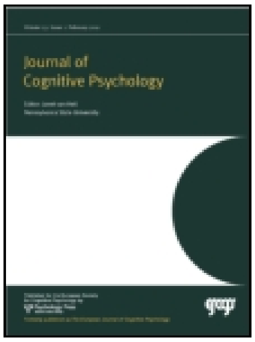

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The interplay between presentation material and decision mode for complex choice preferences

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Recent research suggests that, when faced with a choice between several alternatives described with a large number of attributes, people make better choices if they do not consciously ponder over the alternatives but rather perform a distraction task assumed to elicit unconscious thought. Subsequent research attempting to replicate this finding, however, provided mitigated support for its existence. The research reported here contributes to this ongoing debate on two grounds. First, it highlights a methodological confound between qualitative and quantitative presentation material and proposes a novel procedure that can accommodate both. Second, it shows that, whereas conscious deliberation leads to better decisions when alternatives are characterised by quantitative information, the use of a qualitative format for presenting information cancels the advantage of conscious deliberation.

Keywords: Conscious thought; Presentation material; Qualitative information; Quantitative information; Unconscious thought.

When faced with complex decisions, recent evidence suggests that it might be better to "sleep on it", that is focus one's mind elsewhere for a few moments, instead of "thinking hard about it", that is engaging in conscious deliberation, or making an immediate choice (Dijksterhuis, 2004; Dijksterhuis, Bos, Nordgren, & van Baaren, 2006). The improvement of complex decision making after distraction has been dubbed the Unconscious Thought Effect (UTE; Strick, Dijksterhuis & van Baaren, 2010) and has been interpreted as evidence that unconscious thought occurs during the distraction period. This claim, however, remains controversial as the evidence for both the existence and the advantage of unconscious thought in complex decisions remains mixed (Newell & Rakow, 2011; Strick et al., 2011).

Most of the unconscious studies used verbal attributes to characterise choice alternatives (e.g., Dijksterhuis et al., 2006). This material is qualitative since verbal attributes are difficult to quantify. Moreover, participants might differ as to which attributes they find most important. Other experiments have used quantitative material (e.g., numerical attributes), which allowed controlling for individual preferences (e.g., Payne, Samper, Bettman, & Luce, 2008). None, however, have precisely examined the impact of the presentation material—that is, the material used to present information characterising alternatives—on the efficiency of each decision mode. We propose an innovative procedure that permits controlling for individual preferences while also accommodating both types of presentation material. In two experiments, we show that the type of presentation material used to represent the choice alternatives moderates the efficiency of conscious deliberation. Conscious deliberation resulted in

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better complex decisions when alternatives were characterised by quantitative information, whereas no advantage of conscious deliberation was found when alternatives were described with qualitative information.

In a typical unconscious thought experiment (e.g., Dijksterhuis et al., 2006), participants are presented with information about four alternatives (e.g., cars) and are asked to form an impression about them. Each alternative is described by either four (simple decision) or 12 (complex decision) positive and negative attributes such as ‘‘good mileage’’ or ‘‘poor sound system’’. Participants are then either instructed to deliberate about the alternatives (conscious thinking) or to perform a distracting task (assumed to elicit unconscious thinking) for a certain period, or else, to make a choice without further thought (immediate decision). In the original experiments (Dijksterhuis et al., 2006), a period of conscious deliberation led to better decisions for simple choices, whereas the best option was more likely to be picked after a distraction task when choices were complex. In those instances, the objective ‘‘best’’ alternative was the alternative characterised by the highest number of positive attributes. However, these attributes were verbal and qualitative and this is problematic. As González-Vallejo, Lassiter, Bellezza, and Lindberg (2008); see also Newell, Wong, Cheung, & Rakow, 2008) pointed out, defining the normatively optimal choice as the choice having the greatest number of positive attributes entails two untenable assumptions: namely, (1) all individuals give the same weight to all attributes in their final choice and (2) all individuals assign a subjective utility value of 1 to all positive attributes and a subjective utility of 0 to all negative attributes. The latter assumption is particularly questionable because, by definition, personal utilities are subjective and idiosyncratic: The match between objective values and subjective utilities cannot provide a valid criterion for evaluating choice quality. Consider, for example, the car attribute value ‘‘little legroom’’—a negative attribute in Dijksterhuis et al.’s (2006) study; its subjective utility may reasonably vary from an individual to another, presumably as a function of anthropometric characteristics such as their buttock–knee length.

