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Brief Article

Similarity and Attraction Effects in Episodic Memory Judgments

Elizabeth A. Maylor and Matthew A. J. Roberts

University of Warwick, UK

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Address for correspondence:
Elizabeth A. Maylor
Department of Psychology
University of Warwick
Coventry CV4 7AL
UK
Tel: 024 765 24926
Email: e.a.maylor@warwick.ac.uk

Abstract

In the decision-making literature, it is known that preferences between two options can be influenced in different ways by the introduction of a third option. We investigated whether such influences could be demonstrated when making decisions about qualitative aspects of episodic memories. In a baseline condition, participants were asked which of two dissimilar events they remembered more vividly: (A) a well-known Olympic victory, or (B) the death of a well-known public figure. In two further conditions, a third event was added: (C) an Olympic victory similar and competitive to A, or (D) an Olympic victory similar but inferior to A. With the addition of C, participants were less likely to choose A than B (similarity effect), whereas with the addition of D, they were more likely to choose A than B (attraction effect), suggesting that effects known in decision-making can be generalised to relative judgments about episodic memories.

Keywords: similarity effect; attraction effect; episodic memory; vividness.

Similarity and Attraction Effects in Episodic Memory Judgments

Although there are demonstrations that the contents of memory can be altered in systematic ways (e.g., Bartlett, 1932; Loftus, Miller, & Burns, 1978; Wade, Garry, Read, & Lindsay, 2002), it is generally assumed that memory recall is reliable (Neisser, 1988) and that qualitative aspects of episodic memories can be meaningfully used in reaching decisions about past events. For example, mock jurors are more influenced by eyewitness testimonies that contain a greater degree of detail (Bell & Loftus, 1988); attributes such as sensory and contextual detail can help to distinguish between memory for performing an action and memory for the intention to perform that action (see Johnson & Raye, 1981, on reality monitoring); and memory strength contributes to the dating of events such that stronger traces are judged to be more recent than weaker ones (Hinrichs, 1970; Hintzman, 2005). The aim of the present article is to show that such decisions about qualitative aspects of episodic memories can be influenced by the available options (i.e., context) in a manner that resembles previous demonstrations in the decision-making literature (see Roe, Busemeyer, & Townsend, 2001, for a summary).

Consider the case of two very different airline tickets between which customers are approximately equally divided in their preferences: A is a cheap flight requiring four stops, whereas B is an expensive nonstop flight. The introduction of a third option, C, that is similar and competitive to A in being even cheaper but requiring five stops, reduces the probability that A will be chosen relative to B (Burton & Zinkhan, 1987; Tversky, 1972). Thus, C steals more from the similar than from the dissimilar option, a result termed the *similarity effect*. In contrast, the introduction of a third option, D, that is similar to, but dominated by, A in being both more expensive and requiring five stops, increases the probability that A will be chosen relative to B (Bhargava, Kim, & Srivastava, 2000; Huber, Payne, & Puto, 1982; Wedell, 1991), termed the asymmetric dominance or *attraction effect*.

These effects violate the preferential choice properties of, respectively, the *independence of irrelevant alternatives* and the *regularity principle* (which states that the probability of choosing an option should not be increased by the addition of a new option) and thereby challenge traditional models of probabilistic choice (e.g., Luce, 1959; Thurstone, 1959; Tversky, 1972). However, more recent theories have been proposed that can successfully account for both effects (e.g., Roe et al., 2001; Usher & McClelland, 2004).

Can similarity and attraction effects be generalized to a different domain, namely, episodic memory? We asked participants to decide which of two (A/B) or three (A/B/C; A/B/D) familiar public events they remembered most vividly. The events A-D were designed to correspond with the options already described so that the ABC condition was predicted to result in a similarity effect in comparison with the AB (baseline) condition, whereas the ABD condition was predicted to result in an attraction effect relative to baseline. Thus, overall, the proportion of participants choosing A rather than B was predicted to be lower in the ABC (similarity) condition than in the ABD (attraction) condition.

