

Does Context Discriminate Recollection from Familiarity in Recognition Memory?

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Five experiments were conducted to examine subjects' ability to make contextual judgements about recognized items for which they report recollective experience or only familiarity within the context of the experiment. In the first four experiments, subjects were able to make judgements of the spatiotemporal context of items that were accompanied by recollective experience significantly better than for items they merely found familiar. In only one of the four studies did subjects display above-chance performance on spatiotemporal judgements for merely familiar items. A fifth experiment examined the frequency with which subjects report the presence of different kinds of contextual knowledge during a standard recognition experiment. All aspects of contextual knowledge were reported with higher frequencies for recollected items than for items only found familiar, although no single contextual feature was strongly associated with recollective experience. Thus, the five studies together provide converging evidence for the validity of the "recollect-know" distinction in recognition memory and supplement studies that have already demonstrated that the two kinds of response are dissociable. The implications of these data for group comparisons of memory-impaired patients, and the role of context in recognition memory are discussed.

There is currently considerable interest in what subjects are aware of when they remember. One way in which this interest has been pursued involves the use of a standard recognition paradigm in which subjects make a further discriminative judgement about each item that they claim to recognize (Tulving, 1985). For each recognized item, subjects have to indicate whether they recollect some aspect of their prior experience of the item (a

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“remember” or R response) or whether they simply know that the item was experienced earlier in the context of the experiment, but can remember no details (a “know” or K response). The veracity of their responses is established by asking subjects to justify two of their responses, randomly chosen at the end of the experiment. Further evidence that the responses, gathered in this way, measure something consistently is provided by strong evidence that several experimental manipulations, such as level of processing at encoding, affect the two responses in a different and repeatable manner (for example, Gardiner, 1988, Gardiner & Java, 1990; Perfect, Williams, & Anderton-Brown, 1995). It is nevertheless strange that no one has directly confirmed that R and K responses are reliably associated with accurate memory for different information, and, in particular, that R responses are associated with accurate contextual memory that is not associated with K responses.

A major reason for the current interest in the remember-know procedure is that many researchers believe that the reports are based on two separate memory processes: recollection and familiarity (Gardiner, 1988; Gardiner & Java, 1990, 1991; Gardiner & Parkin, 1990; Gregg & Gardiner, 1991; Parkin & Walter, 1992; Rajaram, 1993; Mäntylä, 1993). Recollection is believed to be an effortful retrieval process that yields information about associations between attended items and the situation in which they were experienced. In contrast, familiarity is believed to be an automatic retrieval process. Mandler (1980) was the first to advance the hypothesis that recognition depends on two separate memory processes. The first is recollection. The second is familiarity, a form of implicit memory based on intra-item integration that increases the fluency with which items are processed when they are perceived again. Jacoby (1992) has argued that subjects can use this increased fluency of processing to make an automatic attribution of familiarity, based on a non-specific feeling that the item has been encountered before. It is associated with no specific situation-specific contextual markers of the item. The remember/know procedure potentially offers a means to test Mandler's hypothesis in so far as the “remember” response provides a pure measure of the recollection process and the “know” response provides a pure measure of the familiarity process. An alternative means of tapping these two hypothetical processes is the process dissociation procedure, developed by Jacoby (1992), when it is applied to recognition paradigms. An example is provided by the application of this procedure in the “false fame” paradigm: It is assumed that subjects falsely attribute fame to previously studied unknown names when these feel familiar, and it is not realized that the source of the familiarity is the study episode because they do not recollect the names.

If the remember/know procedure is to be capable of throwing light on Mandler's hypothesis, not only must the “remember” response give a pure measure of recollection, but the “know” response must give a pure measure of familiarity. If subjects make “know” responses correctly, they should be indicating that an item is familiar in the context of the experiment. It is not clear, however, how they will follow this direction, because the notion of familiarity contains no reference to a specific context. Familiarity usually means that one merely thinks one has encountered the item before (in one or more *unspecified* contexts). Subjects may feel they should not give a “know” response to an item whose familiarity they specifically identify as deriving from presentation in the context of the experiment, but of which they have no recollective experience. They might give a

“know” response only to an item that is non-specifically familiar or to items that are weakly associated with the experimental context. If they do the latter, then “know” responses will not give a pure measure of familiarity. In contrast, if subjects make “remember” responses correctly, they should be aware of one or more contextual associations of each remembered item. In other words, the “remember” response requires some degree of recollection, although the nature of the information recollected is not specified.

