z-standardized ratings yielded the same results.

It might be objected that the missing sensitivity of fluency ratings is due to a ceiling effect, since fluency ratings generally were higher than liking ratings. However, the mean of fluency ratings ($M = 6.23$, $SD = 0.40$) still was several standard deviations below the scales' upper limit (ranging from 1 to 10).

The weak positive relationship between both fluency and liking ratings and confidence in ratings may simply reflect phasic variations in acquiescence tendency, which would assert an aligned influence on both ratings in one trial.

The pattern of findings are a first hint suggesting that fluency gains that are produced by semantic coherence are too small to enter into awareness; in contrast, the positive affect triggered by these fluency gains is strong enough to be detected.

However, more compelling evidence would come from investigating the use of fluency and affect in the eventual intuitive judgment of coherence. If both fluency and affect would be consciously experienced, individuals could flexibly switch between the two internal cues. If the informational value of one source is invalidated—in a misattribution paradigm, for example—individuals would use the other source as basis for their intuitive judgment of coherence. So far, however, the results imply that only affect, but not fluency is felt. From this, it follows that a misattribution of affect would have consequences for intuitive coherence judgments, because affect is the internal cue that underlies these judgments. This was actually shown by Topolinski and Strack (2008, submitted for publication) who led participants to attribute their affective reactions to a background music (cf. Fazendeiro et al., 2005). Participants discounted their affective internal cues from their judgments and lost the ability to intuitively discriminate between coherent and incoherent word triads. In contrast to that, a misattribution of fluency would have no consequences for intuitive coherence judgments, because fluency is not the basis of these intuitions. Experiment 2 was meant to test this prediction.

3. Experiment 2

The general rationale of a misattribution manipulation is to lead participants to question the informational relevance of certain subjective states for the judgment at hand by introducing a transient external cause for these subjective states. For example, Schwarz and Clore (1983) found that the current whether influenced judgments about life satisfaction by inducing either positive (sunny days) or negative mood (rainy days). When they made the current weather salient to participants as being the source of their current mood, the weather lost its impact on life satisfaction judgments; obviously, because participants were able to discount their current mood from their judgments (see, e.g., Schwarz & Clore, 1988, for discounting mood; or, e.g., Zillman, 1978, for discounting arousal). The essential aspect for the present research is that individuals can reattribute only what they consciously experience (cf. Winkielman et al., 1997), such as mood or arousal. Hence, a misattribution paradigm can elegantly assess the experiential status of psychic qualities.

Such a diagnosis of the experiential status of fluency and affect has been achieved by Winkielman & Fazendeiro, 2003, (reported in Reber et al., 2004) for the domain of perceptual fluency. There, the fluency of pictures of everyday objects was manipulated by subliminal contour priming. As it was known from previous research, this induction of high fluency leads to increased liking for these pictures. Additionally, background music was played to participants to provide an external source to which participants could attribute their internal reactions. Some of the participants were told that the music influences the easiness with which stimuli come to mind (misattributing fluency), while other participants where told that the music influences how they feel about the stimuli (misattributing affect). It turned out that misattributing affect eliminated the effect that fluency exerts on liking; participants who attributed their affective responses to the music liked fluent and nonfluent stimuli equally. Obviously, these participants were able to discount affect from their liking judgment. However, misattributing fluency did not alter liking judgments; participants who attributed the perceptual fluency to the music liked fluent stimuli more than nonfluent. These participants were obviously unable to discount fluency from their liking judgments. Convergent evidence stems from Fazendeiro et al. (2005) who used the same misattribution paradigm investigating word recognition. There, participants could successfully reattribute their feelings of familiarity, but not their subjective fluency-experiences from recognition judgments. According to Reber et al. (2004), it can be concluded from these findings that fluency-triggered affect, but not fluency by itself is consciously experienced. However, there is also contrary evidence. Fang et al. (2007) used this misattribution paradigm to investigate whether fluency (induced by repeated exposure) or fluency-triggered affect underlies preferences for repeated advertising items. There, participants could discount both fluency and affect from their judgment. Given this, the experiential cue underlying intuition remains an empirical question.