Method

Participants

Data were collected from two samples: Sample 1 comprised 200 undergraduates from the University of Warwick, UK, aged 18-25 years (M = 21.4; SD = 1.7) who received no payment for participation. Sample 2 comprised 330 adults aged 18-70 years (M = 36.2, SD = 11.8) who were registered with "ipoints", an online loyalty scheme enabling people to earn ipoints for behaviors such as shopping at particular online stores or participating in research (see http://www.ipoints.co.uk/redeem/). Participants in Sample 2 received 15 ipoints (£1.50 or approximately $3) to spend in the ipoints shop.

Participants in each sample were randomly assigned to one of three conditions – Baseline, Similarity and Attraction – with n = 70, 65 and 65, respectively, for Sample 1, and

n = 108, 98 and 124, respectively, for Sample 2. The numbers of females and males in each condition were almost identical (Sample 1) or identical (Sample 2).

Stimuli

An appropriate set of events was selected on the basis of data from a different group of 50 Warwick undergraduates (25 females; 25 males) aged 18-25 years (*M* = 21.3; *SD* = 1.6) who rated well-known (in Britain, at least) public events from the past 10 years. Five sets of four events were drawn up to satisfy the following requirements: A = a memorable public event; B = as memorable as A but conceptually dissimilar; C = as memorable as A and conceptually similar; D = less memorable than A but conceptually similar. (Note the correspondence with the airline tickets in the Introduction where A and B were very different but equally attractive tickets, C was as attractive as A and with characteristics closely resembling those of A, and D was less attractive than A but also with characteristics closely resembling those of A.) The students completed a questionnaire in which they were asked to rate (1) the vividness of their memory for each event (presented in random order) on a 7-point scale from 1 = extremely weak to 7 = extremely strong, and (2) the conceptual similarity between pairs of events (A & B; A & C; A & D; for each set) on a 7-point scale from 1 = extremely dissimilar to 7 = extremely similar, also presented in random order.

The event set that most closely matched our criteria is shown in Table 1, together with the overall ratings of vividness and conceptual similarity. [Note that Event B was *The Dunblane shootings* for Sample 1, who were tested in the presence of an experimenter. Event B was subsequently changed to *The death of The Queen Mother* for Sample 2 (who were tested via the Internet) to avoid distressing anyone personally affected by the tragedy at Dunblane.] Event A did not differ in vividness from Events B1, B2 or C (all *p*'s > .05) but was rated as more vivid than Event D, $t(49) = 7.45$, $p < .01$. The A-B1 pair was rated as less conceptually similar than either the A-C or A-D pairs, $t(49) = 44.65$ and 40.51, respectively,

p's < .01, with no difference between the latter two pairings (*p* > .05). (Conceptual similarity ratings were not obtained for the A-B2 pair but it seems unlikely that Steve Redgrave's victory and The Queen Mother's death would be regarded as any less dissimilar than Steve Redgrave's victory and the Dunblane shootings.)

Procedure

Participants were presented with a sheet of paper by an experimenter (Sample 1) or directed to a computer screen by an email (Sample 2) that introduced the experiment as about memory for past events. They were then asked to answer a single question either by indicating their response to the experimenter (Sample 1) or by mouse-clicking on a button next to one of the response options (Sample 2). The question was "Which of these events do you remember most vividly?". The events were A and B for those in the Baseline condition, A, B and C in the Similarity condition, and A, B and D in the Attraction condition (see Table 1). For Sample 1, both the condition and the order in which the events were presented within a condition were counterbalanced by the experimenter so that each condition and each possible ordering of events within a condition were administered almost equally often. For Sample 2, the computer program randomly selected both the condition and the order in which the events were presented, resulting in approximately equal numbers of participants in each condition and event order. After making their response, participants were thanked and debriefed.

