On the Long-Term Retention of Studied and Unstudied U. S. Coins[1]

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Abstract

The present study addresses the issue of whether visual information is retained well or not, using the Nickerson and Adams (1979) familiar task of recalling a U. S. penny. Although Nickerson and Adams' findings suggested poor retention of visual detail, earlier recognition memory studies suggested very good retention. An unfamiliar liberty dime was used to assess the durability of a one-minute study period for an unfamiliar coin. Recall performance on the unfamiliar dime was better than recall performance on the familiar penny even when the test on the dime was delayed for one week. The order in which recall of the penny or dime occurred significantly affected performance with the prior unaided recall of the penny enhancing the subsequent recall of the studied dime. These findings document the importance of intentional study on memory for details of a common object and suggest that with intentional study good retention can be obtained for visual details of such objects.

Introduction

Nickerson and Adams' (1979) experiment showing poor memory for the features of common U. S. pennies has had a peculiar impact on the literature of cognitive psychology. On the one hand, it has inspired very few direct follow-up investigations either challenging or expanding upon its methodology and conclusions. But on the other hand, it has made its way into numerous introductory cognitive psychology textbooks (see, e.g., Bourne, Dominowski, Loftus & Healy, 1986, pp. 113-114, Medin & Ross, 1992, p. 165, and Reed, 1992, p. 173) in the context of discussions of the failure to retain visual information and the possible limitations of images as mnemonic devices. Nickerson and Adams contrasted their subjects' failure to retain visual information with the remarkable success of subjects in Shepard's (1967) demonstration of recognition memory for hundreds of pictures. Whereas Nickerson and Adams' remarkable study lends itself well to classroom demonstration (Shimamura, 1984) and has been replicated and extended in several directions (e.g., Foos, 1989; Jones, 1990; Jones & Martin, 1992; Kikuno, 1991; Rubin & Kontis, 1983), no studies have attempted to reconcile the apparent contradiction of the findings by Nickerson and Adams (1979) and Shepard (1967). Our study aims to do so by examining the effect of intentional study of U. S. coins. Of the several memory tests employed by Nickerson and Adams (1979), the recall test (i.e., the test in which a subject was asked to draw a U. S. penny without any aids) was the one used in the present experiment.

Nickerson and Adams (1979) never asked their subjects to *study* a U. S. penny to see how long it would take for them to learn its features; they were simply interested in how well subjects remembered the features of a U. S. penny. But given that a U. S. penny is a very familiar object, and given that people presumably glance at it almost every time they use it, it is worthwhile to ask how long it would take for individuals to learn its features. Because different subjects may have spent different amounts of time prior to the experiment looking at a U. S. penny, we decided to use a novel coin: a 1941 liberty dime (out of mint) to consider this question. The liberty dime has the two-fold advantage of both (a) being a coin that most college-age students have not seen and (b) being a coin that contains all of the same features as a common U. S. penny (see Figure 1). We address the issue of learning time by comparing the recall of the liberty dime after a one-minute study period to the recall of a U. S. penny with no prior study.

An exhaustive search of studies which cited Nickerson and Adams (1979) revealed no studies

Figure 1. The four faces of the liberty dime and the U. S. penny.

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providing either the answer to the question of the durability of the memory trace for the features of a newly-learned coin or the answer to the question of the amount of time required to learn the features of a coin in the first place. With respect to the U. S. penny, it is unclear whether people never study its features in a meaningful way that is recallable later, or whether perhaps they learn its features and then forget them quickly or, less likely, even learn and forget the features over and over again. To examine the effects of a retention interval on a studied coin, we tested subjects either immediately or one week after initially studying the liberty dime. We examined what, if anything, they had forgotten about the specific features of the coin over the retention interval.

Finally, we addressed questions concerning the influence that learning the unfamiliar liberty dime has on recall of the familiar U. S. penny and, conversely, the influence that recall of the familiar U. S. penny has on study of the unfamiliar liberty dime.

Method

Design

The present study used a four-way mixed design with two between-subjects factors -- test order condition (penny-first or dime-first) and retention interval group (immediate or delayed) -- and two within-subjects factors -- coin (penny or dime) and feature (front figure, word "LIBERTY," words "IN GOD WE TRUST," date, mint, words "ONE DIME" or "ONE CENT," words "UNITED STATES OF AMERICA," words "E PLURIBUS UNUM," and back figure). Eight subjects were tested in each of the four subsets defined by the two between-subjects factors. Table 1 outlines the design and tasks performed by subjects.

Subjects

Thirty-two undergraduate men and women from the University of Colorado participated as subjects in partial fulfillment of requirements for an introductory psychology course.

Materials and procedure

For both the penny and dime recall tasks, subjects were given an 8.5 x 11 in. sheet of paper with two four in. circles. Subjects were timed using a stopwatch and were given two minutes for each recall test phase and one minute for the study-dime phase. During recall, if subjects indicated that they were finished (before time was up), they were instructed to continue trying to recall and were informed of the time remaining. When all of the subjects returned the following week, after completing the experiment, they answered the following questions: "Did you do anything during the past week to remember the dime?" and "Did you look at or study a penny or any other U. S. coins during the past week?"

