Truth is in the mind, but beauty is in the eye:

Fluency effects are moderated by a match between fluency source and judgment dimension

Abstract

The eminent role of processing fluency in judgment and decision-making is undisputed. Not only is fluency affected by sources as diverse as stimulus repetition or visual clarity, it also has an impact on outcomes as diverse as liking for a stimulus or the subjective validity of a statement. While several studies indicate that sources and outcomes are widely interchangeable, recent research suggests that judgments are differentially affected by conceptual and perceptual fluency, with stronger effects of conceptual (versus perceptual) fluency on judgments of truth. Here, we propose a fluency-specificity hypothesis according to which conceptual fluency is more informative for content-related judgments, but perceptual fluency is more informative for judgments related to perception. Two experimental studies in which perceptual and conceptual fluency were manipulated orthogonally show the superiority of content repetition on judgments of truth, but the superiority of visual contrast on aesthetic evaluations. The theoretical implications are discussed.

keywords: fluency; truth judgments; diagnosticity; repetition; visual contrast

Introduction

When judging stimuli in their environment, individuals often rely on the subjective experience of ease with which they can process information, that is, the experience of processing fluency (e.g., Whittlesea, 1993). A vast body of research attests to the importance of fluency as a metacognitive cue in judgment and decision-making (e.g., Reber, Schwarz, & Winkielman, 2004). Not only does fluency come from different sources, its effects also involve a wide range of different judgments. Crucially, it has been suggested that the effects of fluency are independent of how fluency came about and different kinds of fluency equally impact different judgments (e.g., Alter & Oppenheimer, 2009; Schwarz, 2004). However, more recent theorizing proposes that fluency experiences are not uniform and that the effect of fluency on judgments depends on the stimulus dimension from which the experience originates (e.g., Lanska, Olds, & Westerman, 2014; Parks & Toth, 2006; Silva, Garcia-Marques, & Mello, 2016). Building on this latter notion, we propose a fluency-specificity hypothesis, in which the extent to which fluency effects manifest is subject to a match between the source of fluency and the judgmental dimension. Specifically, we propose that the priority of conceptual-fluency manipulations for validity judgments suggested by recent research (Silva et al., 2016; Silva, Garcia-Marques, & Reber, 2017) is complemented by a priority of perceptual-fluency manipulations for judgments of aesthetic appeal.

Consistency of fluency effects

The fluency literature is rich with evidence showing that despite the many different ways in which fluency can be manipulated, its effects on judgments are very consistent. Take as an example the truth effect, which denotes the tendency for individuals to ascribe higher truth-value to information that is easy (fluent) rather than difficult (disfluent) to process. This truth effect has been observed when fluency originates from sources as diverse as repetition (repeated statements ring truer than new statements; for reviews see Dechêne, Stahl, Hansen, & Wänke, 2010; Unkelbach, Koch, Silva, & Garcia-Marques, 2019), the figure-ground

contrast (statements presented in higher contrast ring truer than low contrast statements; e.g., Reber & Schwarz, 1999, Hansen, Dechêne, & Wänke, 2008) or the letter font (statements in easy-to-read fonts are perceived as truer than statements in difficult-to-read fonts; e.g., Parks & Toth, 2006) in which information is presented, and even rhyming (aphorisms that rhyme ring truer than non-rhyming aphorisms; McGlone & Tofighbakhsh, 2000). Likewise, judgments related to the aesthetic appeal of stimuli, such as liking or preference, are also affected by diverse fluency manipulations, namely repetition (the mere-exposure effect; e.g., Zajonc, 1968), figure-ground contrast (Reber, Winkielman, & Schwarz, 1998), prototypicality (e.g., dot patterns aligned with a prototype are preferred to dot patterns that deviate from the prototype; Winkielman, Halberstadt, Fazendeiro, & Catty, 2006), or conceptual priming (e.g., products are preferred when preceded by related concepts; Labroo, Dhar, & Schwarz, 2008). The same is true for memory judgments, with fluency increasing the probability that a stimulus is judged as old rather than new. Those judgments are also affected by different fluency instantiations, including semantic priming, visual clarity (e.g., Whittlesea, 1993), or linguistic regularity (e.g., non-words that comply with linguistic rules seem more familiar than non-words that do not comply with linguistic rules; Whittlesea & Williams, 1998).

The supposedly interchangeable nature of processing fluency sources is further corroborated by the finding that participants generalize the learned meaning of fluency originating from one source to another one. In Unkelbach's (2007, Experiment 3) study, participants first learned to associate high color contrast statements with falseness and low color contrast statements with truth (a reversal of the truth effect reported by Reber & Schwarz, 1999). Later, in a critical test phase in which fluency was manipulated by statement repetition, participants generalized the newly learned association from color contrast to repetition and spontaneously judged repeated statements as less likely to be true than new statements, showing a reversal of the typical truth effect.

In light of this consistency of effects, researchers have concluded that "any […] variable that increases processing fluency should have the same effect" (Schwarz, 2004; p. 338) and that "although processing fluency takes many forms, […] fluency exerts the same influence on judgments independently of how it is generated" (Alter & Oppenheimer, 2009, p. 220).

A fluency-specificity hypothesis

Challenging the aforementioned perspective, we propose a fluency-specificity hypothesis. We propose that the processing experiences promoted by different fluency instantiations are not uniform and all alike, and that people are able to dissociate between those different experiences. As a result, judgments are primarily affected by the specific fluency experience relevant to the stimulus dimension being judged. This hypothesis builds on previous research suggesting that the reliance on a certain form of fluency depends on its perceived diagnosticity[1].

