2 A general model of fluency effects in judgment and decision making

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Abstract

Processing or cognitive fluency is the experienced ease of ongoing mental processes. This experience influences a wide range of judgments and decisions. We present a general model for these fluency effects. Based on Brunswik's lens-model, we conceptualize fluency as a meta-cognitive cue. For the cue to impact judgments, we propose three process steps: people must experience fluency; the experience must be attributed to a judgment-relevant source; and it must be interpreted within the judgment context. This interpretation is either based on available theories about the experience's meaning or on the learned validity of the cue in the given context. With these steps the model explains most fluency effects and allows for new and testable predictions.

Processing fluency is the experienced ease of ongoing mental processes; when people perceive, process, store, retrieve, and generate information, they experience the ease or difficulty of these cognitive operations (cf. Chapter 1). This experience has profound influences on judgments and decisions: fluently perceived names are judged as famous; fluently read statements are evaluated as true; and fluently retrieved instances from memory are estimated to be likely and frequent. In addition, fluency is manipulated in many ways: repetition, perceptual clarity, font type, priming, rhyming, semantic coherence, and so forth (see Chapter 1 for examples, and Alter & Oppenheimer, 2009, for an overview). The scope of these manipulations and effects (which we will discuss in greater detail below and the following chapters will add some items to the list) begs three important questions: First, is fluency indeed a unitary construct, or are there different and varying explanations for what researchers call "fluency effects," depending on specific manipulations? Second, if fluency is indeed the theoretical construct that explains all these effects, how does fluency influence such a wide range of variables? And third, if fluency is indeed the explanation for these influences, why are these effects in the observed direction? Why are fluently perceived names judged as famous instead of non-famous, why are fluently read statements evaluated as true and not false, and why are fluently retrieved instances from memory estimated to be likely and frequent, and not improbable and rare?

While Chapter 1 aimed to introduce the construct and give a sense of what processing fluency is, the present chapter aims to delineate a model of fluency effects that answers these three questions and provides a general framework for fluency effects. And although this will be a "fluency" model, we believe that similar basic parameters as we discuss here apply to thinking experiences or cognitive feelings in general, including, for example, the tip-of-the-tongue phenomenon (Brown & McNeill, 1966; Schwartz, 2002), feelings of knowing (Hart, 1965; Koriat, 1993), or the "eureka" experience (Metcalfe & Wiebe, 1987; Topolinski & Reber, 2010).

Range of fluency effects

In this section, we provide a cursory overview of fluency effects. This overview serves to illustrate the phenomenon's richness and to motivate a general model, guided by the three questions outlined in the introduction.

The probably most famous example of fluency effects in judgments was provided by Tversky and Kahneman (1973). In one experiment, participants judged the frequency of English words starting with the letter "r" compared to words with "r" in the third position. Although words with "r" in the third position are factually more frequent, participants judged words starting with the letter "r" to be more frequent. Supposedly this is because words starting with "r" come to mind more fluently and are more fluently generated. While it seems almost self-evident to judge frequency by the fluency with which instances are retrieved from memory, other influences of fluency are less intuitive, and many of these influences have far-reaching consequences.

Besides this classic example how retrieval fluency influences frequency judgments (Tversky & Kahneman; 1973), the experience of fluency influences judgments and decisions regarding liking of stimuli (Reber, Winkielman, & Schwarz, 1998), familiarity of names (Whittlesea, 1993), fame (Jacoby, Kelley, Brown, & Jasechko, 1989), ability of persons (Greifeneder et al., 2010), size and duration (Reber, Zimmermann, & Wurtz, 2004), truth of statements (Hasher, Goldstein, & Toppino, 1977), perceptions of fairness (Greifeneder, Müller, Stahlberg, Kees van den Bos, & Bless, 2011), the economic value of stocks (Alter & Oppenheimer, 2006), or the gross value of companies (Hertwig, Herzog, Schooler, & Reimer, 2008).

For instance, Reber and colleagues (1998, Exp. 1) asked participants to judge the prettiness of slightly distorted pictures of neutral objects (e.g., a horse or a plane). All pictures were preceded by another picture that was only presented for 25 ms. This "prime" either was the contour outline of the following picture (i.e., a matching prime) or of another picture (i.e., a non-matching primes). As previous exposure facilitates processing (Feustel, Shiffrin, & Salasoo, 1983), participants should process the following picture more fluently when it is preceded by its contour. In line with this argument, participants judged pictures that were preceded by matching primes (and were therefore more fluently perceived) as prettier compared to those that were preceded by non-matching primes.

As a second example, consider again Tversky and Kahneman's (1973) finding that people estimate categories frequencies as being higher when instances from that frequency come easily to mind. In addition to laboratory results such as the letter frequency experiment detailed earlier (see also Greifeneder, Bless, & Scholl, this volume), Combs and Slovic (1979) provided a naturalistic example by showing that people grossly overestimated the likelihood of causes of death in relation to their availability from newspaper coverage; because these well-covered causes of death are easily and fluently available, people overestimate their frequency.

Finally, consider work by Begg, Anas, and Farinacci (1992) on the influence of fluency on judgments of truth. The authors reported that participants believed more in previously presented statements than new ones, even though participants could not remember having seen those statements before. Supposedly, this is because previous exposure renders later processing of the same stimuli more fluent, and this fluency is then used in judgments of truth.

Again, for a general model to explain these effects, it is necessary that providing contour outlines of pictures, featuring death-causes in newspapers, and encountering statements in previous sessions, influences the same psychological construct, processing fluency. We will save this question for the end, but already on a mere structural level, the common denominator of these examples is that people use the fluency of their ongoing mental processes (e.g., perceiving, retrieving) to judge an otherwise unknown or uncertain property, such as liking, frequency, or truth. This structure is at the heart of Brunswik's lens-model (1952), and we will apply this model to the question of how fluency influences judgments and decisions.