Taking these idiosyncratic preferences into account in an effort to define choice optimality at an individual level raises other issues. Some researchers (e.g., Newell et al., 2008; Waroquier, Marchiori, Klein, & Cleeremans, 2009) asked participants to rate the subjective importance of each attribute. To prevent participants’ prior introspection on their preferences from influencing their choice, those measures are usually taken after a choice is made. What remains unclear, however, is whether importance ratings reflect participants’ intrinsic preferences rather than a product of their earlier choices. In the latter case, subjective ratings do not provide a valid evaluation of the relative importance of different attributes for the decision process. To circumvent the issues raised by idiosyncratic preferences, González-Vallejo et al. (2008); see also Calvillo & Penaloza, 2009) proposed to use a dominating alternative design. This approach is based on the principle of dominance, which states that if an alternative is better than the others on at least one attribute and is at least as good as the others on every other attribute, then this alternative is the optimal alternative. The few experiments using this design, however, did not find any difference between decision mode conditions (Calvillo & Penaloza, 2009). This approach also assumes that individuals ought to value all choice attributes for making their choice. Suppose, however, that a short person is asked to identify the best car among a set where the dominating alternative offers plenty of legroom but is otherwise as good as the other cars. As legroom will not be a relevant choice criterion for this particular person, she no longer ought to prefer the dominating alternative. So, the use of a dominating alternative design still falls short of providing an adequate test of the relative performance of each decision mode in the absence of the identification of the dimensions that informed individual choices. Another approach to overcome issues arising from the use of qualitative attributes consists in providing participants with quantitative information about the attribute values they need to consider. Payne et al. (2008); see also Ashby, Glöckner, & Dickert, 2011) did this by designing a lottery task with numerical attributes. Participants were asked to choose their preferred lottery among a set of four. Each lottery was characterised by 12 equiprobable events. Each of those 12 events was described by a different positive monetary outcome (e.g., $2 won). Payne et al.’s task differed from the choice task used by Dijksterhuis et al. (2006): Participants were presented with precise numerical values ranging between $0 and $16 that could be unambiguously ordered instead of positive or negative qualitative verbal attributes such as "has poor legroom" or "has good mileage". Payne et al. did not replicate the UTE with the lottery task. In fact, conscious thinkers fared better when choices were complex but demanded sensitivity to magnitudes and the precise application of strict rules. This corroborates the rule principle of the Unconscious Thought Theory (UTT; Dijksterhuis & Nordgren, 2006), which states that conscious thought is best suited for applying strict rules and computing precise answers, whereas unconscious thought cannot be used to actively follow strict rules but will, instead, produce gist answers (see also Abadie, Waroquier & Terrier, in press). Hence, although the use of numerical material allowed for a better control of attribute values, it might also have handicapped distracted participants. Due to the more holistic and associative nature of the presumed unconscious thought process (see also Strick et al., 2011), it is indeed difficult to engage in a systematic, analytical processing during the distraction period. Second, according to the UTT's capacity principle, conscious thought is constrained by the number of items or chunks that it can process at any one time.[1] This limitation does not apply to unconscious thought, supposedly well suited for integrating large amounts of information (Nordgren, Bos, & Dijksterhuis, 2011). The capacity handicap of conscious thought will arguably be easily overcome, however, in tasks where the information can easily be combined or grouped together in chunks. Hence, tasks such as the lottery task, which offer precise numerical values that can be combined by the conscious application of simple rules of arithmetic, cannot provide an adequate test of the capacity advantage of unconscious thought.

Here we propose a methodological distinction between choice tasks in which alternatives are described with quantitative and qualitative presentation material. We define presentation material as quantitative when alternatives are characterised by precise and quantifiable attributes such as monetary outcome values (e.g., Payne et al., 2008). The quantitative material can be easily processed analytically and combined in chunks with a few simple calculations. In this case, following UTT's rule principle, choices should be better in the conscious deliberation condition even when they involve a large number of attributes. By contrast, we define presentation material as qualitative when alternatives are characterised by attributes that are vague and difficult to quantify or to combine in chunks such as verbal attributes (e.g., Dijksterhuis et al., 2006). In this case, following UTT's capacity principle, conscious deliberation should lose its advantage and better choices should be observed when they are preceded by a distraction task. The few empirical results obtained with pictorial material (e.g., Dijksterhuis & van Olden, 2006) suggest that such material may help unconscious thought because it leads participants to integrate and configure information holistically (Lerouge, 2009; Usher, Russo, Weyers, Brauner, & Zakay, 2011).