Experiment 2 should implement a misattribution paradigm to untangle the role of fluency and affect as experiential cues in semantic coherence intuitions. Although literature is not fully consistent (see above) we predicted that participants would be unable to discount fluency from their intuitive judgments, since fluency is not consciously experienced (present Experiment 1) and is thus not used in coherence intuitions.

3.1. Method

3.1.1. Participants

Fifty-three (33 female) non-psychology students participated for a reward of two Euros (approximately 2.50 US$ at that time), $N = 18$ in the no-reattribution control group, $N = 18$ in the fluency-reattribution group, and $N = 20$ in the affect-reattribution group, respectively.

3.1.2. Materials and procedure

The 72 word triads from Experiment 1 were used again. We replicated the response-time window paradigm provided by Bolte and Goschke (2005), (for more details; see also Topolinski & Strack, 2008, Experiment 3). First, participants were trained to react within a time window of 500 ms after offset of a training stimulus. Then, they were informed about the rationale of semantic coherence by computer-based instructions and were provided with examples of coherent and incoherent triads (these stimuli were taken from Beeman et al., 1994, and did not appear in the later experimental block). In the experimental block, each trial started with an exclamation mark placed in the center of the screen for 1000 ms. Then, the word triad appeared for 1500 ms, in a stacked format in which each word was written horizontally and the second word was placed into the center of the screen. The triads were about 4 cm high and 3–5 cm wide, and the distance between screen and participants' eyes ranged from 60 to 80 cm. After the presentation of the triad, an interrogation mark appeared in the center of the screen and the words "coherent" and "incoherent" appeared on the right and left side of the screen depending on which key was assigned to each option (the assignment of response categories was counterbalanced across participants). If a participant did not respond within 500 ms after the onset of the response request, the sentence "Too slow!" appeared on the screen for 300 ms and the next trial started. If participants succeeded in reacting within the response-time window, they were prompted to type either the assumed solution word, or an 'x' if they believed the triad to be incoherent. To generate a word, participants were given 5 s before the next trial started.

The 36 coherent and 36 incoherent triads were presented in random order re-randomized for each participant. At the end of the experimental block, a computer-directed debriefing followed in which the participants were asked to type in any suspicion about the rationale of the experiment. The entire experimental session lasted 15–20 min.

3.1.3. Reattribution procedure

Participants were exposed to background music via headphones (cf. Fang et al., 2007; Fazendeiro et al., 2005; Winkielman & Fazendeiro, 2003; Winkielman et al., 1997) during the whole experimental session. To obtain an ambiguous piece of music that is not known to any participant and does not elicit too much affect, we selected the second movement "Jeux de Vages" from the impressionist orchestral work "La Mer" by Claude Debussy (1905) and run it on quarter speed. Five volunteers read sample triads and were asked to adjust the volume of the music in such a way that the music was clearly audible but did not interfere with proper reading of the triads. For the experiment, the averaged loudness of these settings was used. As in Topolinski and Strack (2008, submitted for publication), we ran the Experiment in a room adjoining a noisy cafeteria at the campus. Thus, we could implement the cover story that the music was played to the participants to avoid noise interference. In the *no-reattribution control group*, participants were only told this information. Additionally, two different crucial items were given in the instructions for the other groups: In the *fluency-reattribution condition* it was mentioned that "Previous research showed that this music influences the easiness of reading and the fluency with which the meaning of words is recognized.", whereas in the affect-reattribution condition it was mentioned that "Previous research showed that this music influences the emotional reactions of individuals." (cf. Winkielman & Fazendeiro, 2003). Participants were randomly assigned to the three conditions.

3.2. Results

3.2.1. Solved triads

If a participant had generated the correct solution word, a synonym, or a different but acceptable solution word after the semantic coherence judgment (which was collectively decided by two raters being ignorant about the conditions), then this trial was considered as being solved (cf. Bolte & Goschke, 2005). Solved trials were discarded from further analysis because the participant likely had not judged intuitively but based on an explicit retrieval of the solution word. Participants in the no-attribution control group solved 2.95 ($SD = 1.12$) triads on average, participants in the fluency-reattribution group solved 3.07 ($SD = 1.51$) triads on average, and participants in the feeling-reattribution group solved 3.40 ($SD = 1.35$) triads, respectively. These numbers do not reliable differ from each other (all ts < 1).