How fluency is used as information in judgment—a Brunswikian explanation

As stated, the present argument is inspired by Brunswik's (1952, 1955) lens-model, which we depict schematically in Figure 2.1 (see Karelaia & Hogarth, 2008, for an overview of lens-model applications in human judgments and decision making). For the present argument, the most important model feature is the distinction in *distal* properties of the environment and *proximal* cues to infer these properties. The lens model assumes that an organism (e.g., a human judge) uses proximal cues to infer a distal criterion that is not directly accessible (Hammond, 1955). A good illustration of these abstract concepts is intelligence; it is impossible to see, hear, feel, or assess a person's intelligence directly; it is a distal property. To judge intelligence, people must use available information, that is, proximal cues; for example, a person's performance in an intelligence test or her grades in school. None of this information perfectly predicts intelligence, but there should be some relation between school grades and intelligence, or between intelligence and school grades. Here, we assume that individuals use fluency in a similar way as a proximal cue to form judgments about distal criteria – such as liking, frequency, or truth.

The extent to which cues correlate with criteria (e.g., grades with intelligence) is referred to as "ecological correlations;" the weight assigned to a specific cue when forming a judgment is referred to as "cue utilization" (cf. Figure 2.1). These termini are best illustrated by the example of depth perception. Although humans readily experience a visual sense of depth, human eyes are actually not equipped to convey visual depth directly. Rather, depth is a distal criterion that people infer from proximal visual cues to create three-dimensional representations from the two-dimensional pictures on the retinas. Prominent cues in vision to infer depth are overlap (objects that hide other objects are closer to the perceiver), motion parallax (when perceivers move, objects that are closer seem to move faster than far away objects), and texture gradients (distant objects have denser textures than close objects). By using these cues and by combining them in a linear weighted fashion, people are able to infer depth from strictly two-dimensional sensory input.

The principle of "ecological correlations" suggests that cues vary in the extent to which they correlate with the criterion. For example, overlap is perfectly correlated with the distance of the perceiver to objects: An object overlapping another object will always be closer to the perceiver. In contrast, texture gradients are influenced by factors other than distance, and thus, the cue's relation to the criterion is probabilistic. And this probabilistic relation is certainly true for school grades and intelligence. Applying this reasoning to fluency, the ecological correlation is the fluency cue's validity with respect to the judgmental criterion (e.g., truth or frequency).

The principle of "cue utilization" suggests that people place differential weight on specific cues when forming judgments. For example, in a moving train, people usually weight motion parallax more strongly than texture gradients to judge visual depth. Similarly, some people and institutions use test scores as the sole

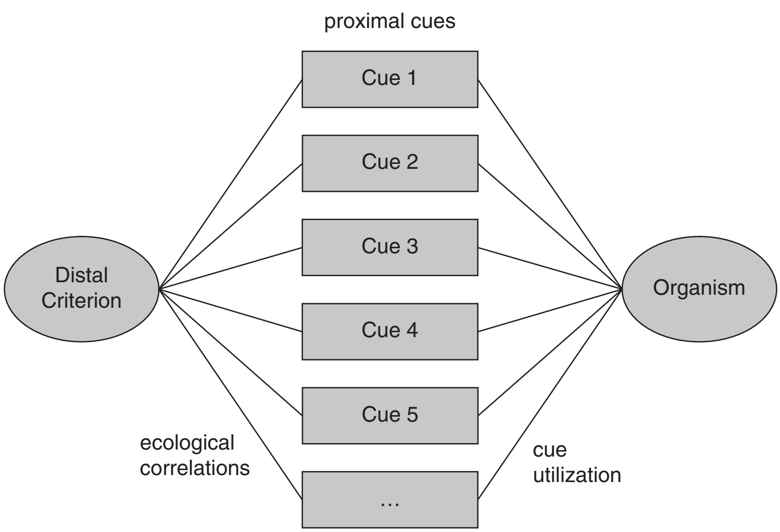

Figure 2.1 A "lens-model", illustrating how organism judge distal criteria by proximal cues.

cue for intelligence, while others scorn them completely. Applying this reasoning to fluency, cue utilization is the weight judge places on given cues when forming judgments in a specific situation. This also implies that judges use other available information as well (e.g., factual knowledge about truth), and the judgment output is a weighted function of the available cues.

Ideally, a cue's ecological correlation (i.e., its validity) determines the cue's utilization (i.e., its weight in a judgment). However, in many cases, ecological correlation and cue utilization do not match (Karelaia & Hogarth, 2008); for the fluency case, these are the instances when the influence of fluency is rightfully termed a bias or an unwanted influence; for example, when statements are believed because one has heard them before (e.g., Begg, Anas, & Farinacci, 1992), or when stocks are rated higher because their names are easy to pronounce (Alter & Oppenheimer, 2006).

Again, most, if not all, judgments that are influenced by fluency refer to distal properties of the environment, such as liking, fame, truth, ability, justice, or economic value. And people have no directly available informative about these properties—in contrast, for example, to the criterion "temperature," for which people have directly available sensory input. Distal properties defy almost by definition exact quantifications; so people *must* infer them from proximal cues. We believe that is very helpful to conceptualize fluency as such a proximal cue when modeling the influence of fluency on judgments. We suggests that this proximal cue (a) is readily and easily available from ongoing mental processes (see Greifeneder, Bless, & Scholl, this volume) and (b) is not a perfect cue but in a probabilistic relation with ecological criteria, just as texture gradients are not perfect cues for depth perception and school grades are not perfect cues for intelligence. In the following model, we will implement the suggested notion of fluency as a proximal cue in a comprehensive model with three distinct steps: experiencing, attributing, and interpreting fluency.