We present two experiments that test these predictions using an innovative procedure to address the shortcomings of previous tasks using quantitative or qualitative presentation material. Instead of using multidimensional verbal attributes to distinguish decision alternatives, we asked participants to compare products defined on a single dimension based on a number of independent ratings. This procedure allowed us to ascertain objectively what the optimal choice was, while controlling for the perceived relevance of each attribute value since all ratings were equally important and their relative weight was precisely manipulated. In a first experiment, we used numerical and colour-coded ratings. In Experiment 2, we replicated our findings using a slightly different procedure to display information using more familiar qualitative presentation material (star ratings).

EXPERIMENT 1

Method

Participants. A total of 206 (82 men and 124 women) social sciences students from the University of Toulouse, ranging in age from 18 to 49 ($M = 23.34$, $SD = 5.28$) participated voluntarily.

[1] Dijksterhuis and Nordgren (2006) justified the capacity principle by arguing that conscious thought could only process a limited amount of information, measured in bits. This principle was heavily criticised by González-Vallejo et al. (2008), who argued that the focus on bits of information was "outdated" compared to the more critical concept of information organisation in chunks. This latter position is better aligned with a core assumption of the modern view on memory span. To overcome this issue, we simply assume that the capacity of conscious thought is determined by the number of chunks of information it can handle at any one time.

TABLE 1
Distribution of consumer ratings of the four creams in Experiments 1 and 2

	Experiment 1				*Experiment 2*			
	H Best	*K Good*	*D Bad*	*N Worst*	*N Best*	*K Good*	*H Bad*	*D Worst*
Consumer ratings	4	4	4	4	5	5	5	5
	4	3	3	3	5	5	5	5
	3	2	2	2	5	4	4	4
	2	2	1	1	4	4	4	4
	2	1	1	−1	4	4	4	2
	1	1	−1	−2	4	4	2	2
	1	−1	−1	−2	4	2	2	2
	−1	−2	−2	−3	2	2	2	2
	−1	−2	−3	−3	2	2	2	1
	−2	−2	−3	−3	2	2	1	1
	−3	−3	−3	−4	1	1	1	1
	−4	−3	−4	−4	1	1	1	1
Sum	6	0	−6	−12	39	36	33	30
Mean	0.50	0.00	−0.50	−1.00	3.25	3.00	2.75	2.50
Standard deviation	2.68	2.45	2.65	2.80	1.54	1.48	1.54	1.57

Material. The experimental material was composed of four lists of 12 attribute values, presented as positive or negative ratings from consumers, on four moisturising creams labelled H, K, D, and N (see Table 1). The ratings were generated randomly and matched the three following criteria: (1) The frequencies of positive evaluations increased from the worst to the best product, (2) the sums and the means of the evaluations increased from the worst to the best, and (3) the variance of the evaluations was equivalent. Products were ranked as follows: Cream H, Cream K, Cream D, and Cream N. The information was displayed in four separate ‘‘consumer panels’’. Each panel consisted of four separate cards presented simultaneously. Each card represented one product along with three consumer ratings. The ratings were selected at random from the set of ratings for that product. Ratings were presented either in a numerical format using numbers ranging from –4 to 4 or in a colour-coded format using coloured scales ranging from dark blue to dark red (see the left panel of Figure 1 for an illustration). Product order within each panel was randomised.