The experiments described in this paper had two main aims. The first aim was to determine whether “remember” reports are associated with accurate memory for the temporal and spatial location of remembered items, and also to find out what kinds of recollective experience typically accompany “remember” reports. As the nature of the recollection is not specified by the instructions given with the remember/know procedure, it seems possible that what is recollected may vary across occasions. We therefore sought not only to validate “remember” reports by determining whether they are associated with reasonably accurate spatiotemporal memory, but also to find out how variable is the contextual memory that underlies the reports by identifying the kinds of recollective information subjects claim to be able to recall when they make “remember” reports. The second aim was to determine whether “know” responses are indeed associated with no specific spatiotemporal memories, and an inability to remember any other kind of contextual information. Of course, the remember/know procedure would be completely invalid if contextual memories were as available with “know” reports as they were with “remember” reports. However, even if “know” reports are associated with some degree of specific recollective memory, it would become extremely hard to argue that they are pure reflections of familiarity. If this turns out to be the case, then serious questions would be raised about the suitability of the remember/know procedure as a means of exploring the hypothetical underlying explicit and implicit memory processes.

Experiment 1 looked at whether subjects could remember when an item was experienced, relative to a set of presented items. Subjects were tested in the standard R–K paradigm and then asked to indicate separately for items they recollected or found only familiar the temporal order of the original presentation. It was predicted that subjects would demonstrate some knowledge of temporal order for items they recollected, but less or possibly none for items that were found familiar only.

EXPERIMENT 1

Method

Subjects

Thirty-six sixth-formers (students in their last two years of secondary education), who were visiting the University of Liverpool Department of Psychology on an Open day were tested.

Materials

Seventy words within the frequency range of 99–371 per million (Nelson & Kucera, 1982) were selected. All were between 4 and 10 letters long. Sixty of these words were used at presentation. Half of these were used at test, along with the 10 words not presented, mixed in a random order.

Procedure

Subjects were tested in small groups of 6 to 10 at a time. The experimenter instructed the group that the session would involve a memory test but did not specify the nature of the test. Subjects were told that they were to try to remember the material presented to them. The experimenter then presented the target words on an overhead projector, one at a time, at a rate of approximately 2 sec per item, with an inter-stimulus interval of around 1 sec. At the end of the list there was a brief pause of around 2 min while the response sheets were distributed. Subjects were then given a printed list of words and told that some of these were words they had just seen and some were new, and they had to indicate which they had seen on the overhead projector screen. For the words they recognized, subjects were instructed to indicate whether they actually recollected their prior occurrence (an R response) or just found them familiar in the context of the experiment (a K response). Thus, subjects had to distinguish between three states for each item—recognition with recollection, recognition without recollection, or not previously seen. The subjects made this three-way discrimination by writing down each word on the printed list in one of three headed columns on their response sheet. There was no time limit for this task.

After the subjects had responded to all the items on the recognition list, a second instruction sheet was distributed. This told the subjects that they were required to make a further discrimination concerning the items they remembered. For the words they claimed to recognize, they were asked to put them in order of their occurrence in the original list; subjects were instructed to do this separately for those items they claimed to recollect, and those they claimed to just find familiar—that is, they were instructed to order each column of items on their response sheet separately. Two subjects failed to meet this instruction and were dropped from the analyses.

Results and Discussion

Overall, a mean of 22.64 items were recognized from the original list, giving a hit rate of 75.5%. Of these, 13.58 ($SD = 3.95$) were R responses and 9.06 ($SD = 3.41$) were K responses. There were an average of 0.86 ($SD = 0.90$) false positives for R responses, and 2.86 ($SD = 1.76$) for K responses. For correct answers, this reflects a higher rate of K responses than has been reported previously, but is quite convenient for present purposes, as it means that there were fewer scaling problems in comparing the ability of the subjects to order their responses between R and K responses. If the subjects had split their responses in the usual manner, with an overwhelming majority of R responses, list length could have been an important determinant of the accuracy of the ordering.

For each subject, the Spearman rho correlation between subjective ordering of items and their actual order of occurrence was calculated. Obviously, the subjective orderings included false positives. As there can be no actual serial position for items that were not presented, these were omitted from the subjects responses, and the remaining responses were re-ranked prior to the calculation of rho. A Wilcoxon signed rank test was conducted on the resultant rho values, and there was a significant difference between the two conditions ($W+ = 139$, $n = 36$, $p < .0025$, one-tailed). The mean correlation for the R condition was $\rho = 0.447$ ($SD = 0.298$) and for the K condition it was $\rho = 0.171$ ($SD = 0.343$). Only the former of these mean correlations is greater than the critical value ($p < .05$) of rho for $n = 36$, which is $\rho = 0.331$.