A process model

In the introductory passage, we have sketched that fluency may influence a multitude of very different judgments. This is precisely because fluency is a probabilistic cue that people use to judge otherwise inaccessible distal criteria. The Brunswikian lens-model presents a formal theoretical framework for this influence. In the following, we discuss the necessary process steps for this influence. People must have a feeling of fluency or ease (i.e., experiencing fluency), they must identify the proper cause for the feeling (i.e., attributing fluency), and they must infer what the feeling means in the given context (i.e., interpreting fluency). These steps are illustrated in Figure 2.2 and we will explain them in what follows.

Experiencing fluency

We start by postulating that people experience the working of ongoing mental processes, and that this working is reflected in feelings of fluency. Although people have little conscious access to what our mind really does (or does not) when performing mental operations such as accessing memory (Nisbett & Wilson, 1977), people experience the ease or difficulty of these operations. A parallel process is the experience of hunger when blood glucose level is low; albeit the level itself is not directly accessible (and hunger may stem from other sources as well), the experience itself is readily available. Similarly, feelings of fluency grant a window to otherwise inaccessible processes (Koriat & Levy-Sadot, 1999).

Two interesting questions directly ensue from this postulate: First, how do mental processes translate into perceptions of fluency? One possible answer is that all cognitive processing is continuously monitored, and that the output of this monitoring is fluency (Whittlesea & Leboe, 2000; see also Whittlesea & Price, 2001; Whittlesea, 2002). Koriat and colleagues (Koriat, 1993; Koriat & Goldsmith, 1996) have used the term "parasitic" to describe the effect that cognitive processes cause subjective experiences as by-products. Although describing feelings of fluency as parasitic might carry some negative connotations, it captures nicely the fact that the feeling emerges without need for attention or resources. The continuous monitoring function seems more problematic in that respect, but the analogy of cognitive with biological functions helps to illustrate the idea. The human body's biological systems monitor dozens of homeostatic variables such as body temperature, hormone concentrations, heart beat frequency, or again, blood glucose levels. These monitoring functions also work without attention and awareness. It is not too far-fetched to assume a similar monitoring function for cognitive functions.[1]

The second question pertains to *when* fluency is experienced and influences judgments and decisions? This question has been thoroughly investigated and we believe there is a clear answer: People experience fluency when there are processing differences compared to what is expected or compared to what has appeared

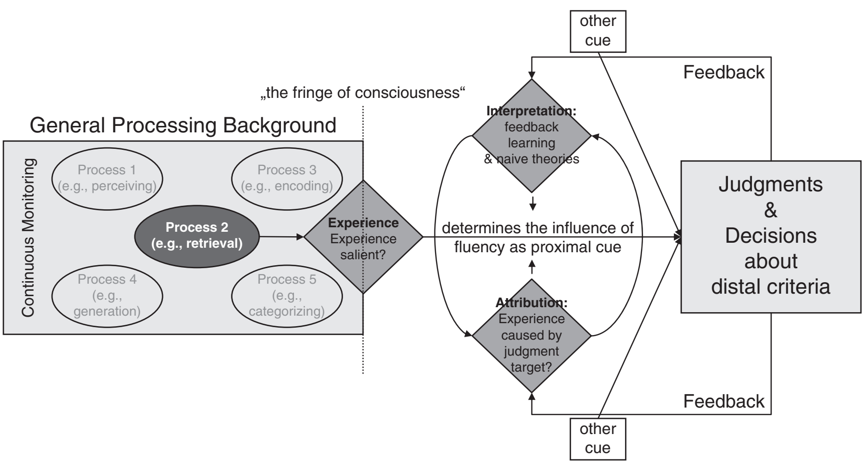

Figure 2.2 A general process model of fluency effects in judgments and decisions.

previously (Whittlesea & Williams, 1998; Hansen & Wänke, 2008; Hansen & Wänke, this volume). Deviation detection in monitoring is a well-established principle: for example, in a series of numbers, the deviating letter will stand out and vice versa (e.g., 2-6-7-K-8 vs. K-L-T-4-W). Similarly, unfamiliar names will stand out in a series of familiar names and vice versa (e.g., Bach, Beethoven, Weisdorf, Mozart vs. Weisdorf, Miller, Beethoven, Brown); or, as Whittlesea and Williams (1998) have argued, people will not detect how fluently they can process the faces of their family members during breakfast, but they will immediately detect the stranger at their table. Likewise, people will detect the deviating fluently processed face of a friend in a crowd of strangers.

In biological monitoring processes, people will for example notice when they are hungry and they will notice when they have eaten too much. Yet, most of the time the stomach does not provide a noticeable experience, although monitoring is going on continuously; it is when there are deviations from the norm that an experience becomes salient and is noticed. We have incorporated this principle in Figure 2.2, left side. For reasons of illustration, we assume that there are currently five cognitive processes going on (e.g., perceiving one stimulus, categorizing another stimulus, etc.). Of those five, only Process 2 deviates strongly enough from the processing background to be perceived or experienced. For example, when the retrieval of a certain memory is particularly easy, this retrieval process is noticed. This perceptual process takes place on the "fringe of consciousness" (Reber, Wurtz & Zimmermann, 2004).

It is important that the deviation does not have to between multiple ongoing processes, but can also result from expectancies, baselines, or prior experiences. Otherwise the model would not predict fluency effects when there is no variation in a given situation—for example, when people are asked to estimate the frequency of words having the letter "r" at the third place. Nevertheless, our model posits that for the underestimation effect reported by Tversky and Kahneman (1973), the retrieval should be difficult to some baseline (e.g., how easy/difficult is it in general to recall words from memory), to what is expected (e.g., are people being told that this is an easy or difficult task), or to comparable other processes (e.g., how easy/difficult is it to recall words from memory *starting* with the letter "r").