Procedure. Participants were instructed to assume the role of a market research company director. Their task was to recommend to their client the moisturising cream that would be most successful with consumers. The experiment took place in four stages. In the preacquisition phase, participants were told they would first review information from four consumer panels but that

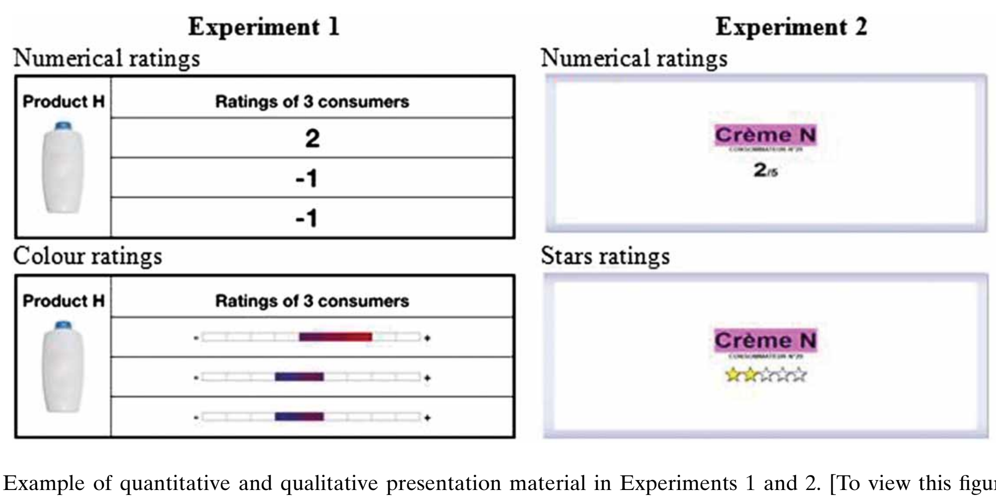

Figure 1. Example of quantitative and qualitative presentation material in Experiments 1 and 2. [To view this figure in colour, please see the online version of this journal].

they would have time to decide which product to recommend to their client at a later stage. In the acquisition phase, the experimenter manually presented ratings from the panels in a random order. Ratings were presented in a numerical format for half of the participants; the other half saw colour ratings. All participants were given a maximum of 45 s to consult each panel. In the postacquisition phase, participants were first reminded that their task was to choose which product to recommend to their client before they were assigned randomly to one of the decision mode conditions: conscious deliberation or distraction. The immediate choice condition was added to the design after the two other conditions had been completed. In the original procedure introduced by Dijksterhuis (2004), participants in the deliberation condition had to recall attributes in order to examine the pros and cons of each choice alternative during the post-acquisition phase. As noted by Rey, Goldstein, and Perruchet (2009), this procedure is likely to create output interference (Tulving & Arbuckle, 1966) given the similarity of the different product attributes to be considered for making a decision. Therefore, to ensure that deliberation was not artificially hindered, participants in this condition were given access to the panel information for all four products while they were deliberating. They were instructed to review and rearrange the consumer panel ratings for a maximum of 5 minutes before making their choice. This ‘‘open-access’’ procedure also has the advantage of better reflecting decision making in natural settings. In the distraction condition, participants were asked to solve anagrams for the same maximum period. Participants in the immediate condition entered the decision phase immediately after the acquisition phase. Finally, during the decision phase all the participants chose a product and rated each of them from the most attractive to the least attractive using a 10-point scale (0 = ‘‘very unattractive’’ to 10 = ‘‘very attractive’’).

Results

Frequency of optimal choice. As in previous research (e.g., Dijksterhuis et al., 2006), the proportion of participants who choose the best cream was compared to the proportion of participants who choose one of the three others. A hierarchical log-linear analysis was used to determine the interaction between presentation material and decision mode for the optimal choice data. Presentation material (numerical vs. colour), decision mode (deliberation vs. distraction vs. immediate), and optimal choice (best cream vs. other creams) were entered as factors. The analysis produced a final model that retained all effects. The likelihood ratio of the model was, $\chi^2(0) = 0$, $p = 1$. The highest order interaction (Presentation material × Decision mode × Optimal choice) was significant, $\chi^2(2) = 6.08$, $p = .05$. In line with our predictions, the left panel of Figure 2 shows that participants choose more often the best cream in the deliberation condition than in the other conditions when ratings were presented in a numerical format. A first chi-square test indicated that, when numerical ratings were used, there was a significant difference in the proportion of optimal choices as a function of decision mode, $\chi^2(2, N = 103) = 11.46$, $p < .01$, Cramer's $\varphi = .33$. The best cream was chosen more often in the deliberation condition than in the distraction condition, $\chi^2(1, N = 72) = 9.46$, $p < .01$, Cramer's $\varphi = .36$, and in the immediate condition, $\chi^2(1, N = 67) = 7.62$, $p < .01$, Cramer's $\varphi = .34$. There was no difference between the distraction and immediate conditions, $\chi^2(1, N = 67) = 0.05$, $p = .83$, Cramer's $\varphi = .03$. By contrast, when colour ratings were used, the best cream was preferred by a majority of participants in each condition. There was no longer a significant difference in the proportion of optimal choice as a function of decision mode, $\chi^2(2, N = 103) = 0.39$, $p = .82$, Cramer's $\varphi = .06$.