In a study by Lanska & Westerman (2018, Experiment 4), participants learned a list of words during which attention was either directed to the visual or the phonological features of the words. Later, participants were given a recognition test in which two types of fluency were manipulated: visual fluency was varied by presenting a prime matching (vs. not matching) the test word (e.g., Jacoby & Whitehouse, 1989); and phonological fluency was varied by presenting a non-word either rhyming or not rhyming with the test word (e.g., Whittlesea & Williams, 2001; see also Lanska, Olds, & Westerman, 2014). When instructions during the learning phase had directed attention to the words' visual features, participants' responses in the test phase were affected more by visual than phonological fluency. Conversely, when attention had been directed to the phonological features of the words in the

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[1] Throughout the paper we use the term diagnosticity to refer to perceived (vs. actual) diagnosticity.

learning phase, participants' responses in the test phase were affected more by phonological than visual fluency. Apparently, people did not experience a general uniform fluency, but differentiated between fluency as related to visual versus phonological processing. Moreover, the reliance on either form of fluency experience differed depending on what was made salient during encoding. Taking the perspective of the transfer-appropriate memory framework (Morris, Bransford, & Franks, 1977), the authors concluded that a match between encoding and retrieval stage had affected the perceived diagnosticity of fluency, causing the differential effects of the two fluency manipulations.

The differential reliance on different forms of fluency has also been discussed in relation to Whittlesea's prominent conception of perceptual versus conceptual fluency (Whittlesea, 1993). Whereas perceptual fluency refers to the ease with which the physical properties of a stimulus can be processed, conceptual fluency refers to the ease with which the semantic meaning of a stimulus can be comprehended. In Whittlesea's (1993) influential study, manipulations of conceptual fluency influenced judgments concerning the semantic relatedness of target words and items previously presented in a study list (e.g., presenting the target words at the end of a predictive vs. non-predictive sentence; Experiment 2). However, the same judgments were insensitive to manipulations of perceptual fluency (i.e. the stimuli's visual clarity; Experiment 1), unless participants were told that the visual characteristics of the stimuli were relevant for the judgment (Experiment 4). Further evidence comes from a study by Lanska and collaborators (Lanska, Olds, & Westerman, 2014, Experiment 4) exploring the effects of conceptual and perceptual fluency on recognition memory. On some of the test trials, they manipulated perceptual fluency by presenting a visual prime that either matched or mismatched the test word in a recognition test. On other test trials, they varied the semantic predictability of the context in which the test word was presented as a conceptual fluency manipulation. When the memory test was presented as a standard verbatim recognition test, the perceptual fluency manipulation yielded stronger effects. But when the recognition test

was presented as a synonym recognition test requiring processing of the stimulus meaning (i.e., participants were to indicate whether the target was a synonym of a word presented at study), the conceptual fluency manipulation had stronger effects. These results suggest that participants used the two different fluency experiences to a lesser or greater extent according to their fit to the processing operations triggered by the two recognition tests.

In the abovementioned study, participants were only provided with one fluency instantiation at a time. However, in reality, situations are more complex and fluency experiences can be affected by multiple sources (Whittlesea & Leboe, 2003). Thus, the crucial question is if people can dissociate the different signals if they occur together. To test if people are able to disentangle different fluency experiences, Silva and her collaborators (2016) used Unkelbach's (2007) paradigm to reverse truth effects, combining true statements with low and false statements with high visual contrast in a learning phase. In the critical test phase, different from Unkelbach (2007), they manipulated both statement repetition and visual contrast simultaneously and orthogonally to each other. Results showed that participants applied the reversal of the fluency-truth link only to the visual contrast manipulation but continued to interpret repetition as a sign of higher truth-value (for a similar result in the context of memory judgments, see Olds & Westerman, 2012). Thus, participants did not transfer the diagnosticity of high fluency for falsehood that was learned with a specific fluency instantiation (here, high visual contrast) to another one (here, repetition) when both cues were available at the point of judgment. These results imply that, in complex situations, people are able to dissociate different fluency signals occurring at the same time and use them differentially according to their perceived diagnosticity for the judgment at hand.

To sum up, although fluency sources and outcomes are widely interchangeable, there is tentative evidence suggesting that individuals might be able to disentangle the processing experiences originating from different fluency manipulations and apply them according to their diagnostic value to the target judgment.

The present research

In the present research, we test a fluency-specificity hypothesis. We predict that the reliance on either perceptual or conceptual fluency is moderated by the judgment dimension. Often, different forms of fluency may function vicariously. Thus, in lack of diagnostic information, they will nevertheless inform the judgment. However, in many situations, individuals are exposed to different sources of fluency at the same time (Whittlesea & Leboe, 2003). And assuming that they can dissociate between different fluency experiences within the same judgment context (e.g., Silva et al., 2016), they will use them selectively according to their relevance for the target judgment. Crucially, the judgment dimension will then determine which type of fluency is more diagnostic depending on the processes that are perceived as relevant during judgment formation.

