

"Be careful what you recall": Retrieval induced forgetting of genuine real-life autobiographical memories

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Complete List of Authors:	Somos, Eszter; University of Hull Mazzoni, Giuliana; University of Rome La Sapienza; University of Hull Gatti, Daniele; University of Pavia, Department of Brain and Behavioral Sciences Jellema, Tjeerd; University of Hull
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10 **Retrieval induced forgetting of genuine real-life autobiographical memories**
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17 Eszter Somos¹, Giuliana Mazzoni^{1,2*}, Daniele Gatti³, & Tjeerd Jellema¹
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21
22 ¹ *Department of Psychology, University of Hull, Hull, United Kingdom*
23

24 ² *Faculty of Medicine and Psychology, University La Sapienza, Rome, Italy*
25

26 ³ *Department of Brain and Behavioral Sciences, University of Pavia, Pavia, Italy*
27
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32

33 * Corresponding author:
34

35 Giuliana Mazzoni, Faculty of Medicine and Psychology, University La Sapienza; Department of
36 Psychology, University of Hull; *e-mail*: giuliana.mazzoni@uniroma1.it
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41 **Author note**
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Abstract

Which episodes from our lives will be remembered and which will be forgotten, and why? This question has still not been answered satisfactorily by research into autobiographical memory. Previous work has shown that retrieval-induced forgetting (RIF) might be a factor responsible for forgetting parts of the autobiographical memory content. However, none of the previous studies assessed RIF in memories for recent, controlled, personal events. We report here the results of an experiment in which autobiographical memories of real-life events were induced in a controlled, but fully naturalistic, manner, under the guise of team-building exercises, while an adapted RIF paradigm was applied to these memories. Results clearly showed the influence of RIF on autobiographical memory retrieval. These findings demonstrate conclusively that RIF occurs in everyday life when remembering personal events.

Keywords

Autobiographical memory, retrieval induced forgetting, output interference

Introduction

Research on autobiographical memory is typically concerned with the features of the remembered memories, their content and functions, and with the processes that lead to their retrieval. A question which is less frequently asked is what determines which episodes from our lives will be remembered and which will be forgotten (for a review: Eysenck & Groome, 2020; Vecchi & Gatti, 2020). One might be inclined to think that this is largely determined by the nature of the episodes, such as how important, emotional, or recent, they are (e.g., Berntsen & Rubin, 2002; Conway, Singer & Tagini, 2004, Wilson & Ross, 2003). However, laboratory-based memory research on non-autobiographical episodic memory has offered another intriguing perspective on why we forget: if memories A and B are associated with one and the same cue, then the retrieval process of memory A following presentation of the cue may have a dual effect: it strengthens the retrieved memory A, and at the same time weakens memory trace B. This phenomenon of forgetting due to selective remembering was first shown by Anderson, Bjork and Bjork (1994) and is referred to as retrieval induced forgetting (RIF; for a meta-analytic review see: Murayama, Miyatsu, Buchli & Storm, 2014; and for recent evidence see: Abel & Bäuml, 2020).

In the standard RIF procedure, participants learn items related to different categories (e.g., category 1: fruit, with items apple, orange, ...; category 2: colour, with items green, blue, ...). After the learning phase, in which all categories with their items were presented, a retrieval practice (Rp) phase takes place in which half of the items from half of the categories are practiced (Rp+), half of the items of these practice categories are not practiced (Rp-), and the remaining categories are not presented (Nrp), creating a baseline to measure retrieval. For example, during the practice phase, the participant is presented with 'fruit – a ____', where 'apple' should be retrieved, while 'fruit – o ____' is not presented and thus not practiced; the category colour is not presented at all. During the final test participants are presented with all category cues and have to recall as many of the related items presented in the initial learning phase as they can. Typically, there are two main findings: (i) A larger percentage of items that had been practiced in the retrieval practice phase (Rp+ items) is remembered, as compared to the percentage of items remembered from the non-practiced categories (Nrp), a process called *facilitation*. (ii) Crucially, the percentage of remembered non-practised items (Rp-) from the retrieval-practiced categories is lower than the percentage of remembered items from the non-practiced category (Nrp).