Thus, the data support the original hypothesis. Subjects are better able to make temporal discriminations for those items that are accompanied by recollective experience than for those items that are found merely familiar in the context of the experiment. For these “know” decisions there is little evidence that subjects could reliably indicate where in the list the items occurred. These findings neatly dovetail with work recently conducted by Jones and Roediger (1995), who found that R responses show normal serial position effects, whereas the likelihood of a K response is independent of the serial position of an item in a list. This work indicates that R responses are sensitive to temporal order within a list, whereas K responses are not. Stronger evidence that the R–K distinction reflects the retrieval of different kinds of information is provided by the present data, and this supplements the data showing that they are dissociable responses. Furthermore, they are consistent with the notion that the basis of recollective experience is contextual information being available at retrieval. However, as was argued earlier, further evidence is required before it can be concluded that temporal order memory is the basis of the experience of recollection.

Four further studies were conducted that examined whether other kinds of contextual information distinguish the two kinds of response. The first of these examined whether subjects are able to discriminate between two separate lists of items presented at different times. It was predicted that for items that are recollected, subjects would be able to identify the list that the item came from at above-chance levels, but that this would not be the case for items that were merely familiar in the context of the experiment. In addition, for this study a follow-up condition was included to determine whether the same pattern of results is found with responses given with high and low confidence. Previous studies (e.g. Gardiner & Java, 1990; Parkin & Walter, 1992) have indicated that the R–K distinction is not the same as one based on confidence; nonetheless it remains an empirical issue as to whether confidence is associated with knowledge of associated context at test.

EXPERIMENT 2

Method

Subjects

Fifty-nine further sixth-formers who were visiting the University of Liverpool Department of Psychology on an Open day were tested; 28 of them were tested in using the standard R–K paradigm (henceforth the R–K group), and 31 were given a modified paradigm, which replaced the R–K distinction with confidence judgements (the Confidence group).

Procedure

The R–K Group. Subjects were instructed that they were going to have their memory tested. They were then presented with two lists of 21 words, one at a time, on a computer screen for 1 sec per word, with a gap of 0.6 sec between each word. There was a gap of 30 sec between the two lists, and a 2-min delay between presentation and test, during which the response instructions were given. At

test subjects were presented with a single list of 60 words, 30 of which had been presented earlier—15 from each list. Subjects were asked to discriminate whether each word was recollected, known, or not recognized. Following the recognition judgement, the subjects were asked to indicate which list they believed each item had come from. This entire procedure was then repeated exactly, with two new presentation lists, and a new test list. The data were collapsed across the two tests, to give a measure of recognition performance out of 60 items.

The Confidence Group. The procedure for this group was identical to the above, except that at test subjects were asked to indicate whether they recognized each item with high or low confidence or did not recognize it, rather than make the recollect/know/not-recognize judgement. This judgement was followed with the list discrimination task, as before.

Results and Discussion

The R–K Group. Subjects reported a mean of 23.93 ($SD = 9.27$) R responses, and 21.32 ($SD = 9.47$) K responses, which gave an overall hit rate of 75.4%. There were 4.46 ($SD = 5.28$) false positives for R responses, and 18.29 ($SD = 9.96$) false positives for K responses.¹ As in Experiment 1, there was a higher rate of Ks than has previously been reported, although for present purposes this enables comparison of success rates on the list discrimination task without the complication of scaling factors to consider.

There was a significant effect of response type on success in the list discrimination task: For R responses, the mean accuracy on the list discrimination task was 64.4% ($SD = 12.8$), and for K responses it was 51.2% ($SD = 21.2$). This is a robust difference, $F(1, 27) = 12.61$, $p < .01$. List discrimination for R judgements is significantly above chance, $t(27) = 5.39$, $p < .0001$, for K judgements it is not, $t(27) = 1.24$, n.s.

The Confidence Group. Subjects reported a mean of 30.2 ($SD = 8.98$) high-confidence responses, and 17.3 ($SD = 7.57$) low-confidence responses, which gave an overall hit rate of 79.2%. The false positive rates were 5.48 ($SD = 5.90$) and 22.0 ($SD = 10.99$) for high and low confidence, respectively. There was a significant effect of response type on success in the list discrimination task: For high-confidence responses, the mean accuracy on the list discrimination task was 70.7% ($SD = 13.2$); for low-confidence responses, it was 51.3% ($SD = 16.3$). This was a robust difference, $F(1, 30) = 21.38$, $p < .0001$. List discrimination accuracy for high-confidence judgements is significantly above chance, $t(30) = 8.05$, $p < .0001$, but for low-confidence judgements it is not, $t(27) = 0.52$, n.s.