To illustrate this idea, let us take judgements on stimulus content and stimulus appearance as an example. Content-related judgments, such as judgments of truth or semantic relatedness, are by definition related to the conceptual features and meaning of the stimulus. They should therefore be affected primarily by conceptual fluency, which refers to the ease with which one can extract and understand the meaning of a stimulus (e.g., Alter & Oppenheimer, 2009; Whittlesea, 1993). In contrast, appearance-related judgments, such as judgments of physical attractiveness of a stimulus, are by definition related to the physical properties of the stimulus. Thus, they should be affected primarily by manipulations of perceptual fluency, which refers to the ease with which one can perceive the features of a stimulus (e.g., its visual components, color, shape, contour; see, e.g., Alter & Oppenheimer, 2009; Whittlesea, 1993).

While some of the previous studies may have touched on this fluency-specificity idea, (Lanska et al., 2014; Silva et al., 2016, 2017; Whittlesea, 1993), none of them has proposed clearly that the extent to which fluency is used is contingent to a match between the level at which the fluency experience originates and the stimulus-dimension being judged.

Furthermore, none of them provided a systematic test of the hypothesis. This is because in those studies participants were not exposed to more than one instantiation of fluency at a time (e.g., Lanska et al., 2014; Lanska & Westerman, 2018). Therefore, they do not allow for inferences as to whether individuals differentiate between different fluency instantiations within the same context. In other studies, two fluency sources were in fact manipulated orthogonally, but participants performed only one type of judgment (e.g., Silva et al., 2016; Whittlesea, Jacoby, & Girard, 1990). Those studies are inconclusive as to whether people use different experiences selectively depending on their diagnosticity for the respective judgment. Instead, those results may simply reflect differences at the operational level, such as a more powerful manipulation of one fluency instantiation than another.

To allow for a conclusive test of the fluency-specificity hypothesis, the present research pits two different co-occurring fluency signals against each other by comparing their effects on different judgments. Specifically, we employed a double-dissociation procedure that allows the simultaneous and orthogonal manipulation of two different sources of fluency, namely a conceptual and perceptual fluency source, and the judgment of two different and independent stimulus dimensions, one conceptual and the other perceptual. Conceptual fluency was manipulated by repeating the content of statements (e.g., Silva et al., 2017). Perceptual fluency was manipulated by presenting the statements in high vs. low visual figure-ground contrast (e.g., Reber & Schwarz, 1999). As for the conceptual and perceptual judgment dimensions, participants judged either the truth value or the aesthetic appeal of the statements, respectively. Thus, with a critical advantage over previous studies, this is the first experimental investigation in which the effects of the two different sources of fluency on two different judgment dimensions are measured and contrasted within the same experimental paradigm. Only by manipulating content repetition and visual contrast in an orthogonal fashion it is possible to test whether individuals can dissociate the fluency signals stemming

from the two different sources and use one or the other selectively, according to their diagnosticity to the target stimulus dimension.

We assume that different types of fluency yield different effects depending on the spontaneously perceived diagnosticity to the judgment dimension. According to a fluency-specificity hypothesis, people will primarily rely on the type of fluency that is perceived as most relevant for the judgment at hand. This means that the priority of conceptual fluency for judgments of truth should be complemented by a priority of perceptual fluency for judgments of aesthetic appeal. Thus, we hypothesized that a) judgments of truth would be influenced more by repetition than by visual contrast, and b) judgments of aesthetic appeal would be influenced more by visual contrast than by repetition.

Experiment 1

For a test of the fluency-specificity hypothesis, we used an orthogonal variation of perceptual and conceptual fluency and assessed these factors' effects on both judgments of truth (the conceptual judgment) and judgments of aesthetic appeal (the perceptual judgment). For the manipulation of perceptual fluency, we chose to vary the visual contrast of the test statements. For the manipulation of conceptual fluency, the test items either repeated the content of statements presented in a previous moment of the experiment or were completely new (e.g., Silva et al., 2017)[2].

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2 Preliminary support for the fluency-specificity hypothesis was obtained in a pilot study using the same design as Experiment 1 (see supplemental materials S1 for details). In line with our reasoning, visual contrast yielded stronger effects on aesthetics judgments than on truth ratings. Also, content repetition yielded stronger effects on judgments of truth than on judgments of aesthetic appeal. However, in the pilot study, statements were repeated verbatim from the previous exposure phase (though in a different font). Verbatim repetition may impact not only the conceptual but also the perceptual fluency of the stimuli, since the perceptual

Method

      Design & Participants. Two hundred sixty-four MTurk workers ($M_{age} = 35.35$, $SD = 10.77$; 90 female) took part in the study for a compensation of 1.30 USD[3]. They were randomly assigned to one of the between-participants conditions resulting from the variation of 'judgment dimension' and two material factors. The factors 'content repetition' and 'visual contrast' varied within-participants.

      Procedure & Materials. The experiment was described as a study on judgment and decision making and was administered online using the Sosci survey software (Leiner, 2014). The material consisted of 56 trivia statements, half true and half false, taken from Unkelbach and Rom (2017). Content repetition was implemented with the use of paraphrases (e.g., Silva et al., 2017). Paraphrases allow isolating the conceptual fluency component of a repetition manipulation, as they repeat only the conceptual features of the statements (i.e., their content and meaning), while altering their visual appearance (most of the words and syntax of the original statement is changed). Thus, for each of the original statements (e.g., "The second of Gulliver's travels led to Brobdingnag."), a paraphrased version (e.g., "Brobdingnag was the second place Gulliver went to in his journeys.") was formulated and pretested for content equivalence (as in Silva et al., 2017; see Supplemental Materials S2 for details.). To manipulate visual contrast, the statements in the critical test phase of the experiment were displayed in either low or high contrast to the background. Between participants, two material

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features of the statements are also fully repeated. This motivated the use of paraphrases to manipulate content repetition in Experiments 1 and 2.