Preference for the best over the worst cream. Following the procedure initiated by Dijksterhuis (2004), we used the difference between the evaluations of the best and the worst cream as an indicator of the strength of the preference for the best cream (see right panel of Figure 2). A 2 (presentation material: numerical vs. colour) × 3 (decision mode: deliberation vs. distraction vs. immediate) univariate analysis of variance (ANOVA) was conducted on this index. The interaction between presentation material and decision mode on the difference score index was not significant, $F(2, 200) = 0.94$, $p = .39$, $\eta^2 = .01$. The main effect of presentation material was also not significant, $F(1, 200) = 2.14$, $p = .15$, $\eta^2 = .01$. However, a significant main effect of decision mode emerged, $F(2, 200) = 3.81$, $p = .02$, $\eta^2 = .04$. Post hoc comparisons using Tukey HSD tests indicated that participants in the deliberation condition ($M = 3.35$, $SD = 2.92$) were significantly

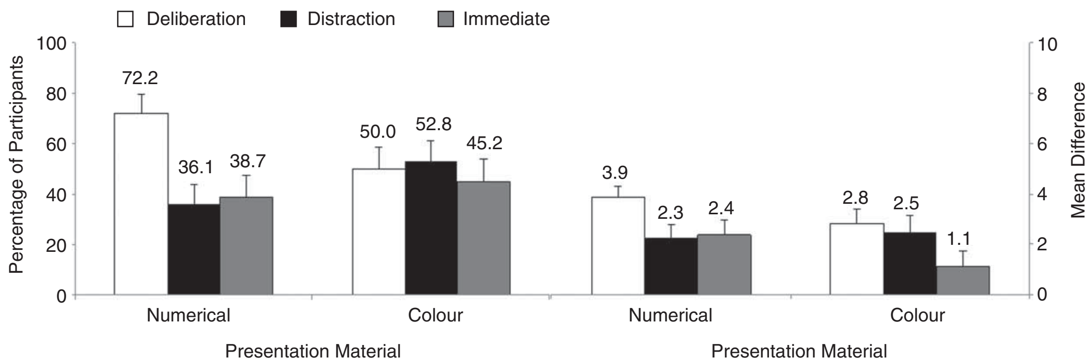

Figure 2. Percentage of participants choosing the best cream as a function of presentation material and decision mode ($n = 31$–36 in each condition; error bars represent the standard error), left panel; difference between the evaluations (on a 0–10 scale) of the best and the worst cream as a function of presentation material and decision mode (error bars represent the standard error), right panel.

better at discriminating the best from the worst cream than participants in the immediate condition ($M = 1.75$, $SD = 3.66$) only. However, as shown in the right panel of Figure 2 and quite similar to the pattern of results obtained with the choice data, it seems that it was only with numerical ratings that a deliberation period led to a stronger preference for the best cream. Since a significant interaction between presentation material and decision mode was found on the choice data, separate analyses were conducted for each presentation material on the difference score index. In line with our predictions, there was a marginally significant effect of decision mode when ratings were presented in a numerical format, $F(2, 102) = 3$, $p = .054$, $\eta^2 = .06$. A planned contrast confirmed that the preference for the best cream was higher in the deliberation condition, $t(100) = 2.44$, $p = .02$. There was no difference between the distraction and the immediate conditions, $t(100) = 0.16$, $p = .87$. Moreover, akin to the choice data, no significant difference on the preference for the best cream as a function of decision mode was observed when ratings were presented in a colour format, $F(2, 102) = 1.93$, $p = .15$, $\eta^2 = .04$.

