Now I like it, now I don't: Delay effects and retrospective judgment

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Abstract

The present paper tests the widely accepted hypothesis that on-line judgment implies functional independence between memory for, and judgment of, verbal stimuli (e.g., Anderson, 1989; Hastie & Park, 1986). In the present study, participants recalled lists of words, after having assessed each for its pleasantness. Presentation position of a negative item within the lists was manipulated. Also, items memorability was manipulated after their presentation – by inserting a filled delay between presentation and the judgment task; in this way, on-line judgment formation was spared. The memory manipulation reduced recall rates for negative items presented in the last position – and their negative influence on pleasantness ratings accordingly. These results contradict the predictions of pure on-line approaches to judgment formation (e.g., Betsch, Plessner, Schwieren, & Gütig, 2001) and suggest that even in on-line judgment tasks, memory plays a role.

Keywords*:* on-line judgment, memory, accessibility, retrospective evaluations, delay effects.

Introduction

In everyday life, it is a regular experience to evaluate events once they have unfolded. Retrospective evaluations (hereafter RE) can be defined as the summary assessments of the quality of the event, provided in hindsight; RE are coherent evaluations which involve the integration of information from hedonic states into a unitary judgment. Such evaluations can be provided about episodes which may have varied in quality and intensity over time (Fredrickson, 2000) and about target stimuli which have been presented in a sequential manner (e.g., Anderson & Hubert, 1963; Bruine de Bruin, 2005).

A very important question concerns the nature of the memory processes involved in RE: Do people retrieve episodic information about experiences in order to evaluate them in hindsight? In the literature, there are two contrasting approaches to this question that are more widely documented. On one hand, some theoretical accounts (e.g. the *two-memory hypothesis*; Anderson, 1989; Anderson & Hubert, 1963; the *value-account*; Betsch et al., 2001) propose functional autonomy between memory and judgment processes. According to these accounts, impressions of episodes are formed "on-line" (i.e., while they are being experienced) and RE are based on the product of this on-line judgment. Retrieving episodic information from the event itself is viewed as a cognitively costly operation –which is called upon if, and only if, the on-line judgment is prevented (for example, by not forewarning participants about the subsequent judgment task; Hastie & Park, 1986). These approaches propose that people do not rely in any significant manner on episodic information about an event when they evaluate it in hindsight.

On the other hand, several theoretical views suggest that – to some degree or another– retrieved information influences judgment often leading to biases in RE (e.g., Dougherty, Gettys, & Ogden, 1999; Tversky & Kahneman, 1973; see also Schwarz, 1998). For these approaches, the moments within an episode that are most available in memory (i.e. "accessible"; Schwarz, 1998) disproportionately affect RE. In support of the role of retrieval in summary assessments, many studies have found significant correlations between memory and judgment measures, suggesting that memory and judgment may be functionally related (e.g., Aldrovandi, Poirier, Heussen, & Ayton 2009; Reyes, Thompson & Bower, 1980; Schwarz, 1998; Tversky & Kahneman, 1973).

However, experimental evidence that highlights correlations between memory and judgment does not preclude the possibility that such correlations are attributable to other factors (e.g., vividness; Shedler & Manis, 1986). It remains possible then that retrospective judgment is not causally related to retrieval processes. For

instance, Anderson (1989) suggested that *impression memory* (i.e., on-line judgment) and *verbal memory* (i.e., episodic memory) may be "distinct functionally" (p. 209) but the output from the two systems may correlate since they operate on the same attended stimuli. To re-iterate, the suggestions is that even if 'memory for' and 'judgment of' verbal stimuli are significantly related this does not necessarily imply that people base their retrospective judgments on the episodic information they retrieve from memory.

The aim of the present investigation was to implement a stricter test of the hypothesis that people access information about a specific event in order to evaluate it. Stronger evidence in support of the role of memory in RE would be produced if manipulating the memorability of certain moments within the to-be-assessed episodes influences retrospective judgment. If RE do not depend on the information retrieved from memory, then manipulating the accessibility of some segments within the events should not affect judgment in hindsight. On the other hand, if retrieval and judgment processes are functionally dependent, then the easier it is to access specific information, the larger its impact on RE.