RIF has proved to be a robust effect, found for a large variety of stimuli (visual scenes: Shaw, Bjork, & Handal, 1995; mathematical operations: Phenix & Campbell, 2004; propositions: Anderson & Bell 2001; goals: McCulloch, Aarts, Fujita, & Bargh, 2008; motor actions: Tempel & Frings, 2013; self-relevant information about a social event: Glazier, Alden, & Graf, 2021; pictures: Scotti, Janakiefski,

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2 & Maxcey, 2020). In contrast, the role of RIF in autobiographical memories has been investigated
3 only scarcely. This is largely due to the very nature of autobiographical memories, which does not
4 easily allow for the kind of experimental manipulation required by the RIF paradigm. Most of the
5 studies of RIF on autobiographical memories that have been conducted (e.g. Harris et al., 2010; Hauer
6 & Wessel, 2006; Matsumoto, Mochizuki, Marsh, & Kawaguchi, 2021; Stone et al., 2012) followed
7 the method devised by Barnier et al. (2004). In the Barnier et al. (2004) study, participants were
8 presented in the elicitation phase with cue words (e.g., 'happy', 'work') and asked to recall several
9 episodic memories from their own lives in connection with each cue word. After receiving retrieval
10 practice for half of the memories from half of the categories, at the final test they had to recall all the
11 memories they had recalled during the elicitation phase. The problem with this design is that when
12 participants retrieve fewer Rp- memories than Nrp memories, then this could simply be due to
13 forgetting which specific memories they reported during the elicitation phase, rather than that the
14 autobiographical memories themselves were forgotten.

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16 In principle, this problem can be solved if, instead of using self-reported memories, one assesses the
17 retrieval of real, experimenter-controlled, events or experiences that happened to the participant.
18 There are some studies in which specific events happening in the laboratory are considered
19 autobiographical memories. For example, Koutstaal, Schacter, Johnson, and Galluccio (1999) asked
20 participants to perform 36 actions (e.g., hammering a nail, pouring beans into a container).
21 Participants returned to the laboratory two days later and did a retrieval practice on half of the actions
22 they had performed, cued by pictures of the same actions performed by actors (Experimental Rp+
23 and Rp- group), or did an unrelated task and received no retrieval practice (Nrp group). Twenty
24 minutes later they had to recall all the actions they had performed in the first session. This procedure
25 was very similar to a typical RIF experiment, except that the Rp+, Rp- and Nrp categories were tested
26 as between- rather than as within-subject variables. The results showed the RIF effect: participants in
27 the retrieval practice condition Rp- recalled fewer actions than those in the Nrp group.

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29 In another study (Sharman, 2011), participants either performed or observed familiar or bizarre
30 actions. All participants practiced half of the actions immediately after performing/observing them,
31 cued by the object names and one-word descriptions of the actions. RIF effects were observed in all
32 conditions (familiar/bizarre actions, performed/observed). Although in this study participants recalled
33 events that happened to them, the procedure did not allow sufficient time for memory consolidation.
34 Hence the tested memories were probably not genuine autobiographical memories.

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36 Two studies (Conroy & Salmon, 2005, 2006) have obtained RIF in a somewhat more ecologically
37 valid procedure in 5-6 year old children. The aim of their study was to assess the impact of selective
38 discussion on memory for non-discussed material. The children were asked to discuss (or not discuss)

1
2 a staged event. The authors found that memory for non-discussed aspects in the ‘discussed’ condition
3 was impaired compared to memory for the same aspects in the control no-discussion condition.