An experimental test that the impact of fluency depends on processing differences was provided by Dechêne, Stahl, Hansen, and Wänke (2009). In a first experiment, they presented participants with new and repeated statements, thereby manipulating how fluently participants could read these statements. Participants' task was to judge the truth of these statements. As discussed, the standard result is that people rate the truth of repeated statements higher compared to new statements (Hasher, Goldstein, & Toppino, 1977; Reber & Schwarz, 1999). To show the importance of processing differences, participants either judged mixed lists containing old and new statements (thereby creating fluency differences in statement processing), or lists of only new/only old statements (thereby eliminating fluency differences in processing). The higher rated truth for old statements only appeared when the lists were mixed, that is, when there were notable differences in experienced fluency across the presented statements. In a second experiment, the authors showed the same pattern for the greater liking of repeated stimuli. When participants judged how much they liked Kanji characters, they only preferred old stimuli when old and new Kanjis were mixed in a list. When participants judged old and new Kanji separately, no fluency effect on liking emerged.

Hence, the answer to the question *when* people actually experience fluency (or disfluency) seems indeed to be: The fluency of mental operation is experienced when the associated experience of fluency deviates markedly (a) from a baseline, (b) from what is expected in a given context, or (c) from comparable other processes.

A supplementary possibility is that fluency influences judgments when attention is drawn to the experience, for example, when people are asked how they feel about something. Just as people can tell that their stomach is full or empty when asked for it, they probably can assess whether cognitive processes are going fluently or disfluently, even when there is no immediate variation. However, in most cases, as the experiments by Dechêne and colleagues (2009) show, the experience should have no detectable impact on judgments when fluency experiences does not vary, for example, between to-be-judged objects. In other words, although family members at the breakfast table should be perceived more fluently than a crowd of strangers, judgments about family or strangers should not vary within the respective groups (Whittlesea & Williams, 1998).

Attributing fluency

The second step is that people need to draw an association between a particular fluency experience and a given stimulus for fluency to be informative about this stimulus. Let us illustrate this again with Tversky and Kahneman's problem of word frequency estimation: To judge words with the letter "r" at the third position as less frequent, people need to draw an association between the experienced disfluency and the mental process of retrieving the words—and not, for instance, an association between disfluency and background noise or splitting headaches. If fluency is attributed to the mental process of memory retrieval, it is informative about the word retrieval task. If fluency is attributed to background noises or headaches, fluency is not perceived as being caused by the task, and hence, the experience is uninformative about the task.

We assume that the attribution of feelings and experiences to possible causes are determined by salience—a salient cause stands out in some way. In Gestalt-Psychology terms, a cause is salient when it stands out as a figure stands out against the background. As this figure-ground principle also applies to the deviation idea we have introduced as one of the pre-conditions to experience fluency, it follows that attribution processes will result in the possibly correct ascription of fluency to the relevant mental process. From this, it seems likely that fluency is attributed to the correct cause in most situations (see Greifeneder, Bless, & Scholl, this volume).

However, there are classic demonstrations that fluency is not used in judgments and decision when another source is identified for the fluency experience. Probably the most direct test of this notion was provided by Schwarz and colleagues (1991; but see also the overview by Wänke, this volume). In one of their experiments (Experiment 3), people retrieved from memory six or 12 instances of either assertive or unassertive behaviors. The idea was that it is easy to retrieve six but difficult to retrieve 12 instances. Based on the fluency of this retrieval process, people should infer that there are few (difficult retrieval) or many (easy retrieval) instances of these behaviors and judge their own assertiveness accordingly. However, when participants were told that the ease/fluency experiences were caused by music in the background, the effects on judgments vanished (for a review, see Greifeneder, Bless, & Pham, 2011).

Interpreting fluency

When people experience fluency, and the experience is attributed to the ongoing mental process, the important last step is to identify the meaning of the experience. This last step explains why fluency is able to influence judgments of liking, frequency, truth, and many other domains. The word frequency estimation task again illustrates this point. If retrieving words having "r" as third letter is difficult and people attribute this difficulty correctly to the retrieval process, why does it follow that these words are rare (in comparison to words starting with "r")? Another interpretation could be that a person's verbal ability is low. Similarly, if people experience that they can read a name fluently, and they attribute fluency to reading the name, there are several interpretations of the experience. It could be that it is a famous name, a frequent name, a recently encountered name, and so forth.

How the experience is interpreted is central for the influence on judgments. In one experiment relevant for this point, Oppenheimer (2004) asked people to judge the frequency of surnames. Usually, one would expect that people judge more fluently processed names as more frequent—however, when the names were fluent because they belonged to famous persons (such as Nixon, Bush, or Lennon), participants did not use fluency to form frequency judgments. Rather, they even judged these famous names as less frequent compared to non-famous names. Thus, people interpreted fluency as fame, and not as frequency, and accordingly, fluency was discounted as a cue for frequency.

Similarly, if people experience memory retrieval as fluent, fluent retrieval can inform many judgments: Maybe the memory was significant, or it was particularly happy, or particularly painful. The interpretation of the experience determines the influence on subsequent judgments.

Direct evidence of interpretation was provided by Mandler, Nakamura, and Van Zandt (1987). In their experiment, people had to judge two grey-colored geometric shapes. One of the two shapes had been presented previously while the other was a new shape. Some participants were asked which of the two shapes they liked better. For these participants, a standard fluency effect emerged: participants preferred, on average, previously presented shapes over new shapes.

A second group of participants was asked which of the shapes were brighter (or, in another condition, darker). Interestingly, these participants also chose the old and hence fluently processed shapes to be lighter (or darker). This pattern of results suggests that the same cue—fluency—may be interpreted very differently (here, as indicating liking, brightness, or darkness).