Discussion

As predicted, participants benefited from reviewing numerical attributes consciously when presented with many attributes. However, contrary to predictions, distraction did not improve decision making with qualitative attributes. This lack of difference between conditions could have occurred because participants were not familiar with colour gradients as a mean of presenting consumer ratings. They might therefore have experienced difficulties in integrating and processing those ratings. Another potential confound relates to the procedure we used in the acquisition phase where attribute values were presented in sets of three consumer ratings. In the UTT paradigm, complexity is indexed by the number of attributes one has to consider to make a choice. This procedure may have afforded the chunking of three pieces of information into one, thus reducing decision complexity. This is problematic for interpreting our results because UTT predicts that conscious thought leads to sound choice preferences as long as its low capacity is not strained. Hence, instead of showing that the presentation material of the choice alternatives is a moderator of conscious deliberation efficiency, our findings could be understood as simply showing that conscious deliberation leads to better performance under simple choice conditions. We designed a second experiment to address these potential issues.

EXPERIMENT 2

The purpose of Experiment 2 was to replicate findings from Experiment 1 using more familiar material to convey qualitative information as well as a procedure that did not allow for information chunking in the acquisition phase. To this end, we used a new qualitative format (star ratings) whose familiarity had been pretested by an independent sample of participants.[2] Moreover, we increased the complexity of the decision task by presenting consumer ratings one by one. With this improved design, we expected to replicate the results obtained in Experiment 1 with numerical material. We also expected to observe better choices in the distraction condition with the new qualitative information format (star ratings).

Method

Participants. A total of 241 (75 men and 166 women) ranging in age from 18 to 71 ($M = 36.27$, $SD = 14.70$) voluntarily completed a Web-based experiment. Data from three participants were excluded from the analysis because they took too long to complete the entire experiment (their time of completion was further than 3 *SD* from the mean completion time).

Material and procedure. As in Experiment 1, the choice alternatives consisted in four moisturising creams characterised by 12 ratings from consumers (see Table 1). The ratings ranged from 1 to 5 and matched the same three criteria used in the first experiment. Products were ranked as follows: Cream N, Cream K, Cream H, and Cream D. The procedure was the same as in Experiment 1, except that ratings were displayed one by one for 4 s each. The order of presentation of ratings was randomised. Ratings were presented in a numerical format for half of the participants and in a visual format using stars for the other half (see the right panel of Figure 1). Next, after being reminded that they had to choose the best cream for their client, participants were randomly assigned to one of the three decision modes: (1) They made an immediate choice, (2) they were again presented with the 48 consumer ratings and instructed to deliberate for 3 minutes, or (3) they were asked to solve anagrams for the same 3-minute period. All participants then chose a cream and rated the four creams on a 100-point scale ranging from 0 (= "not at all satisfied consumers") to 100 (= "very satisfied consumers").

[2] A pretest was conducted from an independent sample of 20 participants to assess the degree of familiarity (on three 4-point scales) of five formats for presenting consumer ratings (numbers, horizontal lines, colour gradients, stars, and concentric circles). Results revealed that star ratings (M = 3.73, SD = 0.63) were perceived as similar as numerical ratings (M = 3.83, SD = 0.33) in terms of familiarity, $t(19)$ = 0.71, p = .49. It is also important to note that star ratings is a format for presenting consumer reviews that is widely used in online stores (e.g., Amazon, Price Minister, etc.).

Results

Frequency of optimal choice. A hierarchical log-linear analysis was used to determine the interaction between presentation material and decision mode for the optimal choice data. Presentation material (numerical vs. stars), decision mode (deliberation vs. distraction vs. immediate), and optimal choice (best cream vs. other creams) were entered as factors. The analysis produced a final model that retained the Decision mode × Optimal choice interaction, $\chi^2(2) = 16$, $p < .01$. The likelihood ratio of the model was, $\chi^2(6) = 0$, $p = 1$. A chi-square test indicated that the best cream was chosen more often in the deliberation (81.82%) condition than in the distraction (59.21%), $\chi^2(1, N = 153) = 9.42$, $p < .01$, Cramer's $\varphi = .25$, and in the immediate (54.12%) conditions, $\chi^2(1, N = 162) = 14.08$, $p < .01$, Cramer's $\varphi = .30$. There was no difference between the distraction and immediate conditions, $\chi^2(1, N = 161) = 0.42$, $p = .52$, Cramer's $\varphi = .05$. However, as the highest order interaction (Presentation material × Decision mode × Optimal choice) was marginally significant, $\chi^2(2) = 5.61$, $p = .06$, separate chi-square analyses were also conducted for each presentation material. As shown in the left panel of Figure 3, it was only when ratings were presented in a numerical format that participants in the deliberation condition choose the best cream more often than the others. There was indeed a significant difference in the proportion of optimal choice as a function of decision mode when numerical ratings were used, $\chi^2(2, N = 121) = 18.47$, $p < .01$, Cramer's $\varphi = .39$. Participants in the deliberation condition choose the best cream more often than those in the distraction and the immediate conditions, $\chi^2(1, N = 78) = 13.25$, $p < .01$, Cramer's $\varphi = .41$, and $\chi^2(1, N = 82) = 16.54$, $p < .01$, Cramer's $\varphi = .45$, respectively. There was no difference between the latter two conditions, $\chi^2(1, N = 82) = 0.17$, $p = .68$, Cramer's $\varphi = .05$. By contrast, when stars ratings were used, there was no significant difference in the proportion of optimal choice as a function of decision mode, $\chi^2(2, N = 117) = 1.38$, $p = .50$, Cramer's $\varphi = .11$.