[3] A sensitivity analysis using GPower (Faul, Erdfelder, Lang, & Buchner, 2007), with $\alpha = .05$, $1 - \beta = .8$, $\rho = .5$, and $\varepsilon = 1$, yields that this sample size allows for the detection of small effects, $f \geq .09$, for the predicted interaction.

factors served for counter-balancing the assignment of each statement to conditions of content repetition and visual contrast.

Exposure phase. Participants were presented with 28 statements (14 true, 14 false, randomly ordered). Statements were presented one by one in the center of the screen, written in a black font (Arial) against the white background. To ensure that participants would read the statements, they were asked to rate each statement regarding its interestingness on a 6-point rating scale (1 = not interesting at all; 6 = very interesting) presented below the statement.

Test phase. In this phase, participants were presented with a random-ordered succession of the 56 test stimuli consisting of seven statements per combination of actual truth (true vs. false), content repetition (repeated vs. new) and visual contrast (high vs. low). In this phase, all statements were written in a different font (Cordia New). For the manipulation of visual contrast, half of the statements in each condition was presented in low figure-ground contrast, and the other half was presented in high figure-ground contrast. Specifically, the color in which each statement was written was determined by a random combination of RGB-values (color values are listed in Supplemental Materials S3). We then determined the corresponding background color by constraining the figure-ground contrast level values to be below 1.5 for low contrast and above 4.5 for high contrast, according to the Web Content Accessibility Guidelines (Caldwell, Cooper, & Reid, 2008). For the manipulation of content repetition, half of the statements in each condition were paraphrases of the statements presented in the exposure phase and half were completely new (i.e., never presented within the experimental setting).

Depending on the 'judgment dimension' condition, participants were asked to either make judgments of truth or judgments of aesthetic appeal. Each statement was presented in the center of the screen and below it the phrase "This is…", and a 6-point scale with the anchors "definitely false" and "definitely true" in the truth judgment condition, or "ugly" and

"pretty" in the aesthetic judgment condition. To obtain indexes of aesthetic and truth evaluations reflecting the four combinations of content repetition and visual contrast, scores were averaged across the respective items. Finally, participants indicated demographic data, and were thanked and debriefed in written form.

Results and Discussion

Participants' average scores were subjected to a 2(repetition: repeated content vs. new content) × 2(visual contrast: high vs. low) × 2(judgment dimension: truth vs. aesthetic) mixed factorial Analysis of Variance (ANOVA), with repetition and contrast treated as within-participants factors and judgmental dimension treated as between-participants factor. Within this mixed-factorial ANOVA, main effects were significant for content repetition, $F(1, 262) = 37.15$, $p < .001$, $\eta^2_p = .12$, visual contrast, $F(1, 262) = 95.76$, $p < .001$, $\eta^2_p = .27$, and judgment dimension, $F(1, 262) = 15.14$, $p < .001$, $\eta^2_p = .06$. As predicted, the repetition × judgment interaction, $F(1, 262) = 30.75$, $p < .001$, $\eta^2_p = .11$, and the visual contrast × judgment interaction, $F(1, 262) = 54.03$, $p < .001$, $\eta^2_p = .20$, were significant. No other effects were statistically reliable, F's < 2.1, p`s $> .14$.

To elaborate on the nature of the interactions, we carried out separate analyses for each judgment dimension. An ANOVA on truth judgments revealed a substantial effect of repetition, $F(1, 131) = 38.68$, $p < .001$, $\eta^2_p = .23$. As shown in Figure 1a, truth scores were higher if the content was repeated, $M_{repeated} = 4.52$, $SE = .07$, than if it was new, $M_{new} = 4.09$, $SE = .07$. We also observed a significant effect of visual contrast, $F(1, 131) = 8.37$, $p = .004$, $\eta^2_p = .06$ ($M_{high\ contrast} = 4.36$, $SE = .06$ vs. $M_{low\ contrast} = 4.26$, $SE = .07$), replicating previous research of perceptual fluency effects on truth judgments (Reber & Schwarz, 1999). However, as demonstrated by the effect sizes, the effect of the conceptual fluency manipulation was three times higher than that of the perceptual fluency manipulation. Thus, in line with our hypothesis, truth judgments were more affected by conceptual than by perceptual fluency. The interaction term was not significant, $F(1, 131) = 1.62$, $p = .206$, $\eta^2_p = .01$.

For judgments of aesthetic appeal, an analogous ANOVA yielded neither an effect of content repetition, nor was the interaction significant, both F's < 1. But, in support of our hypothesis, we observed a significant effect of visual contrast, $F(1, 131) = 87.41$, $p < .001$, η^2_p = .40. As can be seen in Figure 1b, aesthetic judgments depended only on visual contrast (M high contrast = 4.44, $SE = .07$ vs. M low contrast = 3.44, $SE = .11$).