4
5 Glazier and colleagues (2021) asked participants to speak publicly regarding any topic of their choice
6 and provided a standardised mixture of positive and negative feedback on the speech. They reported
7 the classic RIF effect, thus extending the evidence about it also to social stimuli like positive and
8 negative feedback. However, evidence for RIF effects regarding first-person and real-life
9 autobiographic memories is still missing.
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13 Finally, Cinel, Cortis Mack & Ward (2018) reported autobiographical memory RIF effects across a
14 multiple-experiment study using a naturalistic design. In this study, the RIF effect was obtained in an
15 object-location-comment associations paradigm performed during a scavenger hunt game. This study
16 reported relevant findings regarding how end-of-day review can lead to augmentation in human
17 memory. In Cinel and colleagues’ (2018) study, the RIF effect was obtained on stimuli explicitly
18 encoded across different university locations and one could argue that, although participants
19 experienced the events in first-person in a real-like context, the memories encoded were not incidental
20 as a large part of humans’ autobiographical memories are.
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29 **The current study**

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31 The current study aims to solve some of the key problems associated with earlier studies investigating
32 whether RIF applies to autobiographical memories, by inducing genuine, real-life, experimenter-
33 controlled autobiographical memories in adults, rather than artificial, non-ecologically-valid
34 memories, as in earlier studies. The specific autobiographical memories are induced under the
35 disguise of ‘team-building exercises’ for groups (5-9) of undergraduate students on campus. The
36 team-building exercises consisted in total of 20 clearly distinctive and memorable games, divided
37 into two sets of 10 games, each set performed in a different location.
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40 We argue that there are several characteristics that make this study better suited to study RIF of
41 autobiographical memories than the ones before. We used controlled consolidated autobiographical
42 memories that were obtained in natural situations. While in previous studies the simple actions used
43 as items were atypical for the situation, as we can assume that one could not expect to be asked to
44 hammer a nail in a lab experiment, in the present experiment we used complex actions, which were
45 also consistent with the context presented for the study (which was introduced as a study on team
46 building). They followed a behavioral sequence that was in line with the proposed games.
47 Specifically, participants were recruited for a team-building session (there is nothing unusual about
48 such a request as teambuilding games are frequently used in Social Psychology studies) and the games
49 played were later used as the memory stimuli to be recalled in the subsequent phases. The memories
50 were therefore appropriate for the context, as it is not surprising to play games during a team-building
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1 session, and incidental, as participants were unaware of the real aim of the study. Additionally, games
2 were not performed in the lab, but in spacious rooms in which real team-building exercises could
3 have been held. For these reasons we believe that the memories refer to more complex personal
4 experiences, and that the single games were a natural part of the situation that participants were
5 experiencing. Additionally, while in classical RIF studies participants are instructed to study a set of
6 words, in our study participants' memory performance was fully incidental (i.e., they were unaware
7 of the real aim and were not asked directly to learn stimuli, but rather they were asked to play games)
8 and multimodal (i.e., it involved complex team-building games played in first person). Event
9 complexity, personal involvement, the presence of actions and social interaction, as well as lack of
10 intentionality during acquisition, represent key features of this procedure that ensures memories were
11 about personal experiences (i.e., autobiographical). The retrieval practice took place two days after
12 the games were played, leaving time for the memories to become consolidated into the
13 autobiographical memory system. There is ample evidence of autobiographical memories being
14 present after short and long time intervals, as most literature on this topic examines personal
15 memories after very long delays, not just hours and days, but also years (just to mention some recent
16 papers among the very large number that test autobiographical memories after short and long time
17 intervals, see: Addis, Moscovitch, Crawley, & McAndrews, 2004; Lempert, Speer, Delgado, &
18 Phelps, 2017; London, Bruck, & Melnyk, 2009; Simons, Ritchey, & Fernyhough, 2021). The
19 assumption that this time-lapse allowed for autobiographical memory consolidation is also based on
20 the evidence that sleep modulates humans' memory aiding its consolidation (e.g., Gais et al., 2007;
21 Stickgold, 2005; and for a review: Gais & Born, 2004). In this way the effect of retrieval practice on
22 real, consolidated, autobiographical memories could be measured. Therefore, a RIF effect obtained
23 under these conditions would indicate that RIF occurs in autobiographical memory.