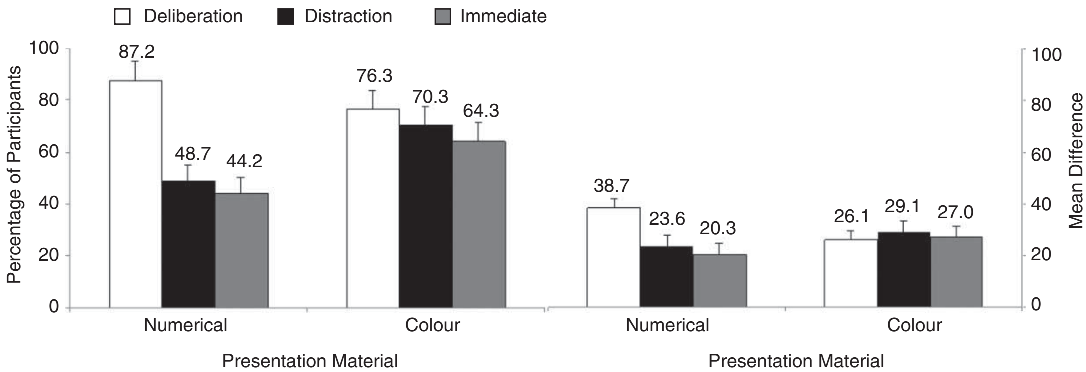

Figure 3. Percentage of participants choosing the best cream as a function of presentation material and decision mode ($n = 37–43$ in each condition; error bars represent the standard error), left panel; difference between the evaluations (on a 0–100 scale) of the best and the worst cream as a function of presentation material and decision mode (error bars represent the standard error), right panel.

Preference for the best over the worst cream. A 2 (presentation material: numerical vs. stars) $\times$ 3 (decision mode: deliberation vs. distraction vs. immediate) univariate ANOVA was conducted on the difference score index. The critical interaction between these factors was significant, $F(2, 232) = 3.65$, $p = .03$, $\eta^2 = .03$. In line with our predictions, the right panel of Figure 3 shows that participants were better at discriminating the best cream from the worst in the deliberation condition than in the other conditions when ratings were presented in a numerical format. There was a significant effect of decision mode, $F(2, 118) = 5.94$, $p < .01$, $\eta^2 = .09$. A planned contrast showed that the preference for the best cream was higher in the deliberation condition than in the two other conditions, $t(118) = 3.38$, $p < .01$. There was no difference between the distraction and immediate conditions, $t(118) = 0.6$, $p = .55$. By contrast, when stars ratings were used, no difference on the preference for the best cream as a function of decision mode was observed, $F < 1$.

Discussion

The results of Experiment 2 replicated the findings of Experiment 1: As predicted, it is only when numerical ratings were used that participants in the deliberation condition were better able to discriminate the best alternative. The use of a more familiar qualitative material, however, did not help distracted participants to make better choices. This pattern of results could not be interpreted as a replication of the simple decision condition of Dijksterhuis and colleagues (2006): The presentation of one piece of information at a time ensured that information could not be chunked and, thus, that the decision task was sufficiently complex. In the qualitative condition, however, neither participants in the deliberation condition nor those in the distraction condition made better choices than immediate choosers. This suggests that all participants may have updated their preferences during the acquisition phase. We review the methodological and theoretical implications of these findings for the UTT next.