Figure 1. Results from Experiment 1
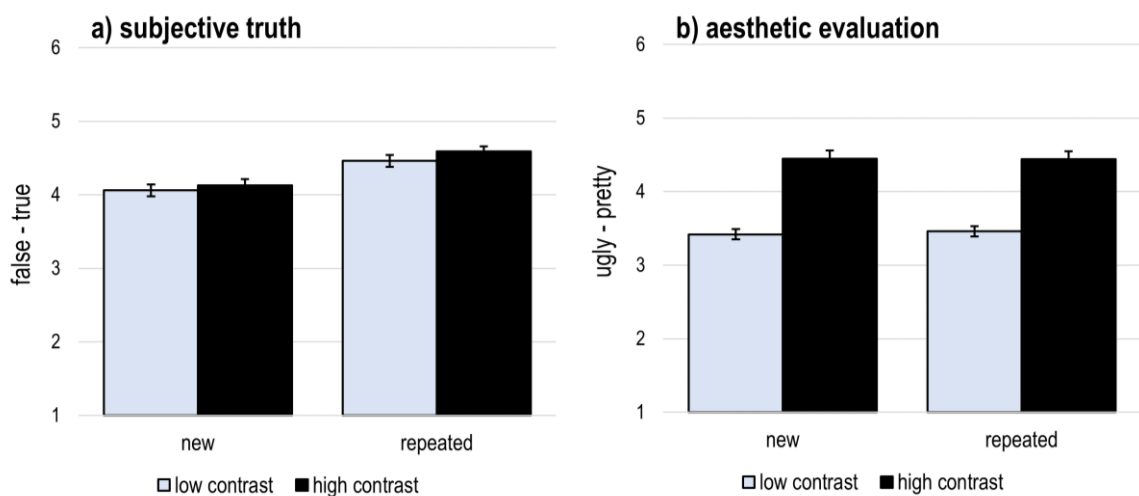
Note. Subjective truth (1a) and aesthetic evaluations (1b) as a function of content repetition and visual contrast. Error bars indicate standard errors.

Taken together, results from the first experiment lent support to the fluency-specificity hypothesis. Aesthetic judgments were affected by perceptual but not by conceptual fluency. Truth judgments, in contrast, were more strongly affected by conceptual than perceptual fluency. Thus, when different sources are available simultaneously, people seem to use them selectively depending on the judgment they have to perform. Despite the clear pattern of results in support of our hypothesis, it is possible that once participants realized that they always had to provide an aesthetic judgment, they stopped reading the statements and focused only on their physical features. This strategy could explain why we did not find an effect of

repetition on the aesthetic appeal of the stimuli. We addressed this issue in a second experiment.

Experiment 2

Our assumption is that judgments are not fed by fluency experiences if the source of the fluency is not relevant for the specific judgment. In the previous experiment, the fact that participants were informed about the stimulus characteristic they were going to judge may have triggered different processing of the stimuli and affected the experience of fluency stemming from the two different manipulations. A litmus test for our proposition would involve a situation where participants have the chance to process every aspect of the stimuli and experience both fluency aspects, which are then used or not used depending on the type of judgment that needs to be made. In Experiment 2, we realized this by presenting the statement slides for a few seconds and providing participants with the information about the judgment they had to perform only after the statement had been removed from the screen. This could then be a truth judgment or a judgment of aesthetic appeal. That is, in this experiment, the 'judgment dimension' factor was varied within-participants. This procedure ensured that the processing of the stimuli dimensions and the resulting processing experience was unaffected by the knowledge regarding which stimulus dimension was going to be judged. Thus, the judgment dimension should influence only how the processing experiences resulting from the two fluency manipulations are used.

By not knowing beforehand which judgment they would have to provide for a given stimulus, participants needed to process all aspects of the stimuli, that is, both their physical characteristics and their content. Differential fluency effects on offline-judgments of truth vs. judgments of aesthetic appeal would then be a clearer indication that participants dissociate between the experiences resulting from different fluency instantiations and use them according to their relevance for the target judgement.

Method

Design & Participants. One hundred and two participants (M_{age} = 30.79, SD = 11.80; 55 female) were recruited via a panel service and were paid 1 British Pound (approx. 1.30 USD)[4]. They were randomly assigned to one of the material conditions reflecting the assignment of specific statements to within-participant conditions. The experimental factors 'content repetition', 'visual contrast' and 'judgment dimension' varied within-participants.

Procedure & Materials. The same materials as in Experiment 1 were used, and the exposure phase followed the exact same procedure. Different from the previous study, instructions before the test phase informed participants that they would have to provide different types of judgments, namely judgments of truth and of aesthetic appeal. Participants were then presented with a series of statements. For half of the stimuli, participants were asked to make judgments of truth and for the other half judgments of aesthetic appeal, using the same rating scales as in Experiment 1. To ensure that participants really read each of the statements, each item was presented for a fixed time (i.e. 5 sec) and the judgment scale appeared only after the statement had disappeared. In total, participants provided 48 judgments resulting from the combination of content repetition, visual contrast, actual truth, and judgment dimension, whereby the order was fully random.

Results and Discussion

Judgments were subjected to a 2(repetition: repeated content vs. new content) × 2(visual contrast: low vs. high) x 2(judgment dimension: truth vs. aesthetic) repeated-measures ANOVA. Significant main effects emerged for content repetition, $F(1, 101)$ = 75.96, $p < .001$, η^2_p = .43, visual contrast, $F(1, 101)$ = 172.05, $p < .001$, η^2_p = .63, and judgment dimension, $F(1, 101)$ = 124.20, $p < .001$, η^2_p = .55. The critical interactions of

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[4] A sensitivity analysis using GPower (Faul et al., 2007), with α = .05, 1-β = .8, ρ = 0.5, and ε = 1, yields that this sample size allows for detecting small effects, f's $\geq$ .09, for the predicted interaction.

repetition × judgment, $F(1, 101) = 47.38$, $p < .001$, $\eta^2_p = .32$, and visual contrast × judgment, $F(1, 101) = 114.66$, $p < .001$, $\eta^2_p = .53$, were significant, too. The remaining terms did not reach significance, both F's < 1.