Some studies have attempted to predict judgment as a consequence of experimental memory manipulations (e.g., Gabrielcick & Fazio, 1984; Hanita, Gavanski, & Fazio, 1997; Lewandowsky & Smith, 1983). Lewandowsky and Smith (1983) increased the memorability of non-famous instances within a set through repetition, which in turn increased the corresponding frequency estimates participants provided. The authors concluded that the successful memory manipulation affected the participants' judgment responses (see also Gabrielcick & Fazio, 1984). One of the common features of most of these studies is that the experimental manipulation was implemented *prior* or *during* the presentation of the—to-be-judged and to-be-recalled—stimuli; it seems thus reasonable to argue that such manipulation may have affected on-line judgment formation as well—most likely in the same way as it influenced memory. Hence, manipulating memorability of the information *after* its presentation may provide more convincing evidence that people access the episode trace of the stimuli in order to assess them—instead of retrieving whatever evaluation was performed on-line, while attending to the stimuli.

Furthermore, participants in the above cited studies (e.g., Lewandowsky & Smith, 1983) were asked to complete an evaluation task that involved frequency estimation of specific instances within a search set—a typical example of *frequency* judgment (e.g., Tversky & Kahneman, 1973). In the literature, there is less evidence that bears upon the role of memory in *hedonic* or quality judgments, which in all likelihood do not rely on the same cognitive processes as frequency estimation (see Hogarth and Einhorn, 1992 for a discussion of this issue).

Aldrovandi et al. (2009) showed that inserting a negative item within a list of neutral words significantly reduced the judged pleasantness of the list – relative to lists that did not contain a negative item. More specifically, both primacy and recency effects were observed for RE, as lists with a negative item presented either in the first or last positions were rated more unpleasantly than those lists where the negative item was presented in the middle positions. In the present paper, we called upon the same type of stimuli and judgment task—but influenced memorability of the negative items through an additional manipulation. For some lists, a filled delay was inserted after the items presentation; the effects of filled delay manipulations are well established in the literature, and when implemented in such simple fashion, they lead to a decrease in recency effects (e.g., Bjork & Whitten, 1974).

The rationale was that if a negative item's accessibility in memory is lowered –as it is presented at the end of a list and a filled delay follows items presentation– then its impact on the summary assessment of the list as a whole should be smaller than if the negative item's accessibility is not manipulated (no delay or immediate condition). As items' accessibility in memory was manipulated after stimuli encoding –and more importantly after the on-line judgment evaluation was formed– no delay effects should be observed for judgment if RE are solely based on on-line processing.

Study

In this study, the role of memory in RE was investigated. First, memorability of the information was manipulated after the items presentation; hence, it seems reasonable to argue that on-line judgment formation was relatively unaffected by the experimental manipulation. If RE are purely formed on-line—at least when people are aware of the subsequent judgment task, like in the present case—then there should be no significant effect of a post-hoc manipulation: After all, the on-line judgment is formed while the stimuli are attended to – and this on-line impression is what RE are based upon. On the other hand, if memory biases judgments –at least in part–, then it is expected that whatever effect is going to be seen for the memory results it is going to be reflected in the judgment pattern.

Second, we examined the associations between memory and judgment. RE were elicited first and memory for the content of the word-list obtained second (details of how this was done follow below). Hence, it was possible to contrast the mean pleasantness rating obtained when the negative item was recalled with the mean rating for the trials when it was not recalled. Presumably, if a distinctive item is available for later recall, it is more likely to have been available at the time of judgment. Conversely, if the negative item is not available for recall, the probability that it was available at the time of judgment is reduced. Hence, we would expect that on average, the pleasantness rating will be lower in the cases where the negative item was available for the memory component of the task. The effect of a negative item's availability was further analysed by examining ease of recall. As a measure of relative memory

accessibility, we used output position in the memory task. Since participants were asked to perform free recall (hence no output constraints were implemented), we made the simplifying assumption that items recalled first are on average more readily accessible in memory. It was assumed that negative items recalled early on were more easily accessible and would have had more impact on RE than negative items that are recalled later on. Hence, our hypothesis was that the earlier a negative item was recalled, the stronger its impact on retrospective evaluations.