Results

Samples 1 and 2 produced qualitatively identical patterns of results; the data were therefore combined across samples for the main analyses to maximize power. (For brevity, The Queen Mother's death in Table 2 and Figure 1 refers to both that event and the Dunblane shootings.) Table 2 shows participants' responses in each condition. As expected, few people chose Event C in the Similarity condition and even fewer chose Event D in the

Attraction condition. Crucially, choices between Events A and B varied significantly in the predicted ways as a function of condition, $\chi^2(2, N = 515) = 5.98$, $p = .050$, Cramér's V = .108, with fewer choices of Event A in the Similarity condition and more choices of Event A in the Attraction condition, in comparison with the Baseline condition. Neither the similarity nor the attraction effect alone reached significance ($\chi^2(1, N = 330) = 1.14$ for Baseline vs. Similarity; $\chi^2(1, N = 363) = 2.00$ for Baseline vs. Attraction; both p's > .05) but the Similarity and Attraction conditions differed significantly, $\chi^2(1, N = 337) = 5.88$, $p < .02$, Cramér's V = .132.

The effects can be seen more clearly in Figure 1 where the percentages of participants choosing A and B (out of those choosing either A or B) are displayed for each condition. Numerically, the similarity effect (a swing of 5.8% from Event A to Event B compared with baseline) was slightly smaller than the attraction effect (an opposite swing of 7.4%). One reason for the relatively weak similarity effect may be that Event C was not a sufficiently strong competitor to Event A to exert much influence on relative choices between A and B (note that C was chosen by only 11 people). Another test of the similarity effect would therefore be to reverse the assignment of Steve Redgrave and Matthew Pinsent to Events A and C. This would then require a new Baseline condition with A = Matthew Pinsent and B = Queen Mother to compare with the old Similarity condition but with Events A and C reversed (i.e., A = Matthew Pinsent; B = Queen Mother; C = Steve Redgrave). Data were therefore collected from a further group of 80 Warwick undergraduates (*M* age = 21.3 years; *SD* = 4.1) who were asked to indicate which event they remembered more vividly: *Matthew Pinsent winning a gold medal in rowing at the Athens Olympics* or *The death of The Queen Mother* (order counterbalanced across participants). Their choices between Matthew Pinsent ($n = 30$) and The Queen Mother ($n = 50$) differed significantly from those in the Similarity condition of Sample 2[1] ($n = 8$ and 55, respectively),[2] $\chi^2(1, N = 143) = 11.11$,

$p < .001$, Cramér's V = .279. It can be seen from Figure 2 that this version of the similarity effect was larger than before, producing a swing of 24.8% from Event A to Event B on the inclusion of Event C.

Discussion

To summarise the findings, participants' judgments concerning the vividness of their memories for two dissimilar events (A and B) were influenced as predicted by the addition of a third event (C or D). Thus, there was a shift from A to B when the third event (C) was similar and competitive to A, and a shift from B to A when the third event (D) was similar but inferior to A. These shifts correspond, respectively, to the similarity and attraction effects observed in the decision-making literature (e.g., Huber et al., 1982; Tversky, 1972). The effects were quite weak (see measures of association), but the similarity effect was strengthened by increasing C's competitiveness over A. Effect sizes in the decision-making literature also tend to vary depending on the stimuli and task conditions (e.g., Kim & Hasher, 2005). Tversky (1972) observed similarity effects of 9% and 13% swings from baseline when choosing between college applicants and gambles, respectively. Huber et al.'s (1982) attraction effects when choosing between different brands ranged from 2% for films to 13% for cars, with an overall average of 9%, whereas Wedell (1991) observed an attraction effect of around 20%. The present effect sizes of 6% (Figure 1) and 25% (Figure 2) for similarity and 7% for attraction are therefore roughly comparable, despite the reduction in experimental control from using real-world events encountered outside the laboratory several years previously. Together, the results provide a novel demonstration that judgments about qualitative aspects of episodic memories, such as those outlined in the Introduction, cannot be made independently but instead are influenced by the context in which the events are presented.