3.2.1. Missed responses

Following Bolte and Goschke (2005) data preparation, all trials were discarded in which the response was not generated within the given time window of 500 ms after the offset of the triad (which applied to 23% of the remaining responses). Again, the experimental groups did not show any reliable differences on this variable (all ts < 0.5).

3.2.2. Coherence judgments

For the remaining responses, the proportion of "coherent" responses was analyzed by means of a 2 (Coherence: coherent triads, incoherent triads) $\times$ 3 (Attribution Group: no-reattribution control, fluency-reattribution, feeling-reattribution) ANOVA with Coherence as a repeated measure. We found a strong main effect of Coherence, $F(2,53) = 25.96$, $p < .001$, $\eta_p^2 = .33$, that was qualified by an interaction between coherence and experimental group, $F(2,53) = 5.96$, $p < .01$, $\eta_p^2 = .18$. Planned pair-wise comparisons within each experimental group revealed the following pattern: in the *no-reattribution control group*, coherent triads were more likely to be judged as being coherent ($M = 0.29$, $SD = 0.13$) than incoherent triads ($M = 0.16$, $SD = 0.14$), $t(17) = 3.72$, $p < .002$. The same was found for the *fluency-reattribution group*, in which coherent triads were also more frequently judged as coherent ($M = 0.26$, $SD = 0.23$) than incoherent triads ($M = 0.11$, $SD = 0.09$), $t(17) = 3.74$, $p < .002$. In contrast to this, in the feeling-reattribution group, there was no reliable difference for the likelihood of being judged coherent between coherent triads ($M = 0.21$, $SD = 0.10$) and incoherent triads, ($M = 0.21$, $SD = 0.06$), $t < 0.3$, as is also evidenced by Fig. 1.

3.3. Discussion

In this study, we caused participants to reattribute either their reading fluency for the triads or their affective reactions towards the triads to an unrelated source in order to invalidate either perceived fluency or affect (cf. Schwarz & Clore, 1983). This procedure should lead participants to discount either fluency or affect from their intuitive judgments. Following the logic that we can only reattribute what we are aware of (Winkielman et al., 1997), this procedure should identify which internal cue—fluency or affect—is actually used in intuitive judgments of semantic coherence. If individuals experience both fluency and affect that are triggered by coherence, their intuitive judgments would remain diagnostic in either misattribution condition, since they could flexibly switch from the invalidated cue to the other (cf. Fang et al., 2007). In contrast, we only found diagnostic judgments of semantic coherence under no reattribution and under reattribution of fluency. However, when participants discounted affect from their intuitions, they lost the ability to detect coherence. They were not able to use the processing fluency of word triads instead of their affective reactions, probably because the fluency is too weak to become object to experiential awareness, as was also indicated by Experiment 1. This finding strongly suggests that it is not the fluency that is used as internal cue in intuitive judgments of semantic coherence, but rather the fluency-triggered positive affect.

4. General discussion

In two Experiments, we investigated the experiential basis of intuitive judgments of semantic coherence by examining the experiential status of fluency and affect that are triggered by semantic coherence. In Experiment 1, we asked participants to indicate either their estimation of fluency in processing word triads or their liking of the triads. We found that coherent triads were liked more than incoherent triads (replicating Topolinski & Strack, 2008; Topolinski et al., in press), but not rated to be more fluent. This finding suggests that the coherence-triggered fluency gains are not strong enough to be consciously detected and verbally reported, but that the positive affective reactions triggered in turn by fluency are experienced (cf. Reber et al., 2004). In Experiment 2, we invalidated the informational relevance of either fluency or affect for intuitive judgments of semantic coherence by leading participants to reattribute either fluency or affect to a transient source (background music) that was irrelevant for the intuitive judgments. Misattributing the ease with which triads were processed, participants' coherence judgments remained diagnostic. However, misattributing their affective reactions towards the triads, diagnosticity of intuitive judgments dropped to zero. This pattern suggests that participants cannot switch from affect as an internal cue for intuitions to fluency as the alternative cue, probably because they are not aware of fluency.