Method

Participants A total of 79 participants (49 males) took part in the internet-based experiment, advertised through ipoints®. Participants' age ranged from 28 to 65 years (M = 46.9, SD = 10.2) and they were granted ipoints® in exchange for their participation.

Design and Materials A pool of 132 words was selected from the Affective Norms of English Words database (ANEW; Bradley & Lang, 1999). Sixteen negative items were selected along with 116 neutral ones. The selection was based on the valence and arousal scores of each item on the database scales. Negative items were selected to be low in valence (less than 3, on a scale of 1-9) and high in arousal (over 5.9, on the same scale). Neutral items scored in the middle range for valence (5.3 to 6.2) and low on the arousal scale (less than 4.6).

From the resulting word pool, 22 six-word lists were created, as follows. Six lists included a negative item in the first position followed by 5 neutral words—hereafter identified as "Start" lists. Four "Middle" lists had a negative item in the middle positions (2 lists in 3rd position and 2 lists in 4th position.)[1] Six "End" lists comprised five neutral items and a negative word in last position. Finally, six control lists contained only neutral words.

Within-list matching between the negative (if any) and the neutral items ensured that negative and neutral words were equated on familiarity ratings (Coltheart, 1981; M = 531.9 and M = 530.8, respectively), number of phonemes (M = 4.7 and M = 4.4, respectively), and the Kucera-Francis frequency index (Kucera & Francis, 1967; M = 28.2 and M = 34.8, respectively). Furthermore, lists were pair-matched on the above dimensions; rotation across participants allowed each list to be presented approximately the same number of times as each of the different list types and in each different delay condition.

Procedure A series of introductory screens gathered demographic data and allowed participants to familiarise themselves with the computer-controlled procedure and to accept the conditions described in the consent form. Participants were told that the aim of the study was to gather normative data about the pleasantness of 6-word lists. They were instructed to attend to the lists and to provide an overall pleasantness rating for each one after its presentation. The ratings were on a 0-100 scale (0 = *very unpleasant*, 100 = *very pleasant*), and participants were encouraged to make use of the whole range in their responses.

Each word was presented for one second with an inter-stimulus interval of 0.75 seconds. A series of asterisks appeared on the screen for 1 second to signal the end of the list presentation. After the asterisks had disappeared from the screen, in half of the trials participants were prompted to immediately provide their rating (*immediate* condition). Participants were required to use the mouse to click on a slide bar (with extremes of 0 and 100) on the position they felt was closest to their impression of the list. In order to limit the extent of anchoring effects (e.g., Chapman & Johnson, 2002) a sliding marker would appear on the bar (with its equivalent numerical value underneath) only after participants clicked for the first time on the slide bar. Participants then had the opportunity to adjust this initial rating by sliding the marker, and were to confirm their final one by clicking on a "Continue" button. In the remaining half of the trials, participants had to engage in a distractor task that lasted 10 seconds (*delay* condition). During this task, a letter was presented on the screen, and participants had to type the following letters, skipping one letter between each entry; for example, if the letter 'A' was presented, participants had to type in the letters 'C', 'E', 'G', and so forth. After the distractor task, participants provided the judgment task. Delay condition was manipulated within-ss, and the alternation between delay and immediate trials was randomised for each participant.

After rating a given list's overall pleasantness, participants were required to perform a recall task, during which they had to recall the two items that came to mind most readily –and any further item they may remembered in the following screen. This modified version of a free recall task was used to reduce the cognitive demands of the memory task. Previous research has shown that typical recall tasks, which require participants to perform an exhaustive search in memory, can hinder the underlying associations between memory and judgment (e.g., Kitayama & Burnstein, 1989). This finding is in line with many others which suggest that people seem to base their evaluations on partial information – on the elements they can retrieve and that are most easily accessible in memory (e.g., Schwarz, 1998; Tversky & Kahneman, 1973). In addition, participants were asked not to overlook the rating task in order to proceed more quickly to the recall task. Four practice trials were provided. List presentation order was randomised independently for each participant and no time limit was set for either the rating or the recall tasks.