A separate analysis for truth judgments showed that subjective truth depended on both content repetition, $F(1, 101) = 109.21$, $p < .001$, $\eta^2_p = .52$, and visual contrast, $F(1, 101) = 16.00$, $p < .001$, $\eta^2_p = .14$. As displayed in Figure 2a, subjective truth was higher for repeated vs. new content ($M_{repeated} = 4.61$, $SE = .08$ vs. $M_{new} = 3.79$, $SE = .06$), and for high than for low contrast ($M_{high\ contrast} = 4.32$, $SE = .06$ vs. $M_{low\ contrast} = 4.08$; $SE = .07$). However, in support of the specificity-hypothesis, the effect of repetition was again stronger and explained more variance than did the effect of visual contrast.

Judgments of aesthetic appeal were also affected by both factors. High contrast levels, $M_{high\ contrast} = 4.10$, $SE = .06$, resulted in more favorable judgments than low contrast, $M_{low\ contrast} = 2.82$, $SE = .10$, $F(1, 101) = 205.38$, $p < .001$, $\eta^2_p = .67$. This time, we also found that stimuli were rated as prettier if their content was repeated, $F(1, 101) = 5.30$, $p = .023$, $\eta^2_p = .05$ ($M_{repeated} = 3.54$, $SE = .08$; $M_{new} = 3.38$, $SE = .07$). However, in support of our hypothesis, the comparison of the effect sizes indicates that the influence of content repetition was rather small as opposed to a strong effect of visual contrast. The interaction effect of repetition and visual contrast was negligible, $F < 1$.

Figure 2. Results from Experiment 2
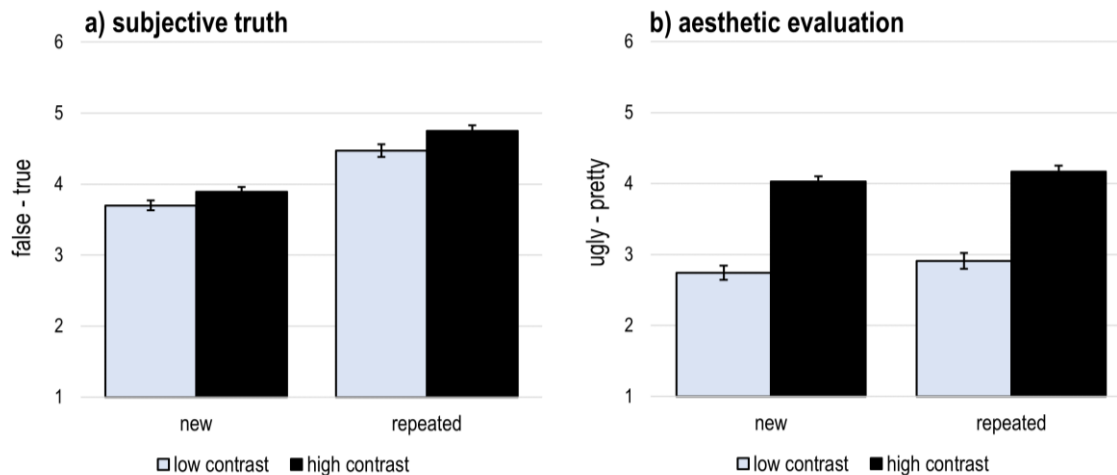
Note. Subjective truth (2a) and aesthetic evaluations (2b) as a function of content repetition and visual contrast. Error bars indicate standard errors.

The results from the second study provide additional support for the fluency-specificity hypothesis. They demonstrate clearly that people can dissociate different fluency experiences present within the same situation and rely more on one or the other as a function of the stimulus-dimension they need to judge.

General Discussion

In the present paper we tested the fluency-specificity hypothesis. We predicted that in presence of two fluency sources, content-related judgments would be affected more by conceptual than perceptual fluency. In contrast, appearance-related judgments would be affected more by perceptual than conceptual fluency. In support of our hypotheses, across two experiments, judgments of truth were strongly affected by content repetition, while the visual contrast in which statements were presented had a much smaller effect. Conversely, aesthetic evaluations were strongly influenced by visual contrast, but remained largely unaffected by repetition of content. Together, the results indicate that fluency – here conceptual or perceptual – is used depending on its subjective appropriateness to inform a given judgment.

The present studies make a novel contribution to the fluency literature. Using a double-dissociation procedure directly juxtaposing different sources of fluency and different judgments, we could show that the advantage of conceptual fluency on content-related judgments is complemented by an advantage of perceptual fluency on perception-related judgments. Especially results from Experiment 2, which required participants to make offline-judgments, indicate that individuals can dissociate between the processing experiences elicited by different fluency cues and use them to a greater or lesser extent depending on the judgment dimension. As such, our studies suggest that different instantiations of fluency (in our studies, conceptual and perceptual fluency) result in psychologically distinct experiences, which are not entirely functionally equivalent as suggested before, but are applied depending on how diagnostic they are for the respective judgment (see also Lanska et al., 2013; Silva et al., 2016). The clear-cut evidence for fluency effects as a match of source and judgment dimensions has several implications for existing accounts and opens avenues for future research, which we discuss below.