The question is then, how do people know the meaning of fluency? One direct answer is that people use fluency in accordance with the task context—if they are asked "how frequent?", "how famous?", or "how true?", more fluently processed names are rated as more frequent, people as more famous, or statements as more true, compared to less fluently processed statements. This is equivalent to stating that people notice a difference (e.g., one name is read more fluently than the other) and translate this difference on the available judgment dimension. However, this answer is unsatisfactory, because it does not explain the direction of the effect. In other words, why do people judge the fluently processed name as more frequent, more famous, and more true, and not *less* frequent, *less* famous, or *less* true?

There are two ways to solve this important problem. The first is that people *learn* via feedback the interpretation of fluency in a given context (cf. Figure 2.2). This explanation is directly derived from the Brunswikian framework. People learn the validity of a cue by feedback from the environment. If a jury member believes a testimony that is easily processed, and she gets later feedback that the witness was indeed truthful (e.g., due to other evidence), she may learn that fluency is a cue to truth. While this explanation assumes a very basic, perception-like process, there is a second possibility (also depicted in Figure 2.2), involving higher cognitive processes, namely that people have naïve theories about the meaning of fluency. This explanation applies to the discussed results by Oppenheimer (2004). If people *know* that fame leads to fluent processing, they will not interpret fluency as frequency for famous names. Let us discuss the evidence for these two explanations.

Feedback learning

Again, this explanation follows directly from the Brunswikian framework. The analogy is apparent by using the perception example: Why do people use overlap in perception to judge distance? First, because haptic feedback from reaching out to objects shows a perfect correlation between distance to objects and their overlap—the object hiding the other object is closer. Second, because overlap correlates with other cues that indicate distance, that is, motion parallax, pattern density, and so forth. We assume that the same feedback-learning and inter-cue correlations allow people to use fluency in judgments: People have *learned* that categories from which instances are easily retrieved have indeed more members, and statements that are easily processed have a higher probability to be factually true. This assumption of learned ecological validity also explains why the same experience can have such differential influences. The fluency influence depends on the ecology in which a judgment is made; in experimental tasks, the ecology is often provided by the questions researchers are asking. And the influence should always be in the direction that people have learned from their experiences. Figure 2.2 includes this aspect in the feedback loop from judgments and decisions.

Direct evidence for the importance of feedback learning stems from experiments by Unkelbach (2006, 2007). In one experiment (Unkelbach, 2006, Exp. 1), participants indicated in a test phase whether they had seen a name before in a presentation phase. Processing fluency was manipulated by color contrast: low contrast names were difficult to read and high contrast names were easy to read. Importantly, before this test phase, there was a learning phase that conveyed correlations between fluency and recognition. Previously presented names were either shown in high contrast (i.e., a positive correlation between fluency and previous occurrence) or in low contrast (i.e., a negative correlation between fluency and previous occurrence). Participants made old-new judgments for each name and received feedback about the correctness of their judgment. In other words, some participants learned by feedback that fluent processing indicated that a name was new and for others fluent processing indicated that a name was false. In the test phase, the names' contrast and old-new status were not correlated. Nevertheless, given that people had received feedback that fluent processing indicated that a name was new, they judged the high contrast names as new. When they had received feedback that fluent processing indicated that a name was old, they showed the standard pattern and judged the high contrast names old.

The same pattern occurred for truth judgments (Unkelbach, 2007, Exp. 2). People learned that high fluency (due to color contrast) correlates with statements' falseness, and accordingly, judged in a test phase easy-to-read statements as false. For both these experiments, the clear critique is that there is no evidence that processing fluency was actually involved. People could simply have learned color contrast as a direct cue to judge the old/new status of a name or the truth of a statement. This point was addressed in another experiment (Unkelbach, 2007, Exp. 3; see also Unkelbach, 2006, Exp. 2). Participants initially saw statements in a presentation phase. Then, in a learning phase, they judged the truth of statements that varied in color contrast and accordingly, in processing fluency. As before, there were two conditions: Either high or low fluency correlated with truth and participants received feedback for their judgments. In the test phase, all statements were presented in black on white background, but half the statements were old and half were new (and this old/new status was orthogonal to factual truth). Thus, the statements did not vary in processing fluency due to color contrast, but varied in fluency due to prior exposure. When high contrast correlated with truth in the training phase, they showed the standard pattern and judged old statements as "true" with greater probability. However, when low contrast correlated with truth in the training phase, they showed the reversed pattern and judged new statements as "true" with greater probability (and old statements as "false"; see Olds & Westerman, 2012, for a replication).

These data provide good evidence that the interpretation of processing fluency changes depending on the learning history in a given context. In most cases, fluently processed statements are indeed true, simply because the factors influencing fluency also correlate with factual truth (for a complete discussion, see Reber & Unkelbach, 2010); for example, when people hear a statement from different sources, it is processed more fluently and the probability that it is true increases. Similarly, when a statement is consistent with known facts, it is also processed more fluently and also more likely true. And the same holds for other judgments—but the interpretation is not fixed and the meaning of the experience does not come out of the blue. In this explanation, it is the adaptive usage of a cue that has been learned via feedback to judge otherwise inaccessible distal criteria.

Naïve theories

An alternative reason why people use fluency the way they do are naïve theories about the meaning of the experience (Schwarz, 2004). Evidence for this theoretical position stems from experiments that show differential fluency effects on judgments when participants are informed about the meaning of fluency in this context. For example, Winkielman and Schwarz (2001) had participants retrieve four or 12 instances from their childhood. Participants should experience the former retrieval process as easy and the latter as difficult. Importantly, instructions provided participants with an interpretation of this experience: Half were told that happy memories fade quickly from memory (making them difficult to retrieve) and half were told that unhappy memories fade quickly. Then, participants judged the pleasantness of their childhood. In line with the idea of naïve theories, participants who were told that happy memories fade quickly and could retrieve memories easily (four instances) and judged their childhood not as happy as participants for whom retrieval was difficult (12 instances). However, the reverse pattern occurred when participants were told that sad memories fade quickly.