The results for the R–K condition replicated those found in Experiment 1, in that the subjective report of recollective experience is associated with objective performance above chance on the list discrimination task. Conversely, when subjects indicate that they recognize but do not recollect, then their objective performance on the list discrimina-

¹ There was an unexpectedly high rate of false positive responses to K items in this experiment. This was also found for the items answered with low confidence. There is no obvious explanation for this. However, as we only examined the list accuracy of the correct responses, it was felt that the false positive rate did not compromise the findings. Our confidence in this judgement is reinforced by the fact that the results of this experiment are consistent with the other experiments in this paper, which do not have high false positive rates.

tion task is at chance. Note, though, that the same pattern of findings is found between items reported with high and low confidence. At first glance this pattern is contrary to the claim that the R–K distinction is not based on confidence. However, it might be expected that the R–K distinction would be associated with differences in confidence. Indeed, one might argue that increased confidence may arise from recollection of the context surrounding an event. This is the position advocated by Tulving (1985) in the article in which he originally introduced the R–K methodology. We will return to the issue of confidence in the general discussion. For present purposes, the data have again provided converging evidence for the utility of the distinction between R and K responses. The next study examined subjects' ability to make a contextual decision of a different kind; this time the test was for spatial rather than temporal information. Once again, it was expected that subjects would be able to indicate where they had seen an item that was recollected at test, but would be less able, or at chance level if they merely reported finding the item familiar.

EXPERIMENT 3

Method

Subjects

Thirty further sixth-formers who were visiting the University of Liverpool Department of Psychology on an Open day were tested.

Procedure

Subjects were tested in exactly the same manner as in Experiment 1, except for the following differences. Instead of presenting words singly at a rate of one item every 2 sec, the words were presented in sets of four, one word printed in each of four quadrants of a box, at a rate of 5 sec per box, with a 2-sec gap between boxes. Responses were collected in the same manner as Experiment 1, except that following the R–K decision, subjects were asked to indicate in which quadrant of the box each word had been presented. Subjects indicated the quadrant by writing down a number from 1 to 4 next to each of the items they claimed to recognize; a numbered key was given to each subject to specify the number for each quadrant.

Results and Discussion

On average 22.17 ($SD = 3.05$) items were recognized correctly, giving a hit rate of 73.9%. Of these, 14.36 ($SD = 3.78$) were R responses, and 7.80 ($SD = 2.55$) were K responses. This ratio of R to K responses is more typical of the pattern found in the literature, in contrast to Experiments 1 and 2. However, as the measure of contextual knowledge in this experiment is not related to the number of responses of each kind, as it had been with the temporal order measure, this was not felt to be a problem. The false positive rates were 0.67 ($SD = 0.88$) and 1.53 ($SD = 1.43$) for R and K responses, respectively. A one-way repeated-measures ANOVA was conducted on the proportion of items of each type accompanied by a correct target location. There was a significant difference between

the two conditions on this measure, $F(1, 29) = 4.64$, $p < .05$. Recollect decisions were accompanied by correct location decisions on 42.7% ($SD = 16.6$) of occasions, whereas for K decisions the figure was 32.9% ($SD = 20.7$). Both these figures are significantly above chance, $t(29) = 5.84$, $p < .0001$, for R decisions, $t(29) = 1.85$, $p < .05$, for K decisions, both tests one-tailed.

The significant difference between the two response types adds further support to the distinction between R and K responses. However, the fact that the subjects were significantly above chance for K responses indicates that, in this study, there was some knowledge about where an event occurred available for those items reported as being merely familiar within the context of the experiment. Why should subjects be able to distinguish spatial location, but not temporal order, or membership of a list when they report only finding the item familiar? One reason might be that somehow the spatial information is not regarded by the subject as sufficient to warrant a "recollect" response—that is, a subject may remember roughly where something happened, but not regard this as a recollection. Given that the spatial context information only consisted of a coarse 4-way choice, this means that each item will share its "context" with a quarter of the other items. Thus, knowing the location is not very informative for any one item, and it may not be associated with a recollective experience so readily. On the other hand, temporal context, and relational context (which items were next to each other) uniquely specify each item in the previous two experiments, even though, ultimately, in Experiment 2, subjects were required only to distinguish between two lists. Thus, in this argument, in the first two experiments, the subject may remember, roughly, when an event happened, and this will lead to recollection because time and relational context are unique. Remembering where something happened in the context of Experiment 3 is not unique and so is more likely to be regarded as a "know" response.