Diagnosticity

In general, our results are in line with the assumption that the fluency experience must be perceived as diagnostic for the judgments at hand, an assumption that has been made by several scholars (see Alter & Oppenheimer, 2009; Schwarz, 2004, 2015). For example, research on the mere-exposure effect (Zajonc, 1968) shows that when people become aware of the repetition of the stimuli they are evaluating, they discount its influence on the stimuli aesthetic appeal, because repetition should not be diagnostic of how much they like a stimulus (e.g., Bornstein & D'Agostino, 1992, 1994). However, sometimes people may not see any reason to discount for fluency experience. As indicated by the present findings, a certain fluency experience (e.g., perceptual) may naturally be considered relevant when judging a related judgment (e.g., aesthetic).

Cue competition and external validity of fluency effects

Although we advocate the specificity-hypothesis, we readily acknowledge that previous research yielded fluency effects despite a mismatch between type of fluency and judgment dimension. That is, perceptual fluency is used for content-related judgments and conceptual fluency for perceptual judgments. For instance, earlier studies attest to judgments of truth depending on perceptual fluency (e.g., visual contrast in Reber & Schwarz, 1999) and judgments of stimuli pleasantness depending on conceptual fluency (e.g., semantic predictability in Whittlesea, 1993, Experiment 5). However, in these studies participants experienced only one type of fluency. In our study, participants always experienced both types, the fluency stemming from visual contrast and the fluency stemming from content repetition. In line with prominent theorizing on judgment and decision-making, individuals may rely on the most informative cue and disregard less relevant information once a judgment can be made (Gigerenzer & Goldstein, 2011). In lack of a highly diagnostic cue, participants may however use the less diagnostic cue.

Interestingly, our results suggest that discounting of the less diagnostic cue can occur at different stages in the information processing, namely cue attention or cue utilization. If the judgment dimension is known beforehand (Experiment 1), people may choose not to attend to the less relevant cue (e.g., content for aesthetic judgments), which completely eliminates the cue's effect. However, if the judgment dimension is not known beforehand (Experiment 2), people attend to all the potentially relevant cues. Once the less diagnostic cue is processed, it may be difficult to fully suppress its influence. Nevertheless, as Experiment 2 shows, the more diagnostic cue will be given higher weight in the judgment (see also Whittlesea et al., 1990).

Independent of whether diagnosticity works at the first (cue attention) or the second (cue utilization) stage, the results raise important questions regarding the external validity of fluency effects. As argued above, previously found effects (e.g., visual contrast on truth) might be stronger in single-cue cases when relevant diagnostic cues are absent. Outside the

lab, however, people can rely on multiple sources. Competing stimuli, cues and judgment dimensions establish comparison standards "on the fly" (p. 77; Whittlesea & Leboe, 2003), which will change cue attention and utilization. Future research may therefore provide direct comparisons of specific fluency effects in isolation as opposed to contexts of multiple sources. To strengthen the external validity of our theorizing, it will also be necessary to test whether people rely on cues whose diagnosticity is less clear. For reasons of internal validity, we used prime operationalizations of perceptual and conceptual fluency: visual contrast is a pure and very direct manipulation of perceptual fluency (see Olzak & Thomas, 1986); content repetition naturally increases conceptual fluency in the first step, and only has an indirect effect on perceptual fluency. Other operationalizations, however, are more likely to operate at the intersection of the two fluency forms and affect perceptual and conceptual processing to the same degree. One may suspect that the presence of multiple cues affecting both types of fluency may cause diffusion, which may in turn reduce the relevance of diagnosticity. Future research may therefore test the effects for other sources that juxtapose conceptual versus perceptual fluency or that affect both types of fluency.

Competing views on repetition-induced truth effects

Despite the plethora of research on the repetition-induced truth effect, the theoretical explanation remains a matter of debate (for an overview, see Unkelbach, Koch, Silva, & Garcia-Marques, 2019). Different from a fluency explanation, some researchers argued that the truth effect is driven by referential memory. For instance, Brown and Nix (1996) proposed that the truth effect may depend on unconscious processing experiences (presumably fluency), but that conscious recollection of a statement also contributes to the illusion.[5] A more recent

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[5] Note that the magnitude of the truth effect is not affected by the delay between the first exposure to statements and the truth judgment session (see Dechêne et al., 2010), a variable

account even states that truth effects do not depend on fluency at all, but only on the

activation of coherent references in memory (Unkelbach & Rom, 2017; also see Unkelbach et

al., 2019). According to Unkelbach and Rom (2017), a given statement is judged to be true if

it matches with the semantic relations stored in memory. In one of their studies, they

compared fluency as measured by response latencies and validity judgments. In line with their

hypothesis, a statement such as "Othello was the last opera of Verdi" increased the fluency of

a similar, but contradictory statement ("Falstaff was the last opera of Verdi"), but decreased

its subjective validity. At first glance, this finding is indeed at odds with a fluency

explanation. However, from the fluency-specificity perspective, one could argue that the

reaction time measure failed to capture the most relevant fluency experience, namely

conceptual fluency. Concretely, response latencies are unreliable indicators of processing

fluency (Reber, Wurtz, & Zimmerman, 2004; Wurtz, Reber, & Zimmermann, 2008). They

confound perceptual and conceptual fluency because they necessarily capture stimulus

perception that temporarily precedes the comprehension of meaning (e.g., Strack & Deutsch,

2004). In light of the present findings, one would expect that truth judgments depend on

conceptual fluency whereas effects of perceptual fluency are negligible. Note that conceptual

fluency refers to the ease with which one can process the semantic meaning and map

statements onto existing knowledge, thus involving the very same process as proposed by