Method

Power analysis

24 The minimum sample size was estimated through G*Power (Faul, Erdfelder, Buchner, & Lang, 2009)
25 using as effect size $d_z = .88$, $\alpha = .05$, $1-\beta = .95$. The effect size estimation was performed on the RIF
26 effect reported by Cinel and colleagues' (2018) in Experiment 2. The minimum sample size was 19.

Participants

27 In total 35 participants took part in the experiment in six groups of 5-9 participants. All participants
28 were undergraduate students from the University of Hull and participated in exchange for course
29 credit. Three participants who did not complete all 15 pages of the practice booklet were removed
30 from the analysis (see below). The remaining 32 participants consisted of 7 males and 25 females,

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2 with a mean age of 20.5 (SD = 2.5, range 18 – 28 years). The sample size was based on comparable
3 and sufficiently powered previous RIF studies (Hanczakowski & Mazzoni, 2013). It is also in line
4 with the classic study that first demonstrated the RIF effect (Anderson, Bjork, & Bjork, 1994; n = 36)
5 and most subsequent studies demonstrating the RIF effect (Murayama, Miyatsu, Buchli, & Storm,
6 2014).
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10 11 12 **Procedure and materials**

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14 Participants signed up on campus to participate in a two-sessions team-building experience, as part
15 of a study into how games help group formation. This was done to ensure the participants were
16 unaware of the real aim, which was to create specific autobiographical memories in a controlled
17 manner. The study contained three consecutive phases: an experience phase, a retrieval practice phase
18 and a test phase. Until the test phase, participants were unaware of the real aim of the experiment, as
19 we wanted to study the RIF effect using ecological paradigms tapping on incidental autobiographical
20 memory processes. Participants completed the experience phase across two different rooms and then
21 they were told that after forty-eight hours they had to come back to another room (i.e., the lab) to
22 complete the study.
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30 31 ***Experience phase***

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33 The experience phase included 20 games in total, which were played in two sets presented in a fixed
34 order due to the content of the games included in the two sets (i.e., the first set was planned to be an
35 ice-breaker session). The first 10 games (game set A) were played in a room in a building on campus
36 under the guidance of the experimenter (room 1). After completion they were told that they had to
37 leave the room because it was booked for somebody else but that they could continue in another room
38 in another building on campus (room 2). The experimenter and all participants walked together to the
39 new room, in which they played another set of 10 games (game set B). The two sessions were thus
40 performed in direct succession, separated only by the time needed to walk from one building to the
41 other (~ 5 minutes). The games played in the first room (set A) required the participants to sit on
42 chairs at fixed positions in the room throughout the session and the games also required them to talk.
43 The games in the second room (set B) required the participants to walk through the room, or to make
44 other bodily movements, throughout the session, but did not require them to talk. In the online
45 Supplementary Material we report the complete descriptions of the games included in both sets. The
46 purpose of these differences in the nature of the games between sets A and B was to boost the
47 formation of a link between the games played and the room in which they were played. Please, note
48 that participants were expected to be very familiar with rooms and buildings, as all the sessions were
49 performed in a specific group of buildings in which participants took lectures and where rooms and
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2 buildings are named after famous scientists. Game set A (sitting/talking games) was always played
3 first, as it included ice-breaking games, followed by game set B (walking/movement games). Four
4 rooms in two different buildings on campus were used. The interiors of the rooms were overall quite
5 similar. Rooms/buildings order was counterbalanced across participants and sets. Half of the
6 participants practiced games from set A, and the other half games from set B. Four possible booklet
7 sets were included in the practice phase (see below: *Retrieval practice phase* section) and were
8 completely counterbalanced across participants. In the test phase, half of the participants were shown
9 the final booklets starting with room 1, while the other half started with room 2 (counterbalanced
10 across the two sets).
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18 19 ***Retrieval practice phase***