Another possibility is that subjects are somehow able to use non-spatial information to guide their answers in the location task. In this experiment, subjects saw four items at once; perhaps subjects might somehow use this fact to their advantage when guessing the location. One such strategy that might raise performance marginally above chance would be if a subject remembered one of the four items in a particular location (say, the top right quadrant). Then, for the remainder of items, the chance of correctly guessing the location would become 1 in 3 rather than 1 in 4, which is the assumed baseline. No doubt other strategies could be adopted to constrain guesses and provide above-chance location performance without recollective experience. However, such accounts are dangerously post-hoc. In order to determine whether such strategies might play a role, we decided to rerun Experiment 3, but this time presenting items one at a time randomly in one of the four quadrants of the box. The aim was to prevent subjects developing a preference for studying one particular quadrant, which could later be used to constrain guessing.

EXPERIMENT 4

Method

Subjects

Twenty-nine undergraduate volunteers from Bristol University were recruited to take part in this experiment.

Procedure

The procedure was identical to Experiment 3, except that the words were printed one per box and presented one at a time for 2 sec per box, with a 2-sec interval between each item and the next.

Results and Discussion

On average, 25.03 ($SD = 3.11$) items were recognized correctly, giving a hit rate of 83.4%. Of these, 18.0 ($SD = 4.62$) were R responses, and 7.03 ($SD = 3.91$) were K responses, with 0.31 ($SD = 0.81$) and 1.55 ($SD = 1.32$) false positives for R and K responses, respectively. This ratio of R to K responses was highly similar to Experiment 3. A one-way repeated-measures ANOVA was conducted on the proportion of items of each type that was accompanied by a correct target location. There was a significant difference between the two conditions on this measure, $F(1, 28) = 7.48, p < .02$. Recollect decisions were accompanied by correct location decisions on 41.2% ($SD = 19.2$) of occasions, while for K decisions the figure was 28.8% ($SD = 21.1$). For R decisions the ability to identify location is significantly above chance, $t(28) = 4.53, p < .001$, one tailed, whilst for K decisions performance it is not, $t(28) = 1.00$, n.s.

The results are in line with those reported in the previous experiments. As in the first three experiments, there were reliable differences between items recognized with recollective experience and those found familiar only. In line with Experiments 1 and 2 the subjects' ability to make contextual judgements in the absence of recollective experience was at chance. This is in contrast with Experiment 3 where spatial location judgements for K decisions were just above chance. It should be noted that the level of performance in the spatial location judgement for K items was similar across Experiments 3 and 4 (32.9% vs 28.9% for Experiments 3 and 4 respectively), so perhaps not too much should be made of this difference. However, given the pattern of findings across all four experiments, perhaps the safest conclusion is that there is reliable evidence that recollected items are associated with above-chance knowledge of context, whereas for familiar only items, there is little or no evidence of above-chance knowledge of context.

Before discussing the overall implications of these studies, there is one further interesting issue to be explored. Throughout the studies presented so far, we have expressed the accuracy of contextual decisions as the proportion of items (R or K) that are accompanied by correct contextual information. However, to claim that this represents the accuracy of contextual knowledge available to subjects assumes that the contextual information subjects are using to make their recollective judgement is the same as that being tested. For example, if 40% of locations are correctly identified, then there are two

possibilities: either the contextual knowledge for location is vague for all items and allows above-chance performance without precision, or, alternatively, for some items spatial location is recollected exactly, whereas for other items it is completely absent. Recollective experience might occur for many facets of context, and if this is the case, to examine only one of these at a time will underestimate the differences between R and K, because there may be occasions when an item is recollected because of contextual attribute X when we are comparing R and K items for attribute Y.

In this final study, we were less interested in determining the accuracy of contextual knowledge that subjects demonstrate, than in the kinds of contextual knowledge they claim to have available at test. There are two aspects to this: How often do subjects report context of any kind for items they recollect or find familiar, and what kinds of contextual knowledge do they claim to have? In order to examine these two points, we reran Experiment 3, but with the extra facet of printing the materials in a mixture of fonts to see how important physical appearance was at study. At test we did not test accuracy of spatial knowledge but simply asked subjects to indicate what aspects of the initial experience they remembered for each item.

EXPERIMENT 5

Method

Subjects

Twenty undergraduate volunteers from Bristol University were tested individually. Their mean age was 20.8 years ($SD = 1.74$).

Procedure

The experiment was identical to Experiment 3, except for the following changes: Subjects were tested individually, using printed sheets to present materials rather than an overhead projector. Subjects were shown the same boxes of words as before, but this time each word in the box was printed in a different, distinctive style (though all were 18-point size). Four styles were used, randomly allocated to each quadrant on each trial (Times New Roman regular, Times New Roman capitalized and italicized, Colonna MT capitalized, and Broadway WP capitalized). An example of the materials used is given in Figure 1.