Results

Information about the IP address and the time participants took to complete the whole experiment was collected. One

[1] Analyses revealed no major differences in either memory or judgment measures between lists with a negative item in 3rd or 4th position.

participant was excluded from the analysis because of excessive task duration, as it took her 112 minutes to complete the whole experiment (while the average duration was 24 minutes.) Six more participants were excluded because of their poor performance on the distractor task, which ranged from 0% to 4% correct trials. This resulted in the total sample size being 72 (i.e. overall, 8.9% of participants were excluded.) Alpha was set to .05 for all analyses.

Memory Figure 1 represents the mean recall proportion for the negative items as a function of item position and delay condition. The recall pattern for the negative items was different between the two delay condition—and in the line with the predictions[2]. Both primacy and recency effects can be observed in the immediate condition; however, recency effects disappeared when a filled delay was inserted between items presentation and the recall task.

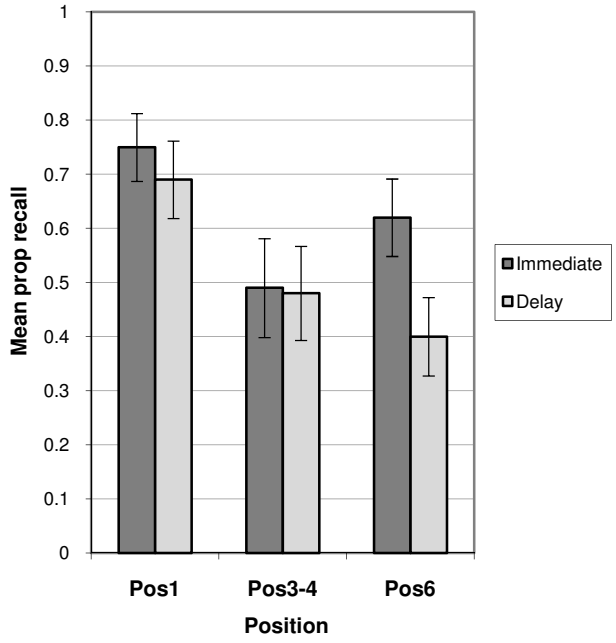

Figure 1: Mean proportion recall for negative items as a function of word position and delay condition. Error bars represent 95% confidence intervals.

The data were analysed using a 3 (position: 1st, 3rd/4th, and 6th) × 2 (delay: immediate vs. delay) repeated measure ANOVA. Main effects of position ($F(2, 127.6) = 28.8$, $p < .001$, $\eta_p^2 = .29$)[3] and delay ($F(1, 71) = 10.1$, $p = .002$, $\eta_p^2 = .12$) were noted. Most importantly, the position by delay interaction was significant, $F(2, 142) = 3.5$, $p = .033$, $\eta_p^2 = .05$. Post-hoc analyses with Bonferroni adjustment revealed no recall differences between immediate and delay conditions for negative items presented at the beginning or in the middle of the list ($ps > .79$). For recency positions there was a recall advantage for the immediate condition, $t(71) = 4.3$, $p < .001$, $d = .51$.

Judgment In order to reduce the influence of potential anchoring effects (e.g., Chapman & Johnson, 2002) and of inter-individual differences in the use of the 0-100 scale, judgment scores were transformed as follows: For each participant, the average pleasantness rating for the Control lists was subtracted from the pleasantness ratings for each Start, Middle and End list. The new corrected judgment scores (J') therefore represented how much more unpleasant each Start, Middle and End list was in comparison to the average Control list for each participant. J' scores were then averaged for each participant, according to the negative item presentation position and whether the negative item presented in the list was recalled or not.