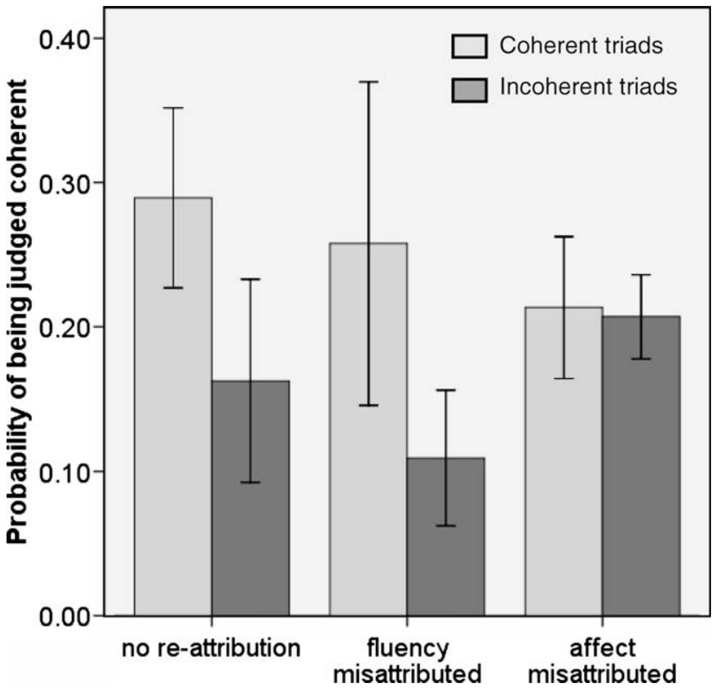

Fig. 1. Average probability for a triad to be judged coherent for coherent and incoherent triads, respectively; and for the no-reattribution control group, the fluency misattribution, and the affect misattribution group, respectively.

The present work tried to illuminate the fringe of awareness in intuitive coherence judgments by assessing which processes in the formation of intuitive hunches can become object to experiential awareness. The obtained findings indicate that the processing dynamics of semantically encoding the words of a triad—running more or less fluent—escape awareness, even when attention is directed to them. Participants could neither detect coherence-triggered fluency gains (Experiment 1) nor exploit fluency differences as basis for intuitions (Experiment 2). The positive affective reactions that are triggered by fluency, however, enter experiential awareness. They can be detected (Experiment 1) and demonstrably used in intuitive judgments (Experiment 2).

4.1. Implications and further research

Our findings have strong implications for another domain of intuitive judgments, namely judgments of visual coherence (Bowers et al., 1990; Volz & von Cramon, 2006). For these judgments, individuals are confronted with visually degraded target pictures. Half of these targets are black-and-white pictures of everyday objects (e.g., a car, Snodgrass & Vanderwart, 1980), that are visually degraded and filtered to such an extent that the originally depicted object is not recognized any more, but basic gestalt features may remain. The other half of the targets are dot patterns derived by additionally fragmenting and rotating the pixel information of the first target type (Volz & von Cramon, 2006). By this means, visually coherent targets (degraded and filtered) and visually incoherent targets (additionally fragmented and the fragments rotated) are derived. As it was shown by Bowers et al. (1990), participants are reliably able to discriminate between coherent and incoherent pictures without recognizing the depicted object. Because Wippich and his colleagues showed that these intuitive judgments of visual coherence can be altered via fluency manipulations (e.g., Wippich, 1994; Wippich, Mecklenbräuker, & Krisch, 1994), it is plausible that visual coherence judgments are also based on the fluency-affect link we have described. Thus, the same question as for semantic coherence judgments can be asked for visual coherence judgments: what is the experiential basis of the eventual intuitive judgment? It would be interesting to analyze whether individuals use the perceptual fluency, the fluency-triggered affective response, or both in those intuitions.