With the exception of the above changes, the initial presentation and subsequent classification of responses at test into R, K, and new responses was exactly as Experiment 3. However, rather than a test of memory for spatial location, the subjects were given a second test sheet, which listed the same test items in the same order, but with several response options that subjects could tick if they remembered that particular aspect of the prior experience. Subjects were given an instruction sheet with the following explanation:

We are interested in your experience of memory. You have just indicated that you remember seeing certain words earlier in the experiment. Now we would like you to indicate what in particular you remember about that original experience. We have generated several kinds of information you may bring to mind when you recognise a particular item. What we would like you to do is for each item on the list provided, is to tick the boxes that correspond to your

<i>EDITOR</i>	DINNER
goal	WEIGHT

FIG. 1. An example of the kinds of material used in Experiment 5.

experience for that particular item. If you can't use our categories, please specify your experience in the "Other" box.

The categories

When: you remember roughly the position of the item in the list, or the time at which you saw it.

Where: you remember where on the page the item appeared.

Visual appearance: you remember something about how the item looked (e.g. font, size) when you saw it in the list.

Associations between items: you remember thinking of a link between the item and another item in the list.

External associations: you remember thinking of a link between the item and your own experience (e.g. the item reminded you of something).

Imagery: you remember forming an image of the item when you saw it in the list.

Other: you remember the item for some other reason than those listed above

Subjects were informed that for each item they could tick as many of the categories as they wished.

Results and Discussions

On average, 23.95 ($SD = 2.70$) items were recognized correctly, giving a hit rate of 79.8%. Of these, 17.55 ($SD = 4.74$) were R responses, and 6.40 ($SD = 3.97$) were K responses, giving a ratio of R to K responses was similar to Experiments 3 and 4. The false positive rates were 1.80 ($SD = 1.40$) for R responses and 1.60 ($SD = 1.43$) items for K responses.

R and K responses were then separated and examined to see what aspects of contextual knowledge were associated with each. As there were different rates of R and K responding, these frequencies of each kind of contextual knowledge were expressed as percentages of the total number of each kind of response. These percentages are shown in Table 1.

There are three points of particular note in Table 1. The first is that subjects failed to mark one of the categories offered for R responses for only 6.1% of items on average, indicating that R responses are reported as being accompanied by some aspect of contextual knowledge on 93.9% of occasions. The corresponding figure for K responses is 32.2%. Thus it is clear that although subjects believe they recollect something almost every time they respond with an R, it is not the case that they recollect nothing for K responses. For roughly a third of their K responses, they report some aspect of contextual knowledge. This implies either that subjects misunderstand the instructions or that they feel that their knowledge of context, though present, is not enough to warrant an R response; that is, they may have a different criterion for ticking one of the context categories than they have for responding R. The second point of note is that no one aspect of contextual knowledge dominates. External associations were the most commonly reported contextual knowledge for R responses, but this only occurred for around a quarter of the items. All contextual categories were reported with frequencies between 13% and 26%. The final point is that the category that is reported least is the *Where* response, which in fact does not reliably differ between R and K responses. This is interesting because the location experiment (Experiment 3), which is most similar to this experiment, gave slightly less clean-cut data than the other studies. This supports the idea that recollecting where an item is printed on a page is perhaps less central to recollective experience than remembering when it occurred or which items were associated with it.

TABLE 1
Experiment 5: Percentage of Occasions That Each Response Type Was Accompanied by a Report of Knowledge of Contextual Information

Context	Response Type		
	Recollect ^a	Know ^a	
When	15.0	3.4	$t(19) = 2.02, p < .05$
Where	13.5	4.7	$t(19) = 1.60, n.s.$
Visual appearance	22.0	5.3	$t(19) = 2.56, p < .01$
Item associations	22.1	8.8	$t(19) = 3.20, p < .01$
External associations	25.5	7.2	$t(19) = 4.14, p < .001$
Image	19.3	7.2	$t(19) = 2.92, p < .01$
Other	0.5	0.0	+
Multiple categories	23.2	3.6	$t(19) = 3.79, p < .001$
Nothing	6.1	67.8	$t(19) = -6.54, p < .001$

^a In percentages.

Note: + insufficient data to analyse—only 2 “Other” responses were recorded.

GENERAL DISCUSSION

The five experiments together constitute strong evidence that subjects are better able to provide contextual information of varying kinds for items they claim to recollect than for items they report as finding only familiar in the context of the experiment. These experiments represent the first attempt to test directly the assertion that R and K judgements are reliably associated with different kinds of knowledge about the item. This supports the distinction between these two kinds of response and supplements the studies reported above that have shown that the two response types are experimentally dissociable.