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21 Forty-eight hours after the experience phase, the participants came to the lab (a different location
22 from rooms 1 and 2 of the Experience phase). Immediately upon arrival the retrieval-practice phase
23 started. During the procedure participants were still unaware of the real aim of the experiment, which
24 was only disclosed following the final test phase. To practice the retrieval practice phase, initially
25 each participant received a practice booklet, in which each page contained one location-game cue
26 pair (e.g., ROOM 250, Larkin Building – “I have never”). The participants had one minute to write
27 down in one or two sentences what they had done in that game. The experimenter indicated when the
28 minute was over, after which participants turned the page. For the actual retrieval practice phase, half
29 of the participants received booklets containing the names of five games from set A, the other half
30 received booklets containing the names of five games from set B. Participants were therefore divided
31 into four groups, depending on the practice booklets they received (containing cues referring to games
32 1, 4, 5, 7, 9 from set A; to games 2, 3, 6, 8, 10 from set A; to games 1, 4, 5, 7, 9 from set B; or to
33 games 2, 3, 6, 8, 10 from set B). Each ‘location – game’ cue pair was shown three times in the booklet
34 in a random page order. The retrieval practice phase took about 15 minutes. Directly after completing
35 the booklet a 20 minute ‘distraction interval’ started during which participants were required to play
36 a Sudoku puzzle.
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50 51 ***Test phase***

52 Directly following the distraction interval, participants received the final test booklets.
53 In these booklets the only cue provided was the room and building where games were played. Half
54 of the final booklets started with room 1, the other half started with room 2. This meant that half of
55 the participants started with the practiced category (Rp+) and the other half started with the not
56 practiced category (Nrp). They were asked to write down all the names of the games they remembered
57 being played in that room. It should be noted that the names of the games were chosen to reflect the
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2 unique details of the specific event, i.e. the name reflected the most characteristic aspect of the game
3 that uniquely defined it. Thus, we assumed that remembering the name of the game was virtually
4 equal to remembering the experience of the event. There was no time limit for completing the booklet
5 but once recalling games from one room was finished and recall from the other room had started no
6 more games could be added to the first room booklet.
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10 11 12 **Results**