Briñol, Petty, and Tormala (2006; see also Briñol, Tormala, & Petty, this volume) reported similar effects on attitude judgments when participants were given theories that retrieval fluency is good or bad, that is, standard effects when fluency had positive implications and reverse effects when fluency had negative implications.

Disentangling naïve theories and feedback learning

These experiments illustrate the importance of naïve theories or lay beliefs for fluency influences on judgments. The important difference to the Brunswikian learning account is that providing naïve theories does not change the experience *per se*. People still experience easiness or fluency, but they use this experience differently depending on the provided information. Put differently, with the provision of naïve theories, the effect is located in the output stage; in contrast, the learning account assumes that the experience takes on a different meaning in a given context. The experience immediately means something different. Let us illustrate this with an example: Imagine you are reading your first crime mystery and all clues so far point to suspect X as the culprit. The provided information gives you the distinct feeling that X is guilty. However, you are also *told* that crime novel authors never give away solutions so easily—rather, they use obvious “red herrings” to lure you away from the factual and hopefully surprising solution. Thus, in the context of the crime novel, when you are asked if you believe whether X is guilty, you can judge that X is not guilty, *because* you have the clear feeling that X is guilty, which makes the person a red herring (and thus, not guilty). Yet, if you have read many crime novels and you have learned from experience that the obvious solution is never true (and the murderer is never the gardener), your feeling will directly tell you that X is not guilty. The effect is not located at the output stage of the judgment but rather on the experience stage. Thus, naïve theories conceptualize the fluency experience as input to a metacognitive judgment, while learning approaches conceptualize the fluency experience as a perception-like cue in judgments.

On an operational level, the two explanations are also easy to distinguish: Naïve theories are communicated in a top-down fashion; for example, participants are given *a priori* explanations about the meaning of their experiences. Accordingly, participants should be able to verbalize the theory. Contrary, for learning approaches, the meaning of the fluency experience is communicated in a bottom-up fashion, for example, by providing feedback about decisions. Participants are not necessarily able to verbalize what they have learned. Further on an operational level, for naïve theories, judgments are mostly done on the summary of the experiences (e.g., after participants retrieve four instances from their childhood). For learned interpretations, the judgments are made immediately, for example, when perceiving a stimulus or reading a statement (Reber et al., 1998; Unkelbach, 2006).

Yet, the explanations of naïve theories and learning are not in competition, they rather complement each other. This is the reason why Figure 2.2 features only one process—interpretation—that can be informed either by naïve theories or feedback learning. One can construe naïve theories as consciously available rules about correlations between fluency and a criterion. In our crime novels example, the experienced reader does not only have the feeling that X is not guilty, but also the available theory that authors use red herrings. Conversely, one can see theories and beliefs about a correlation as the enabling conditions for successfully learning of given fluency correlations. As recent research on learning and conditioning shows, successful learning depends not only on the environments’ stimulus-relations, but also on attention, awareness, and goals on the learner’s side (e.g., Mitchell, De Houwer, & Lovibond, 2009; Shanks, 2010). By acknowledging both the bottom-up component (i.e., learning) as well as the top-down component (i.e., theories and beliefs), we have a complete picture how people interpret fluency experiences.

Disentangling attribution and interpretation

Often, what we refer to as interpretation is referred to as one “attribution” step. We suggest that attribution and interpretation processes are separate rather than amalgamated within one process step. When amalgamated, the term attribution is used in a distal or ultimate sense, such as in “Fluency is attributed to the fame of a person/the truth of a statement/the falseness of the statement…". In this case, fluency is not attributed to a specific mental process (e.g., perceiving a stimulus), but directly to a distal criterion that *causes* fluency, in the best sense of attribution as perceiving causes. That is, it is not the stimulus that is said to cause the experience, but the underlying property of the stimulus (e.g., frequency, truth, or fame). If attribution is understood in this ultimate way, it encompasses the interpretation step. This appears tempting from many experimental setups that mix attribution and interpretation, especially when the task settings presuppose attribution and interpretation ("Please indicate the word frequency" vs. "Please indicate your verbal ability"). While attributions of the experience place constraints on the kind of fluency interpretations that are possible, we firmly believe it to be preferable to discern (a) attribution of perceived fluency to a cause, and (b) interpretation of fluency with respect to a criterion.

The conceptual need to keep these processes separated is shown when attributed fluency is interpreted very differently. Specifically, although the fluency source was clear in the experiments illustrating interpretation reviewed above (Unkelbach, 2006; Winkielman & Schwarz, 2001), participants used this fluency differentially—something that is difficult to explain with a pure attribution processes.

Word frequency estimation again illustrates this point; let us assume that people retrieve words starting with "r" easily. In a single-step frame, when attribution and interpretation are amalgamated, the ultimate cause for this fluent retrieval could be, for example, the absolute frequency of words starting with "r" in the English language (a distal criterion). In this case, fluency can only be used to judge this distal criterion, because the attribution to the criterion constrains the interpretation.

In contrast, in a two-step frame, people first attribute fluency to the process of retrieving words starting with "r", a very specific mental process. Only in a second step would individuals interpret retrieval fluency as indicative of word frequency. The same fluency experience could also be used to form many other judgments, including having a high verbal ability that facilitates word retrieval, or having recently read a list with "r" words. As the example illustrates, the attribution of fluency to a mental process in a two-step process does not (or at least less) constrain possible interpretations. Note that, compared to the one-step account which amalgamates attribution and interpretation, the present two-step account is much more in line with the empirical evidence on the many possible interpretations of one fluency experience discussed above.