GENERAL DISCUSSION

In the experiments reported here, we predicted that the presentation material of the alternatives is a key moderating factor of the quality of decisions made after conscious deliberation or after distraction. Our experiments showed that, when alternatives were defined by numerical attributes, participants made better decisions after a deliberation period than after a distraction period or immediately after the presentation of the choice alternative features. There was no evidence that deliberation was advantageous, however, when alternatives were defined by qualitative attributes. These results confirm that conscious deliberation is best suited for applying precise rules such as those needed to do simple arithmetic calculations. This also suggests that we may not necessarily benefit from "looking before we leap" in order to make complex decisions.

One could object that the "open-access" procedure we used in the deliberation condition provided an unfair advantage to participants. This would explain why a main effect of decision mode was found on the difference scores in the first experiment and on optimal choice data in the second. However, studies that examined the impact of providing information during deliberation on decision quality found no evidence for an advantage of making such information available (Ashby et al., 2011; Huizenga, Wetzels, van Ravenzwaaij, & Wagenmakers, 2011; Newell et al., 2008). In contrast, the type of material used to present information seems to be of particular importance. Our two experiments showed that participants who could examine the information during deliberation outperformed both distracted participants and those asked to choose immediately when the material used to characterise alternatives was presented in a quantitative format (see also Ashby et al., 2011) but not when the material used a qualitative format of presentation (see also Newell et al., 2008; Rey et al., 2009). These results suggest that the number of attributes that can be processed by conscious thought at any given time is higher when those attributes values are expressed in quantitative rather than qualitative formats. This is presumably because numerical ratings can be easily combined together by using a simple rule of arithmetic such as summing the attribute values of each alternative. By contrast, there is no obvious rule one could apply to "combine" many coloured scales or star ratings. This would explain why participants in the deliberation condition performed better with numerical ratings and, thus highlights the need for a clearer methodological distinction between quantitative and qualitative information format of material presentation.

We did not replicate the Unconscious Thought Effect, even with qualitative material. In both experiments, choices made after a distraction period were not better than those made immediately after the presentation phase. It is thus unlikely that decision-relevant unconscious processes, allowing participants to integrate large amount of information, have occurred during the distraction phase (see also Lassiter, Lindberg, Gonzalez-Vallejo, Belleza, & Phillips, 2009; Waroquier, Marchiori, Klein, & Cleeremans, 2010). These findings suggest instead that all participants updated their preferences during the acquisition phase and decided accordingly. It is possible that the design of our qualitative ratings unduly facilitated online judgements, for example by using discrete colour blends or stars (see Figure 1), which participants may have used as rough analytical guidelines. This would explain why decision performance between decision modes was roughly similar: These visual cues may have impeded global processing while benefiting online and analytical processing (Lerouge, 2009; Usher et al., 2011). Future research could improve on this potential shortcoming, for example by (1) using continuous colour blends that may be more difficult to use analytically and, (2) including a preliminary learning phase to ensure participants could easily process this type of material. Strick et al.'s (2011; see also Abadie et al., in press; McMahon, Sparrow, Chatman, & Riddle, 2011) meta-analysis also highlights another possible explanation for the lack of effect of decision modes: The anagram task we used as a distraction task may have taken up too much cognitive resources and consequently interfered with the presumed unconscious processing. The nature of the distraction task may therefore itself be the focus of future research.

In summary, this paper argues that previous choice tasks used to assess the efficiency of conscious and unconscious thinking were limited because they inappropriately dealt with the issue of idiosyncratic preferences (e.g., Dijksterhuis et al., 2006) or provided an unfair advantage to conscious deliberation (e.g., Payne et al., 2008). We devised a new choice task that overcomes those issues by providing the same objective benchmark for both qualitative and quantitative cue values. This enabled us to demonstrate that (1) conscious thinking is best suited for dealing with numerical material, and (2) when confronted with material presenting information in a qualitative format, conscious deliberation does not lead to better choices (compared to instantaneous choices, or choices made after a distraction period). Future research may benefit from using this novel task to further explore the advantages and limitations of different decision modes when choosing between different alternatives.

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