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14 In the final test, the recall scores for Rp+, Rp- and Nrp items did not differ between the group that
15 started their recall with the room cue linked to the practiced items and the group that started their
16 recall with the room cue linked to the non-practiced items (room 1 vs room 2, Rp+, $t(30) = 0.28, p =$
17 0.78 ; Rp-, $t(30) = 0.293, p = 0.77$; Nrp, $t(30) = 0.82, p = 0.42$). There was also no difference between
18 the final recall rate of game set A ($M = 7.13, SD = 1.18$) and game set B ($M = 7.22, SD = 1.36$), $t(31)$
19 $= 0.337, p = 0.74$. To check that the games had similar memorability, the total amount of recall in the
20 final test was calculated for each game. Each game was recalled by at least 8 and maximally 31
21 participants. According to the Shapiro-Wilk test the distribution of the recall rates was not different
22 from the normal distribution ($S-W = 0.921, p = 0.1$).
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30 The final recall scores for the Rp+, Rp- and Nrp categories are shown in Table 1. As there were twice
31 as many potentially recalled games for the Nrp category than for either Rp+ or Rp- items, Nrp scores
32 were divided by 2 to make recall scores comparable for analysis. To assess the benefit of retrieval
33 practice, we first performed a one-way ANOVA having participants' memory performance as the
34 dependent variable and type of item (Rp+ vs. Rp- vs. Nrp) as the categorical predictor; in order to
35 exclude possible effects of which set was practised, such condition was included as an additional
36 between-participants factor (set A vs. set B). The effect of type of item was significant, $F(2,60) =$
37 $28.50, p < .001$. In particular, participants recalled significantly more Rp+ than Nrp items, $t(31) =$
38 $7.38, p < .001$, and fewer Rp- than Nrp items, $t(31) = -2.32, p = .04$ (Bonferroni corrected). The effect
39 of group and the interaction type of item by group were not significant, $F(1,30) = 2.01, p = .16$, and
40 $F(2,60) = .04, p = .95$, respectively.
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54 We further examined whether the decrease in recall of the Rp- items was due to output interference
55 rather than to the retrieval practice of the Rp+ items. Output interference refers to the possibility that
56 items recalled early during the final recall session (which are likely to be the Rp+ items) interfere
57 with the recall of subsequent items (which are likely to be the Rp- items; Roediger & Schmidt, 1980).
58 To examine if such an output interference effect may have contributed to the low recall of the Rp-
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1 items, we conducted an additional analysis. For each participant the average recall position of the
2 Rp+ and Rp- items was calculated. The average position of the Rp+ items ($M = 3.61$, $SD = 0.72$) was
3 indeed significantly lower than the average position of the Rp- items ($M = 5.21$, $SD = 1.03$; $t(31) =$
4 6.487 , $p < 0.001$), indicating that Rp+ items were output earlier. To investigate whether this difference
5 in recall positions of the Rp+ and Rp- items had an effect on recall rates we estimated a linear model
6 having participants' performance in the Rp- items as dependent variable and the difference between
7 the average recall position of the Rp+ and Rp- items as continuous predictor. The effect of the
8 difference between the average recall position of the Rp+ and Rp- items was not significant, $t(30) =$
9 $-.09$, $p = .92$, $b = -.01$, $BF = .33$, thus suggesting that output interference did not contribute to the
10 observed effects.
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21 Discussion

22 This study aimed to find out whether retrieval practice affects the forgetting of every-day consolidated
23 autobiographical memories. We obtained the expected retrieval practice effect for the Rp+ items ($Rp+ >$
24 Nrp), but also a retrieval induced forgetting effect for the Rp- items ($Rp- < Nrp$). Given the
25 limitations of the small number of previous studies assessing RIF in autobiographical memory, and
26 given the characteristics of the memories used in this study, the current finding represents the first
27 evidence that RIF occurs in real-life incidental autobiographical memory. The current study replicates
28 and extends the evidence reported by seminal autobiographical memory studies on RIF (Cinel et al.,
29 2018) by using more complex stimuli and experimental procedure. Cinel and colleagues (2018)
30 obtained the RIF effect in an object-location-comment associations paradigm performed during a
31 scavenger task. Consistent with their findings, here we show that the RIF occurs also for memories
32 encoded incidentally in real-life events.
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42 Specifically, the stimuli traditionally used in RIF studies, such as word lists, pictures and text
43 passages, are not self-relevant and more importantly are not embedded in an organized and
44 interconnected autobiographical knowledge base as autobiographical memories are. In studies that
45 did examine more complex memories, stimuli were not part of an autobiographical knowledge base
46 but very simple, random actions, unexpected in the specific context in which they were performed
47 (Koutstaal et al., 1999; Sharman, 2011) or, when expected, they were extremely simple (Glazier et
48 al., 2021). In contrast, the present study strongly indicates that retrieving personally experienced,
49 consolidated and interconnected personal episodic memories linked to a particular cue can cause the
50 forgetting of other similar memories linked to the same cue. The results are in accordance with RIF
51 effects induced by discussions of events in children (Conroy & Salmon, 2006) and by Cinel et al
52 (2018).
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2 The present finding of RIF for autobiographical memories is in line with the prediction from current
3 theories (Conway, 2005; Brown, 2005) claiming that specific autobiographical memories are
4 organized into categories. These categories can bind memories together based on chronological order,
5 geographical sameness, thematic similarities or causal relationship. In our study the team games were
6 grouped based on location (i.e., room, building) and type of activity (i.e., games played sitting vs.
7 standing). These elements (location and type of activity) can serve as retrieval categories similar to
8 the traditional semantic categories of RIF studies (e.g., fruits, animals).