The judgment pattern mirrors the memory results. There seems to be little or no difference for pleasantness ratings for Start and Middle lists; however, End lists were rated as more unpleasant in the immediate condition compared to the delay condition.

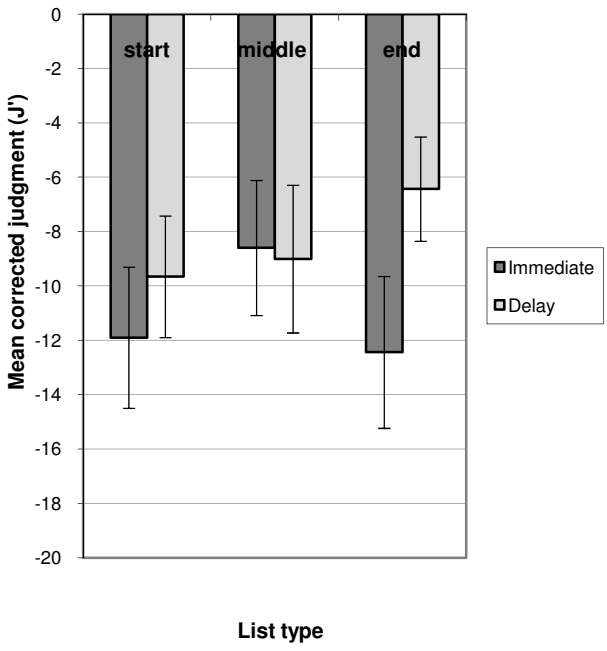

Figure 2: Mean pleasantness ratings as a function of list type and delay condition. Error bars represent 95% confidence intervals.

A 3 × 2 repeated measures ANOVA was run, with list type (Start, Middle and End) and delay (immediate vs. delay) as the factors. The significant main effects of list type ($F(2, 127.1) = 3.3$, $p = .047$, $\eta_p^2 = .04$) and delay ($F(1, 71) = 7.7$, $p = .007$, $\eta_p^2 = .09$) were qualified by the significant

[2] Preliminary analyses revealed that, overall, recall for negative items ($M = .58$, $SD = .16$) was higher than for neutral words ($M = .48$, $SD = .15$; $t(71) = 6.4$, $p < .001$, $d = .76$).

[3] When degrees of freedom are not integers, they were adjusted according to the Greenhouse-Geisser correction due to violations of the Sphericity assumption.

interaction between the two variables ($F(2, 142) = 7.4$, $p < .001$, $\eta_p^2 = .10$). Post-hoc analyses with Bonferroni adjustment confirmed that there was no reliable difference in terms of pleasantness ratings between immediate and delay conditions for Start and Middle lists (both ps > .19); on the other hand, End lists were rated as significantly more pleasant in the delay condition, $t(71) = 4.1$, $p < .001$, $d = .49$.

Memory-Judgment relationships[4] We explored the associations between memory and judgment in two ways. First, we compared the corrected average pleasantness rating for lists where the negative item was recalled versus lists where the negative item was not recalled (cf. availability as "content of recall"; Schwarz, 1998)—separately for the immediate and delay conditions. Table 1 indicates that when the negative item was recalled in the memory task, pleasantness ratings were lower ($M = -11.7$, $SD = 9.6$) than when the negative item was not recalled ($M = -5.9$, $SD = 7.0$). This pattern seems true for both immediate and delay conditions.

A 2 (memory: negative item recalled vs. not recalled) × 2 (delay: immediate vs. delay) within-subjects ANOVA confirmed these observations. The main effect of memory was significant ($F(1, 71) = 40.6$, $p < .001$, $\eta_p^2 = .37$), confirming that overall ratings were more unpleasant for those lists where the negative word was recalled. Neither the main effect of delay ($F(1, 71) = 2.5$, $p = .113$) nor the interaction between memory and delay ($F < 1$) were significant – the latter confirming that the memory and judgment measures were associated regardless of the delay condition.