Model summary and open questions

We have discussed three steps of perceiving, attributing, and interpreting fluency experiences, and provided a conceptual background (i.e., Brunswik's lens-model) for how fluency, as well as cognitive feelings and experiences in general, influence judgments and decisions. Figure 2.2 presents a summary of these steps: First, some deviation or difference in processing is necessary to experience a cognitive feeling (here, a deviation from the general processing background). Second, the model assumes a unitary experience and the multitude of fluency effects comes about by the interpretation of that experience, or, in Brunswikian terms, by the ecological validity of the fluency cue. This validity is conveyed by feedback from the actual judgments and decisions and the intercorrelation of the fluency cue with other available cues; or, people have naïve theories about the meaning of the experience. Third, attribution and interpretation determine reciprocally the impact of experienced fluency on subsequent judgments and decisions. While attributions constrain the interpretations that are allowed, interpretations also feed back into the attribution process by making possible causes salient. Finally, consequences from the judgments feed back into the ecologically validity of the cue. If interpretations of fluency lead constantly to wrong decisions, this interpretation must change or people should not use the cue anymore. Based on this summary, we now turn to what we believe to be intriguing open questions worth of future research.

Automaticity of the process?

A topic that is not featured in Figure 2.2 is the consciousness or automaticity issue. While the distinction of automatic and controlled, implicit and explicit, or conscious and unconscious processes has a long tradition in psychology (e.g., Chaiken & Trope, 1999), we avoided this point deliberately for the present discussion as it carries two problems: At present, there is no good criterion for defining consciousness in fluency research that can be tested experimentally. This lack of a criterion is pointedly apparent when fluency is localized at the "fringe of consciousness" (James, 1890; Reber, Wurtz, & Zimmermann, 2004), which we have incorporated as the threshold at which fluency experiences are perceived. Without such a criterion and resulting theoretical implications, it is not useful to discuss whether the postulated processes are controlled or automatic, conscious or unconscious. Second, we believe that processes can move along the scale from unconscious to conscious. Attribution processes can be highly controlled, deliberate, and conscious—especially when the source of a strong experience is not clear. However, attribution can also be automatic and follow a default (Weiner, 1991). Similarly, people can interpret their experiences controlled and with effort. Imagine you are wearing prism glasses that distort your vision—in the beginning, you must correct for the distortion with great effort, but after a relative short time period, you adapt to the distortion and the correction becomes effortless and automatic (see Redding, Rossetti, & Wallace, 2005, for an overview). Given these two problems, we believe it is not meaningful to incorporate assumptions about automaticity or consciousness into a fluency model.

Positivity of the experience?

Another feature not included is the positivity of the experience. Many authors assume and present strong evidence that fluency feels good (Garcia-Marques and colleagues, this volume; Winkielman & Cacioppo, 2001; see Reber, Schwarz, & Winkielman, 2004, for a review), or leads to positive affect (Topolinski & Strack, 2009).

And across many judgments tasks, it seems that fluency influences are biased toward the positive: statements are judged to be true, faces to be familiar, and people to be famous. The reverse is not often observed, and if so, under very specific circumstances; for example, when people are told that everything they heard before is false (Unkelbach & Stahl, 2009, Exp. 2). However, whether the experience is inherently positive or neutral to begin with is of no consequence for the present model, as we have stressed the interpretation of the experience as one of the critical variables for fluency effects. The model is about the meaning of the cue; whether this cue is generally positive or negative poses to begin with is largely inconsequential. On the contrary, if the fluency experience is inherently positive, then it allows for new and testable hypotheses within this model; for instance, it should be easier to learn that fluency correlates with positive distal variables than with negative distal variables. Interestingly, this is exactly what Mandler and colleagues (1987) found in the experiment described previously: while fluency led participants to judge geometric shapes as preferable, brighter, and darker, the fluency manipulation failed to influence judgments of disliking.

Another theoretical possibility is the path chosen by Weiner (1991) for his attribution theory of emotions. Supposedly, there is a very basic emotional positive-negative dimension that is not subject to other cognitive processes. For any other emotion, though, attribution processes play a role. The same could be true for fluency experiences, namely, that they can be used directly in judgments as a positive evaluation, but for more complex tasks, the steps depicted in our model are necessary. However, at present, there is no data on such a theoretical conceptualization.

Another intriguing possibility is given by the overall faster processing of positive information (Unkelbach et al., 2008), suggesting a reverse pathway from positivity to more fluent processing. Thus, people might also learn that fluency is highly correlated with positivity, leading to the observed positivity-fluency effects. However, similar to the argument above, there is no data yet available to support this conception of a reversed fluency-positivity pathway.

Fluency sources

We have stressed cognitive processes such as categorization, retrieval, or generation, as sources for fluency experiences; however, as the overview by Alter and Oppenheimer (2009) shows, there are many ways to create and manipulate fluency (for example, fluency resulting from motor movements, see Topolinski, this volume). Such multiple sources of fluency are compatible with our model, as long as the fluency experience feeds into the judgmental process. Whether we can summarize all these experiences and manipulations under the fluency label or more general, under the label of cognitive feelings, is a question we will discuss below.

Fluency and thinking styles

Another interesting aspect of the fluency experience is omitted in Figure 2: fluency also changes thinking styles (Oppenheimer, 2008). For example, Alter, Oppenheimer, Epley, and Eyre (2007) found that participants who experienced tasks as difficult switched from intuitive to more analytic thinking styles. The idea that fluency also influences thinking styles, for example, analytic vs. intuitive reasoning, adds another layer to research on fluency effects. At present, the interaction of such thinking styles with the present cue framework are not fully clear, and thus, we have omitted this interesting aspect from the model. We refer the interested reader to the chapters by Alter and Oppenheimer, as well as by Garcia-Marques and colleagues in this volume.