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14 There are two main theories attempting to explain the mechanism underpinning the RIF effect.
15 According to the inhibition-based theory (Anderson, 2003; Anderson & Levy, 2002), to be able to
16 recall several specific memories associated with a cue, other memories associated with the cue need
17 to be inhibited. In contrast, interference-based theories claim that inhibition is not necessary to explain
18 RIF (McLoad et al., 2003, Raaijmakers & Jakab, 2013), retrieval of the items strongly related to the
19 cue (practiced items) interferes with the retrieval of weaker (not practiced) memories during the final
20 recall, without their memory traces being inhibited. We found that output interference is not supported
21 in our data. Specifically, the difference in position between Rp+ and Rp- did not predict participants'
22 memory performance in Rp- items. Thus, our findings are more consistent with an inhibition-based
23 account. Several studies on the RIF have shown the predominant role of inhibitory processes (for a
24 review Anderson & Hulbert, 2021). More recent reviews document how inhibition at retrieval is not
25 just one of the mechanisms that, by promoting memory loss, enhance other cognitive and non-
26 cognitive functions, such as facilitating retrieval of important information and minimizing errors. It
27 seems that these mechanisms might also affect directly more general mnemonic processes and create
28 some forms of amnesia in non-clinical individuals (Anderson & Hulbert, 2021). Moreover, the links
29 observed between memory-related inhibitory processes and frontal areas that exert control over
30 memory processes (Anderson, Bunce, & Barbas, 2016) insert such inhibitory processes as part of an
31 essential executive/control function in human cognition.

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45 However, the present data do not provide a direct falsification of an interference-based explanation,
46 as the output order was not controlled during the recall test by cueing individual test items. The choice
47 of not cueing individual items was taken in order to avoid possible ceiling effects, thus opting for
48 cueing using rooms and buildings names. In our study, thus, the contribution of inhibition vs.
49 interference processes in autobiographical memory cannot be fully disentangled and it is possible that
50 both processes are involved. As no independent recall cues were used in the final test, or retrieval
51 practice with extra study, we cannot claim that the RIF effect observed here is due only to inhibition
52 processes. We can only point to the fact that recall position did not predict memory performance as
53 a suggestion that interference might not have played a major role. Still, interference might have
54 contributed to some degree, as forgetting of Rp- items might have been in part due to the