Whether the presence/absence of contextual information is the basis of the distinction between an R or K response is another matter. Experiments 1, 2, and 4 suggested that subjects have no knowledge of spatiotemporal context for familiar-only items, but Experiment 3 suggested that subjects have diminished but above-chance level knowledge of the context of familiar-only items. Experiment 5 also indicated that K responses are associated with reduced levels of contextual knowledge, rather than no contextual knowledge at all. Thus the interpretation of K responses remains problematic; although it is tempting to argue that K responses reflect a pure context-free familiarity process, it is difficult to rule out the idea that such responses are based on low-level memory for the context in which the information was learnt, or that this kind of memory interspersed with mere familiarity underlies K responses.

There are two issues here that need to be disentangled: whether R and K responses correspond to two separable memory processes, and whether K responses reflect a context-free familiarity process. On the former point, the most plausible single process account would claim that R and K responses reflect the operation of a single underlying recognition memory process, with R responses merely reflecting greater strength of this process. However, strong evidence against this position and in favour of a two-process account is provided by Rajaram's (1993) priming study, which showed that subliminal priming at test increased recognition and K responses, but not R responses, even though it also increased confident (strong) recognition responses. This indicates that subliminal priming selectively affects a familiarity process underlying K responses rather than merely influencing performance based on a single recognition memory process that is weak. In other words, this study supports a dual-process account of the R-K procedure, which provides the framework within which our results should be interpreted. Regarding the second point raised earlier, our work suggests that K responses do not amount to a pure measure of familiarity, as in Experiments 1 to 4 specific kinds of context memory associated with K judgements are always above chance (if not always significantly so), and in Experiment 5 a sizeable minority of K responses were accompanied by reports of contextual knowledge of one kind or another.

The first impression from Experiments 1-4 is that subjects have far from perfect recollection of the context of recollected items. In Experiment 1, the mean rho correlation was $\rho = 0.447$; in Experiment 2, subjects identified the correct list on only 64.4% of occasions; in Experiment 3, subjects were able to locate the item on only 42.7% of trials, and in Experiment 4 the equivalent figure was 41.2%. These experiments show that subjects often claim to recollect without having accurate spatio-temporal memories. It

appears there are many items that are reported as being recollected but for which there is no evidence of memory for specific contextual features. Either subjects are retrieving incorrect information about the context and are using this as the basis of the judgement of recollection, or they are using a different source of information. Experiment 5 sheds some light on this issue.

It appears that subjects exhibit a wide range of contextual knowledge for the items tested, and that no single piece of contextual knowledge is dominant. This has several implications. It means that for Experiments 1–4, the estimates of the accuracy of contextual knowledge are underestimates, as subjects only report a particular kind of contextual knowledge on between 0% and 26% of occasions and yet are tested on all items. This means that the absolute level of accuracy for different kinds of contextual knowledge that is available for a particular response remains untested. It may even be that the very few occasions on which subjects report recollective experience for K responses are in fact highly accurate. However, as there are so few of these (< 9% for all kinds of context), then, overall, performance for K will not differ from chance. Thus the implication of Experiment 5 is that it is difficult to draw separate conclusions about the accuracy and amount of contextual knowledge demonstrated for items recollected and those considered only familiar.

The data from Experiment 5 invite the question of what conclusions to draw about those items for which subjects report some aspect of contextual knowledge yet give a K response. It would be tempting to classify these simply as mistakes by the subjects. This would allow for a clear dichotomy to be drawn between R and K responses, with the latter reflecting a context-free familiarity process. However, we believe that this is inappropriate. There are simply too many such responses to be dismissed. One third of all K responses are accompanied by some kind of contextual knowledge. Almost 4% of responses are accompanied by more than one kind of context. This seems to us to represent evidence of a continuum of contextual knowledge along which subjects are required to draw a distinction between recollection and knowing. This is not to say that there might not be a context-free recognition process; it is simply that K responses do not uniquely draw upon such a process. Further work is required to determine the extent to which K responses are influenced by the recollective memory process.

There also remains the question as to whether the quality, or uniqueness, of the contextual information is relevant to the occurrence or otherwise of R or K responses. For Experiment 3, the contextual information was based on four possible locations, and, in Experiment 2, on two lists. It is perhaps not surprising that such crude measures of context showed only moderate relationships with reported recollective experience. Future research will need a more sophisticated notion of context to determine what information is being utilized by individuals when they experience recollection of a past event, and exactly what information they use to make the decision that an item is, or is not, “recollected”. Experiment 5 is one attempt at such research, but the current data cannot be used to determine the veracity of each kind of contextual knowledge claimed by the subjects.