One way to understand the present findings is in terms of two processes, attention-switching and lateral inhibition (cf. Roe et al., 2001). The similarity effect depends on the first process in which relative rather than absolute choices between options are made along a series of dimensions, with the outcomes integrated over time. In the present case, the notion of vividness or memorability is regarded as multidimensional with participants, either consciously or unconsciously, comparing episodic memories in terms of dimensions such as level of visual and/or auditory detail, emotionality, national/historical significance, recallability of personal circumstances and/or reactions at the time, and so on. When attention is focused on one dimension, A and C might be preferred over B, whereas when attention is focused on another dimension, B might then be preferred over A and C. Thus, the additional option C only takes away from its similar option A and does not affect the overall probability of choosing the dissimilar option B – hence the similarity effect. The second process of lateral inhibition explains the attraction effect as follows: Relative comparisons between D and the other two options A and B result in a negative preference state for D, which then feeds back through negative inhibitory connections to A and B. This produces a bolstering (disinhibitory) effect on nearby A but not on distant B because the connection between D and B is too weak. (In the present case, we make the common assumption that semantically related events such as Olympic victories have stronger associative links in memory than unrelated events such as an Olympic victory and the death of a public figure.) Thus, the inclusion of D enhances the strength of the dominant option A relative to option B – hence the attraction effect.

Our study raises the possibility that other effects identified in the decision-making literature could also be extended to judgments about episodic memories. For example, in the *compromise effect* (e.g., Pettibone & Wedell, 2000; Simonson, 1989), a third option, E, representing a compromise between A and B (e.g., a mid-priced flight requiring two stops

for the case in the Introduction) can be preferred in the ternary choice (ABE) even when it is not preferred in either binary choice (AE or BE). An interaction between the two processes of attention-switching and lateral inhibition can explain the compromise effect (see Roe et al., 2001). It remains to be seen whether suitable events can be constructed to test whether a compromise effect can also be found in episodic memory.

Other questions for future research include: (1) Do similarity and attraction effects apply to all episodic memories or are there exceptions, such as flashbulb memories (see Brown & Kulik, 1977)? (2) Do the effects apply to all individuals or are some groups less susceptible (e.g., for evidence that older adults show smaller attraction effects in decision-making than do young adults, see Kim & Hasher, 2005; Tentori, Osherson, Hasher, & May, 2001)? (3) Do the effects apply to other aspects of episodic memories in addition to vividness, such as relative recency judgments (Friedman, 1993)? (4) Do the effects apply to speeded as well as to nonspeeded conditions (see Roe et al., 2001, for discussion of differential effects of time pressure on similarity, attraction and compromise effects in decision-making)?

In conclusion, the present results demonstrate that at least two effects known in decision-making can be generalised to relative judgments about episodic memories. They therefore illustrate the value of combining insights from the memory and decision-making literatures, a point also emphasised by Dougherty and Sprenger (2006) in their study of the effects of irrelevant information in working memory on probability judgments.

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Author Note

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Correspondence concerning this article should be addressed to Elizabeth A. Maylor, Department of Psychology, University of Warwick, Coventry, CV4 7AL, England. E-mail: e.a.maylor@warwick.ac.uk

Footnotes

[1]Sample 2 was the appropriate comparison group for this new Baseline condition because the Dunblane shootings were not used.

[2]The remaining 35 participants in the Similarity condition of Sample 2 chose Steve Redgrave.