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2 strengthening of Rp+ items at retrieval practice. While there is clear evidence that RIF is, at least
3 partially, the result of inhibition at retrieval (e.g., Verde, 2013; Del Prete, Hanczakowski, Bajo, &
4 Mazzoni, 2015), additional experiments are needed to examine its contribution to the effect.
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7 One might wonder why retrieval practice of items does not cause facilitation of the non-practiced
8 related items (Rp- items), since retrieval of one memory could in principle facilitate retrieval of
9 related memories, as suggested by e.g. spreading activation (Collins & Loftus, 1975) and associative
10 memory (Raaijmakers & Shiffrin, 1981). Indeed, previous studies found that under certain
11 circumstances, Rp- items were remembered better than Nrp items (Anderson et al., 2000; Chan,
12 McDermott, & Roediger, 2006). Two main features have been identified that may help explain why
13 sometimes a facilitation of the Rp- items is found. The first is the length of the delay between the
14 retrieval practice and the final test session. While after a short delay (20 minutes) RIF is typically
15 found, after a long delay (at least 24 hrs) some studies reported facilitation (e.g., Chan, 2009), which
16 may be related to the transient nature of RIF (Bjork et al., 2006). Note, however, that long-term RIF
17 effects have been reported (e.g., Garcia-Bajos, Migueles & Anderson, 2009; Storm, Bjork, & Bjork,
18 2012). The other identified feature is the extent to which the individual items are
19 semantically/temporally integrated (a process firstly showed by: Anderson & McCulloch, 1999; for
20 further evidence see e.g., Chan et al., 2006; Maxcey, Glenn, & Stansberry, 2018). Specifically, across
21 three experiments, Anderson and McCulloch (1999) showed that instructing participants to interrelate
22 category exemplars during an initial study phase reduced the RIF, thus suggesting that certain
23 semantic structures in which the items are particularly interrelated might be resistant to RIF. In our
24 paradigm, the delay between retrieval practice and test was relatively short (15 minutes) and all items
25 consisted of distinctly different, unrelated, games. This is likely causing the forgetting rather than
26 facilitation of Rp- items in the current study. In future studies, an independent cue (i.e., a different
27 cue which equally well discriminates between the two sets of memories) could be used to further test
28 the hypothesis that the RIF observed in autobiographical memory is better explained by the inhibition
29 account than by the interference account.
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32 Our finding that retrieval-induced forgetting of personal events occurs in naturalistic, yet staged,
33 scenarios, strongly suggests that it also plays a role in determining what we remember of our
34 spontaneous daily-life autobiographical experiences. We all know the saying “be careful what you
35 wish for”; perhaps we should also say “be careful what you recall”. The very act of recalling
36 autobiographical memories biases our view of oneself and of others due to suppression of related
37 autobiographical memories. One obvious real-world situation where this is particularly relevant is
38 eyewitness testimony (e.g., Laney & Loftus, 2018; Schacter & Loftus, 2013). The act of repeatedly
39 retrieving selected parts of a certain memory considered more crucial (the equivalent of the Rp+
40 retrieval phase) may, inadvertently, cause other related parts of the autobiographical memory (the
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2 Rp- items) not to be remembered. Thus, even though the eyewitness is entirely truthful in their
3 testimony, they could produce biased evaluations of others and of events due to RIF (see: Storm et
4 al., 2015, for an overview of real-world RIF applications within the autobiographical and other
5 domains).
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9 Finally, one main limitation should be acknowledged. In the testing phase, participants were only
10 asked to remember the names of the games they played in each room. From our perspective, the
11 names of the games represented a 'title' for a complex personal experience and asking for the names
12 of the games was a way to ask for the experience. This procedure in our opinion should have induced
13 participants to rely on autobiographical memories of the games played, besides being the best option
14 to ensure that participants' responses were fully quantifiable, avoiding the need to introduce
15 qualitative judgements of participants' responses. However, we acknowledge that more basic
16 episodic processes can be involved, and participants might have simply remembered, episodically,
17 just the titles of the games. Episodic processes are commonly involved in autobiographical
18 remembering (e.g., Schacter & Madore, 2016), but an autobiographical experience is certainly richer
19 than just remembering titles of games. In our study the names of the games were part of an
20 experience/encoding phase which was completely different from classical word-list RIF experiments
21 and was aimed at ensuring that memories of genuine personal experiences were created
22 (autobiographical memories). Games were not performed in the lab, but in spacious rooms in which
23 real team-building exercises could have been held. For these reasons we believe that the memories,
24 including the names of games refer to more complex personal experiences. The single games (and
25 their names used as cues) were a natural, integral part of the situation that participants had
26 experienced.
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30 In conclusion, we believe that by using self-relevant memories that are embedded in an organized,
31 interconnected, autobiographical knowledge base, the current study demonstrated that RIF plays a
32 role in determining which autobiographical memories are remembered and which are not.
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50 **Supplementary Material**

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52 The Supplementary Material is available at: qjep.sagepub.com
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Table 1. Number of recalled games at the final test.

	Mean (SD)
Rp+ (max 5)	4.53 (0.62)
Rp- (max 5)	2.94 (1.19)
Nrp/2 (max 5)	3.44 (0.64)

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