Table 1: Mean corrected pleasantness ratings (J') as a function of list type and negative item being recalled or not

		Delay condition	
		Immediate	Delay
Was the negative item recalled?			
No	*M*	-7.1	-4.7
	SD	(10.2)	(7.2)
Yes	*M*	-12.2	-11.2
	SD	(10.3)	(10.9)

Second, retrospective evaluations were analysed depending on the negative item recall position[5,6]. The pleasantness ratings (J') were examined according to the position in which the negative item was recalled by the participants – regardless of its presentation position. The underlying rationale was that items that are more accessible in memory are likely to be recalled earlier—if the negative item is more accessible and recalled early we would expect its impact on retrospective evaluations to be higher than when it is recalled later in the protocol or not at all (cf. availability as "ease of access"; Schwarz, 1998)

Table 2: Mean corrected pleasantness ratings (J') as a function of negative item recall output position

		Negative item recall output position		
		Not recalled	Positions 1 & 2	Positions 3 to 6
Pleasantness ratings (J')	*M*	-6.6	-13.3	-8.3
	SD	(6.9)	(10.7)	(11.1)

Table 2 above suggests that pleasantness ratings varied depending on the negative item output position – and that they were lowest when the participants recalled the negative item as either the first or second response ($M = -13.3$, $SD = 10.7$).

The analysis revealed a significant main effect of recall position on pleasantness ratings ($F(2, 142) = 18.5$, $p < .001$, $\eta_p^2 = .21$). Post-hoc analyses with Bonferroni adjustment confirmed that judgments provided when the negative item was recalled among the first two responses were lower than when it was recalled among the last four responses ($t(71) = 6.4$, $p < .001$, $d = .77$) – or not recalled at all ($t(71) = 3.9$, $p < .001$, $d = .46$). For the latter two scenarios, the difference was not significant, $t(71) = 1.5$, $p = .383$.

Discussion

The results of the present experiment suggest that, even when aware of the upcoming judgment task, people rely on the memory trace in order to provide RE (see also Dougherty et al., 1999; Schwarz, 1998).

As expected, inserting a filled delay hindered recency effects for the items' recall. More importantly though, negative items presented at the end of the series exerted a large impact on RE for the immediate condition—while recency effects for RE were largely hampered in the delay condition.

The results of the correlational analyses support the prediction that, even in on-line judgment tasks, memory drives RE. Pleasantness ratings were lower for the lists where the negative item was recalled—compared to those where it was *not* recalled. This finding supports the idea that

[4] For all these analyses, non parametric tests were run as well—as parametric assumptions were not always met. As all the results were the same, we will report the parametric analyses.

[5] This analysis yielded a total of 3.2% missing values, which were missing completely at random as the MCR Little's test was not significant, $\chi^2(2) = 1.5$, $p > .47$. Missing values were replaced using different methods, including mean substitution by subject, grand mean, and Expectation-Maximization algorithm (Schafer & Olsen, 1998). As all the analyses returned the same results, we will be reporting the data obtained via Expectation-Maximization algorithm.

[6] In this case, the analyses could not be broken down by delay condition because of the large number of missing values.

when negative information was easily available in memory at the time of judgment, it exerted a higher impact on judgment. The assumption was that when a negative item was not recalled in the memory task, it was also less likely to be available at the time of RE; on average, this would lead to a less negative assessment of the list. These results suggest that, when prompted to provide a pleasantness rating, participants relied at least to some extent on episodic information stored in memory. If participants had solely relied on on-line judgment formation, there would be no reason to expect the observed judgment pattern for the delay condition; after all, the on-line judgment stores the formed impression which will be the base for the RE. Furthermore, accessibility in memory of a negative item seemed to moderate retrospective judgment, since lower ratings were associated with the negative item being recalled early in the response sequence. The on-line view would not lead to the expectation that the accessibility of the distinctive-negative item would have an impact on RE.

In conclusion, the results of the present experiment provide evidence supporting the hypothesis that memory plays a significant role in biasing summary assessments. Retrospective judgment was successfully predicted on the basis of the memory pattern observed.

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