Theoretical restrictions

The way we present the model, it seems to account for most, if not all, fluency effects on judgments and decisions. However, this poses a problem for the logic of science (Popper, 1959), because it might be impossible to falsify the model. A model that allows for everything has no scientific value for experimental psychology and applied issues. We believe this is not the case and we want to present the model's theoretical restrictions for fluency effects that are testable in experiments. First, the model clearly implies that there is only one attribution and interpretation of the experience. These two process steps explain the experience. Thus, it should not be possible that an easily-read statement is judged to be true and to be liked more. Fluency influences judgments of remembrance ("old/new"), liking ("good/bad"), or truth ("true/false"); but once such judgments are made, fluency should not influence judgments about other distal variables.

Second, feedback should change the interpretation and this change should be specific to one context. People should be able to re-learn the usage of the cue (as shown in Unkelbach, 2006, 2007). And *if* people learn that fluency indicates, for example, a statement's falseness, they should not generalize this to judgments of fame, that is, that fluently processed names are non-famous.

Third, if other cues correlate negatively with the experience (e.g., when a known-to-be-unreliable witness gives a vivid and coherent testimony), the ecological validity or the cue weight determines the influence on the judgment/decision. Such a situation is often used to illustrate dual-process models of decision-making, but in the present framework, there is no need for such a duality. Imagine you have to choose between two cars; a friend tells you that car A is better, but you have a positive feeling about car B (e.g., the driving feels fluent). Whether you choose A or B depends heavily on the cues' validities—if your friend is a reliable expert for cars, you will follow her advice. Yet, if you have learned that following your feelings leads usually to good outcomes, you likely discard her opinion. These kinds of cue competitions are currently investigated in our research group and clearly illustrate that our proposed model is falsifiable.

A unitary construct?

We have saved one important point up to the end: It is the question if all the different manipulations used to cause fluency, including repetition, color contrast, priming, logical consistency, and so forth really result in one unitary experience. The alternative hypothesis is that fluency is not a unitary construct at all, but that there are multiple distinct experiences that have an inherent meaning which influences judgments the same way affective feelings influence judgments (e.g., Schwarz & Clore, 1983). If a stimulus makes you happy, it is a good stimulus and if it makes you sad, it is a bad stimulus—the meaning is inherent in the feeling and does not need further interpretation to influence judgments. If cognitive feelings are similar to emotional feelings, their meaning is distinct—it might be the set-up of all the experiments that leads to the illusion of one unitary experience. For example, Reisenzein (2000) discusses "surprise" as such a cognitive feeling that has a distinct meaning. So can we build our research on a unitary construct?

Aware of this question, Alter and Oppenheimer (2009) made a case for a unitary construct in an overview of methods to manipulate fluency. The central premise was that: "…the degree to which diverse instantiations of fluency converge to produce consistent outcomes […] implies that they share a common mechanism" (p. 227). However, this notion implies that if manipulation X leads to outcome Z, and manipulation Y also leads to outcome Z, X and Y must be the same. Logically, this inference is not valid and the evidence, albeit highly suggestive, remained inconclusive.

However, there is experimental evidence that people have the same experience from different fluency manipulations, and it is based on the idea of changing the interpretation of the experience. Remember that our model forbids generalizations of newly learned interpretations across different contexts (that is, from fluency implying falseness to fluency implying non-fame). Another generalization, however, must be possible: If people learn that fluency implies statement falseness, and fluency is a unitary construct, this must hold true independent from the specific statement fluency manipulation. For the learning account, we already discussed the data by Unkelbach (2007, Exp. 3), when participants learned that fluency indicates falseness. During learning, fluency varied due to color contrast. At test, fluency varied due to repetition. Nevertheless, the learning effect occurred although different fluency manipulations were used. This result is most likely when both manipulations influence the same experience, that is, the theoretical construct of fluency.

A similar effect was shown by Unkelbach and Stahl (2009; Exp. 2; see also, Unkelbach, Bayer, Alves, Koch, & Stahl, 2011) using naïve theories. They first showed that people process a set of factually true statements more fluently than factually false statements. Then participants saw true and false statements in a presentation phase. After some delay, participants saw true and false statements; half of those were old and half were new. Importantly, instructions informed participants that *all* statements from the presentation phase were false. Using this information, participants judged the old and easy-to-process statements as false, but also the new, factually true and easy-to-process statements. In other words, they applied the naïve theory about the meaning of fluency due to prior exposure ("all false") to fluency due to factual truth; again, this is only likely when repetition and truth result in the same fluency experience.

These experimental data are best explained by assuming that fluency is a unitary construct. Accordingly, a general model of fluency effects is a helpful requisite to understand the full scope of fluency effects.

Conclusion

We have presented a general model of fluency effects in judgments and decisions, based on the lens-model by Brunswik (1955, 1957). This model conceptualizes fluency as an experience resulting from ongoing cognitive processes (perception, retrieval, generation, etc.), and the experience is used as a cue in judgments and decisions. This conceptualization shows that we conceive fluency both as a metacognitive experience (Koriat, 2008) and the influence on judgments and decisions as a perception-like process (Whittlesea, 1993). The important steps in this model are experiencing fluency (i.e., when processes stand out as figures before a ground), attributing fluency (i.e., when mental process are salient and applicable causes of the experience), and interpreting fluency (i.e., when the process is given meaning by the context, learning history, or naïve theories and lay beliefs).

This model answers the three questions posed in the beginning that arise from standard fluency research: First, fluency is a unitary construct, thereby justifying a general model. Second, the processes of experiencing and attributing fluency allow one unitary construct to influence diverse judgments and decisions. And third, the process of interpretation determines the direction of observed fluency effects. By answering these questions, the model presents a comprehensive account of fluency effects so far; it organizes the available research in one coherent framework and clarifies assumptions and pre-conditions. Most importantly, it allows for new and interesting hypothesis (cue competition, salience manipulations, feedback learning), that will lead into further insight how the experience of thinking guides people's judgments and decisions.

Note

1 In addition to purely cognitive experiences of fluency, embodied sources of fluency have come into focus within the last years. Topolinski (this volume) provides an overview of this particular fluency source.

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