Table 1

Overall Ratings on Seven-Point Scales for Vividness of the Memory for Each Event and Conceptual Similarity Between Pairs of Events (N = 50)

Event		Vividness	
		M	*SD*
A	*Steve Redgrave winning a gold medal in rowing at the Sydney Olympics*[a]	4.64	1.68
B1	*The Dunblane shootings*[b]	4.52	2.00
B2	*The death of The Queen Mother*[c]	4.66	1.42
C	*Matthew Pinsent winning a gold medal in rowing at the Athens Olympics*[d]	4.40	2.19
D	*Jason Queally winning a gold medal in the 1km cycle time trial at the Sydney Olympics*[e]	2.38	1.82
Event Pair		Conceptual similarity	
		M	*SD*
A & B1	(Steve Redgrave and Dunblane)	1.12	0.35
A & B2	(Steve Redgrave and Queen Mother)[f]	---	---
A & C	(Steve Redgrave and Matthew Pinsent)	6.28	0.76
A & D	(Steve Redgrave and Jason Queally)	6.16	0.74

Note. B1 was used for Sample 1; B2 was used for Sample 2.

[a]Generally regarded as Britain's greatest-ever Olympian, Sir Steven Redgrave won an unprecedented fifth gold medal in consecutive Olympics in 2000 by a margin of 0.38 s in the Coxless Fours. [b]On March 13, 1996, Thomas Hamilton walked into the gym hall of Dunblane Primary School in Scotland and shot and killed 16 5-6 year-old children and their teacher (see Cullen, 1996). [c]Queen Elizabeth, The Queen Mother was Queen Consort to King George VI (1936-52) and mother of his successor, Queen Elizabeth II. She died on March 30, 2002, at Royal Lodge, Windsor, aged 101. [d]Matthew Pinsent CBE won his fourth gold medal in consecutive Olympics in 2004 by a margin of 0.08 s in the Coxless Fours. [e]Jason Queally MBE won his gold medal on Day 1 of the Sydney Olympics (the first of Britain's 11 gold medals in 2000). [f]Data not obtained.

Table 2

Numbers of Participants Choosing Each of Two/Three Events as the More/Most Vividly Remembered in the Baseline, Similarity and Attraction Conditions

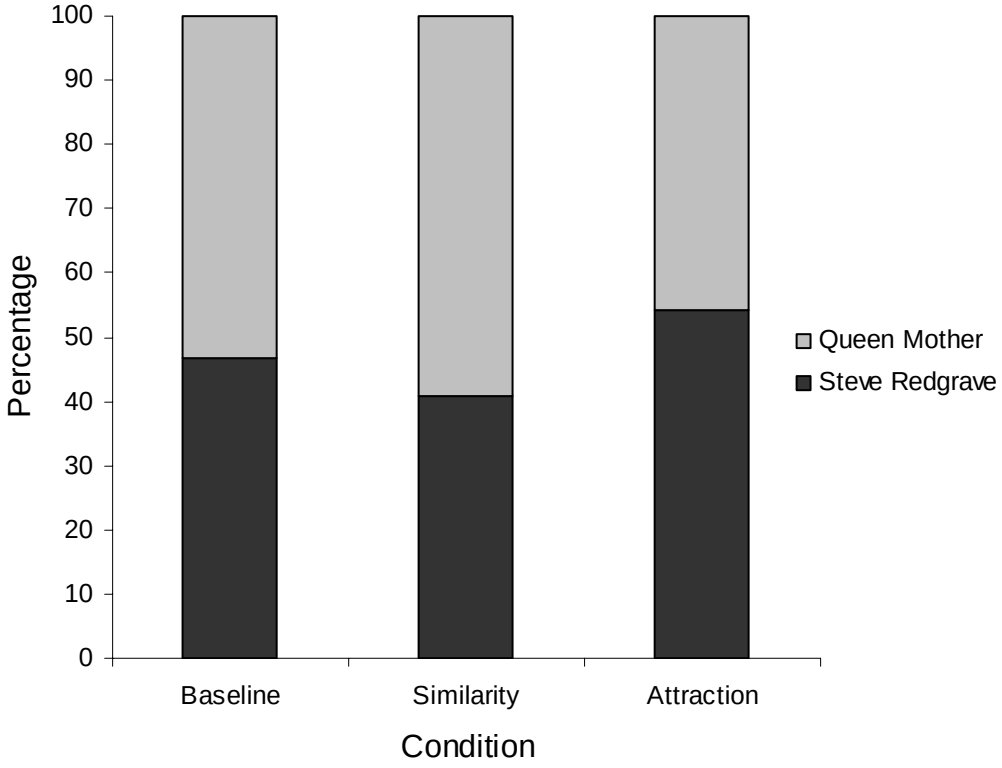
	Event			
Condition	A Steve Redgrave's victory	B Queen Mother's death	C Matthew Pinsent's victory	D Jason Queally's victory
Baseline	83	95	---	---
Similarity	62	90	11	---
Attraction	100	85	---	4