4.2. The experiential status of fluency

Another interesting empirical question arises concerning the general experiential status of processing fluency. Recapitulating previous research and the present findings, we see that different types of processing fluency have different experiential consequences: (1) With respect to *perceptual* fluency, the findings by Winkielman and Fazendeiro (2003) as well as Fazendeiro et al. (2005) imply that perceptual fluency per se is not consciously experienced. (2) With respect to *conceptual* fluency, Poldrack and Logan (1998) as well as Hertwig et al. (submitted for publication) suggest that only substantial fluency gains in processing the meaning of stimuli trigger an experience of fluency. They determine a "just noticeable difference" of approximately 100 ms for fluency to be consciously detected, which is supported by our finding that coherence-triggered fluency gains of averaged 60 ms are not strong enough to trigger ease experiences. (3) With respect to retrieval fluency, it is widely established that individuals experience the ease or difficulty in retrieving memory contents. This becomes apparent through the manipulation checks used in numerous studies manipulating retrieval fluency (e.g., Schwarz et al., 1991), but also through the fact that individuals can reattribute retrieval fluency and discount it from their judgments (e.g., Haddock, Rothman, Reber, & Schwarz, 1999; Winkielman, Schwarz, & Belli, 1998).

A specific pattern appears when we compare the temporal dynamics of the different processes that were made more or less fluent in these works: Fluency gains in perception, which is a fast running and effortless process (Palmer, 1999), are hardly noticed; fluency gains in word recognition and semantic processing, being slower and controlled processes (Schneider & Shiffrin, 1977) are noticed when exceeding a certain threshold; fluency gains in memory retrieval, which is a process taking up to seconds and minutes (Schwarz et al., 1991), are well noticed. It is obvious that the longer the increased or decreased fluency states are the more likely they are detected, as was discussed before in Topolinski et al. (in press). Consistently with this argumentation, Hertwig et al. (submitted for publication) argued for the domain of word recognition that a fluency difference of around 100 ms between two word recognition latencies is necessary to detect this difference. It is possible that this benchmark is an absolute value that applies to all other tasks involving conceptual fluency, and that even applies to perceptual and retrieval fluency. For example, the retrieval of twelve biographical episodes takes longer than the retrieval of six biographical episodes (Schwarz et al., 1991); this difference exceeds 100 ms by far, and this is why retrieval fluency gains are easily detected. In contrast, the perception of a control picture takes longer than the perception of a subliminally primed picture (Bar & Biederman, 1998); this difference, however, falls below 100 ms and is therefore not consciously detected (cf. Winkielman & Fazendeiro, 2003).

However, it is also conceivable that the critical magnitude of the fluency variation to be noticed depends on the temporal dynamics of the process itself. That means that accelerations and decelerations of a certain process must exceed a certain threshold that may be proportional to the speed or temporal extent of this very process. Let us elaborate this thought using an example: the overall latencies for name recognition Hertwig et al., submitted for publication; (Experiment 2) found were around 1000 ms and the threshold for fluency differences they determined was 100 ms, which is a tenth of the basic process. It is possible that the fraction 1/10, not the absolute value of 100 ms is the crucial parameter. When we apply this to another, hypothetical process that may take 500 ms—picture recognition, for example—the question is whether fluency variations should exceed a critical threshold of 100 ms, or 1/10 of the basic process, which would yield a critical threshold of 50 ms.

Let us connect an even more puzzling speculation: As we know from psychophysics (MacKay, 1983; Stevens, 1957) the just noticeable difference for some psychic intensities increases with increasing magnitude of the intensity (e.g., the louder the intensity, the greater variations in loudness must be in order to be perceived), while the just noticeable difference for other intensities decreases with growing magnitude of the intensity (e.g., the heavier the weights that have to be lifted, the smaller are the differences in weights which can be detected; Stevens, 1961). The question is which rules fluency may follow. Although these speculations of a *Fechnerian law of fluency experience* remain to be conceptually elaborated and tested, they may serve as stimulation for further research questions.

In sum, the present work shows that not the coherence-induced fluency, but the affect that is turn triggered by increased fluency is the internal cue used in intuitions about semantic coherence.

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