Unkelbach & Rom (2017). From this perspective, seemingly fluency-independent truth effects

as explained by the activation of coherent memory links can be reframed as effects of

conceptual fluency. As such, the truth effect cannot be accounted for by the more

parsimonious explanation of a uniform fluency experience. However, it is possible to

conceive of the referential memory explanation (Unkelbach & Rom, 2017) as an effect of

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that is known to decrease memory accuracy (Yonelinas, 2002). This suggests that conscious

retrieval is not the main contributor, but fluency plays a strong role in illusions of truth.

judgment-specific fluency. Doing so allows for a more general account that even applies to judgments other than truth judgments (e.g., aesthetic). Future research may try to assess different forms of subjective fluency[6] to test whether the ease with which stimuli can be perceived or the ease with which stimuli can be integrated into semantic memory accounts for effects on truth versus aesthetic appeal.

Hedonic marking of perceptual and conceptual fluency

Finally, one may speculate about the role of affective and cognitive components involved in the process. Arguably, the most prominent explanation for fluency effects on liking and aesthetic appeal is the hedonic marking of fluency hypothesis (Winkielman, Schwarz, Fazendeiro, & Reber, 2003). Taking a functional perspective, Winkielman and colleagues (2003) proposed that processing efficiency is adaptive in nature, and easy-to-process stimuli therefore cause positive affect. Supporting this, several studies showed that fluency leads to an increase of the activation of the zygomaticus major (i.e. the facial muscle responsible for a smile; e.g., Harmon-Jones & Allen, 2001; Winkielman & Cacioppo, 2001). It is straightforward that the affect elicited by perceptually fluent stimuli transfers to their evaluation (e.g., Winkielman et al., 2006). After all, appearance-related evaluations are a matter of taste and experienced affect is highly informative. Perhaps the hedonic marking also drives truth effects. That is, the semantic processing of the statements feels easy which yields an affectively positive response used to judge the statement as true (see Garcia-Marques, Mackie, Claypool, and Garcia-Marques, 2001). However, while perceptual and appearance-related judgments are a matter of taste and there is no objective value, conceptual and content-

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[6] Graf, Mayer, & Landwehr (2018) proposed a single-item measure of subjective fluency. They suggest that this measure could be used to assess both, perceptual and conceptual fluency. Note however, that the measure was introduced by different instructions depending on whether it meant to assess perceptual (Study 1a) versus conceptual fluency (Study 1b).

related judgments can be valid or not, and the experienced affect is not a direct indicator of their objective value. In this vein, conceptual judgments may rely also on cognitive processes taking into account, for example, the ecological validity of the cue (for a discussion of fluency validity, see Herzog & Hertwig, 2013) or the use of rules of thumb (e.g., Hertwig, Herzog, Schooler, & Reimer, 2011). In contrast, perceptual judgments may rely more on internal affective responses and thus be more likely to reflect the hedonic marking of fluency experiences. Lastly, it is possible that the effects are composed of both affective and reflective components. For instance, the non-specific effects (i.e. visual contrast on truth and repetition on liking) maybe accounted for by the hedonic marking of fluency, but the specific effects (i.e., contrast on liking and repetition on truth) may reflect a more reasoned reliance on fluency. Hence, future research may relate the present findings to contemporary dual-process models differentiating between analytic and experiential processes (e.g., Gawronski & Bodenhausen, 2006; Sloman, 1996; Strack & Deutsch, 2004).

Conclusion

In summary, our experiments attest to the fluency-specificity hypothesis. The origin of the fluency experience determines to what extent fluency informs the judgment at hand. It is the experience emerging from the processes that are the most relevant in forming the judgment that has the most impact on the judgment while experiences emerging from less central processes have less influence. As truth judgments logically involve semantic processing, they are particularly affected by conceptual fluency. Aesthetic judgments mostly involve processing of the physical properties, and are therefore affected particularly by perceptual fluency. Future research should address the mechanisms that underlie the specific use of different types of fluency.

Context of the Research

The present work challenges a central tenet in fluency research, by which the experience of processing fluency represents a global metacognitive feeling that is used

equally for different judgments independent of how the fluency experience originated (see

Alter & Oppenheimer, 2009). This assumption is supported by findings that the experience of

processing ease impacts a wide range of judgments independent of whether they are based on

the same processing operations that are facilitated by a given fluency manipulation. Contrary

to this, we propose a fluency-specificity hypothesis, by which the impact of a given fluency

experience on a judgment depends on the fit between the process by which the fluency

experience is generated (e.g., perceptual or conceptual processing) and the judgment to be

made (e.g., perceptual or conceptual judgment). The idea follows from previous work by

Silva and colleagues (2016, 2017; see also Lanska et al., 2014), who showed that conceptual

fluency led to stronger effects on truth judgments (i.e., a conceptual judgment) than fluency

originating in the stimuli's perceptual features, and that individuals can dissociate between

different fluency experiences within the same judgment context. However, those previous

studies did not allow for a critical test of the specificity-hypothesis, since either participants

were not exposed to more than one fluency instantiation at a time or the effects of multiple

fluency sources were measured on only one type of judgment. Thus, the present studies

employed a double-dissociation procedure contrasting the effects of two different co-

occurring fluency signals on two different judgments.

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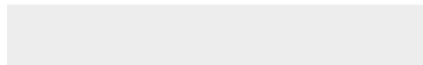
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