Figure Captions

Figure 1. Percentages of participants choosing Steve Redgrave's victory in Sydney (A) or The Queen Mother's death (B) as the event they remembered more vividly in the Baseline, Similarity and Attraction conditions of the main study. For the latter two conditions, participants choosing the additional event (Matthew Pinsent's victory in Athens [C] and Jason Queally's victory in Sydney [D], respectively) were ignored.

Figure 2. Percentages of participants choosing Matthew Pinsent's victory in Athens or The Queen Mother's death as the event they remembered more vividly in the Baseline and Similarity conditions of the reverse study (A = Matthew Pinsent; B = Queen Mother; C = Steve Redgrave). In the Similarity condition, participants choosing the additional event (C) were ignored.

Figure 1.


100
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Percentage
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Queen Mother
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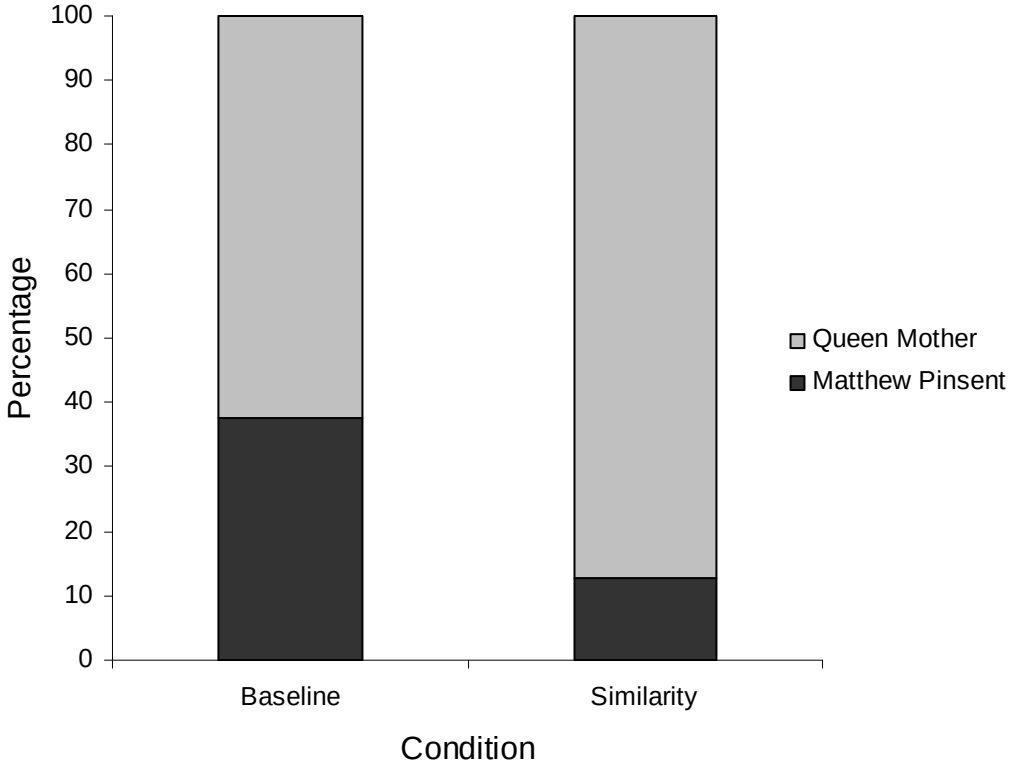
Figure 2.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