The studies also have implications for studies that seek to compare groups of amnesics (or elderly adults) with “normal” subjects on recognition memory. If the two groups are matched on level of recognition, this does not mean that they are matched on the type of

recognition the subjects are experiencing. Recent work has shown that although recognition memory in elderly people is little impaired relative to the recognition memory of the young, it is associated much more strongly with mere feelings that the items are familiar in the context of the study (Fell, 1992; Parkin & Walter, 1992; Perfect et al., 1995—although see Mäntylä, 1993, for a different claim). If so, one would expect the elderly to be far worse at remembering contextual details than young people, despite their relatively preserved recognition memory. This would indicate that their recognition is qualitatively different from the young.

Although amnesics have very impaired recognition memory, it has been claimed that when their recognition is matched to that of normal control subjects by giving amnesics more learning opportunity and/or testing them at shorter delays, they still show impairments in remembering various aspects of context, including spatial, temporal, and sensory modality information (see Mayes, 1988, for a review). These disproportionately severe context memory deficits suggest that even when the recognition memory of amnesics is matched to that of their controls, it differs qualitatively in that most of the items they recognize will be associated not with recollection, but with a mere feeling of familiarity. This suggests that amnesics are either less impaired at familiarity than recollection or not impaired at all. The findings of Experiment 5 indicate that the Tulving–Gardiner procedure may not be appropriate for assessing this claim because the K response does not provide a pure measure of familiarity. However, the process dissociation procedure may be appropriate for this purpose. In fact, we are currently investigating whether amnesics show preserved familiarity using a modified version of the procedure with the false fame paradigm, and although our earlier work suggested that amnesic familiarity was completely preserved (Mayes, Van Eijk, & Isaac, 1995), our results with a revised procedure have made us less sure about this view.

The present data, although not directly testing the issue, have some pertinence for the issue of context effects on recall and recognition. Context dependency effects are often found with recall but not with recognition (e.g. Godden & Baddeley, 1975). One reason suggested by the present data is that recognition contains an element that is independent of context. This idea is not new, but the data offer a different perspective from previous studies. Whereas previous studies have shown that recognition is not affected by context, the present work shows that one aspect of recognition occurs without subjects being able to distinguish context much above chance levels. There are two possibilities that may follow. The first is that the more K responses are found within the recognition conditions, the less likely there is to be a context effect. Another view is that although R responses in recognition could be affected by context, K decisions may be available as a context-free basis for recognition should recollection fail, so that, overall, recognition levels do not change with context. This idea has yet to be tested.

The final area that is in need of further consideration is that of the relation between confidence and recollective experience. Many of the previous studies have striven to demonstrate that the R–K distinction cannot be reduced to merely one of differences in confidence in recognition judgements. This applies to Rajaram's (1993) study, referred to earlier, which found that subliminal priming selectively affected K responses but influenced confident and unconfident recognition responses to the same extent. The same pattern of findings has been found by others. Thus, Gardiner and Java (1990)

showed that for non-words, subjects reported more K and fewer R responses than for words, but in a condition where subjects had to choose between “sure” and “not sure”, the word/non-word factor did not make a difference. Similarly, Parkin and Walter (1992) found that whereas age had a major effect on the number of items leading to an R responses, in the sure/not-sure condition there were no age differences. Perfect et al. (1995) also found that although older adults reported less recollective experience for the items they recognized, nonetheless they were just as confident as younger adults that the items came from the original list. However, in the original study conducted by Tulving (1985), he reported that subjects were more confident in responses that they recollected. In fact, he went further, arguing that confidence in responses was one of the functions of recollective experience:

If recovery of information about past events can occur independently of episodic memory and auto-noetic consciousness, why should the episodic system and auto-noetic consciousness have emerged at all in the course of evolution? One possible answer to this question, supported by the data showing positive correlation between confidence ratings and “remember” judgements in our second experiment, is that the adaptive value of episodic memory and auto-noetic consciousness lies in the heightened subjective certainty with which organisms endowed with such memory and consciousness believe, and are willing to act upon, information retrieved from memory. (pp. 9–10)

In this view, confidence and recollective experience should go together, as was found in the second experiment presented here. However, this does not mean that the distinction is *merely* one of confidence, but that increased confidence is an outcome of the fact that more (contextual) information is available when an item is recollected. The distinction between R and K responses remains central, and the differences in confidence are a result, rather than an explanation, of the dissociations found. Of course, confidence may come from factors other than the availability of associated information, so it should be no surprise that it is possible to show dissociations between confidence judgements and R–K judgements. Clearly, further work is required to determine the relationship between consciousness and certainty that an event has occurred before.

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