As can be seen in Table 1, subjects in the penny-first group were first instructed to recall the penny: "Please draw the front and back of a U. S. penny from memory. Do not worry about accurately depicting any of the elements but concentrate on including all of the elements and placing them correctly on the penny faces. Please write out the words. You will have two minutes."

After the penny-first subjects finished this task, they were told: "I will allow you to study this liberty dime for one minute." If they were in the immediate-test group they were then instructed to recall the dime: "After that you will have two minutes to draw the front and back of the dime from memory. Do not worry about accurately depicting any of the elements but concentrate on including all of the elements and placing them correctly on the dime faces. Please write out the words. You will have two minutes." After following these instructions, these subjects performed a distractor task and then were reminded of their appointment for the following week. When they returned one week later they drew the dime again. Otherwise, if they were in the delayed-test group, after studying the dime, they were simply given the distractor task followed by the reminder. The instructions to recall the dime were read to them in the second week.

Subjects in the dime-first condition were first instructed: "I will allow you to study this liberty dime for one minute." Then, if they were in the immediate-test group, they were read the instructions to recall the

Table 1. The order of tasks performed for each of the four combinations of test order condition and retention interval group.

	PF CONDITION		DF CONDITION	
TASK	IMM	DEL	IMM	DEL
RP (WEEK 1)	1	1	3	2
STUDY DIME	2	2	1	1
RD (WEEK 1)	3	---	2	---
DISTRACTOR	4	3	4	3
RD (WEEK 2)	5	4	5	4

Note. PF = penny-first condition, DF = dime-first condition, IMM = immediate group, DEL = delayed group, RP = recall of penny, RD = recall of dime.

dime followed by the instructions to recall the penny, finally followed by the distractor task and reminder. If subjects were in the delayed-test group, after studying the dime, they were read the penny instructions and were given the distractor task and the reminder. The following week they were then read the dime instructions.

The distractor task was a letter-detection task in which subjects read instructions given on a sheet of paper which told them to read a paragraph-long passage at their normal rate of reading and circle all of the letter *t*s which they encountered. It was hoped that the letter-detection task would discourage subjects from anticipating the test of the dime the following week.

None of the subjects were explicitly told that the following week they would be required to reproduce the dime, but many of them surmised this for themselves, a fact which is discussed below. In summary, all groups drew a penny the first week and a dime the second week. Subjects in the two immediate-test groups drew the dime both weeks. All groups performed the distractor task the first week.

Results

Two methods of assessing accuracy were employed. The first (or lenient) method scored a feature as correct if it was simply included in the drawing. The second (or strict) method scored a feature as correct if it was both included and positioned correctly in the drawing. For example, a subject may have correctly included the feature "IN GOD WE TRUST" on either the penny or the dime but incorrectly placed it on the back face. By the lenient scoring, this feature would have scored a 1 but by the strict scoring, it would have scored a 0. In addition, no synonyms were allowed (e.g., "ONE PENNY" was not allowed as a substitute for "ONE CENT") but some latitude was given for the Latin phrase "E PLURIBUS UNUM.". If the front figure's bust faced the incorrect direction (i.e., right or left) it was scored as incorrect in the strict method. No positional information was relevant to the back figure and so correct positioning was not included in scoring utilizing the strict method for this feature.

Comparison with Nickerson and Adams (1979)

To address the issue of replicability of Nickerson and Adams (1979) findings, we examined the differences and similarities between their results and our results in the penny-first group, which did the comparable task. Using our strict scoring method, we found that the proportion of responses in which subjects both correctly included and correctly placed a feature was actually somewhat lower for our group of subjects (M = .28, n = 16) when compared to subjects in Nickerson and Adams' study (M = .39, n= 20). Not only was Nickerson and Adams' (1979) basic finding of rather poor recall of the features of a U. S. penny clearly repeated, the pattern of differential retention for the various features was also replicated.

Analyses of Proportion Recalled

In our first analysis, by ignoring the second recall test of the liberty dime for the immediate test group, we were able to compare recall of the U. S. penny and liberty dime as a function of retention interval group (immediate, delayed), test order condition (penny-first, dime-first), and coin feature. There was a main effect of retention interval group by both the lenient and strict scoring methods ($F(1,28) = 7.24$, $MS_e = .1749$, $p < .05$, and $F(1,28) = 17.34$, $MS_e = .2118$, $p < .001$, respectively) with a higher proportion of items recalled in the immediate test group (M = .757 lenient; M = .566 strict) relative to that in the delayed test group (M = .663 lenient; M = .406 strict). This effect was due almost exclusively to the influence of the retention interval on the dime; that is, no effect would be expected for the penny because the penny was only tested during the first week and indeed no effect was obtained (see Figure 2). Thus, for both the lenient and strict scoring methods there was a significant interaction of retention interval group by coin ($F(1,28) = 6.03$, $MS_e = .0647$, $p < .05$, and $F(1,28) = 21.66$, $MS_e = .1414$, $p < .001$, respectively). There was a main effect of coin, however, by both the lenient scoring method ($F(1,28) = 87.14$, $MS_e = .0647$, $p < .001$) and the strict scoring method ($F(1,28) = 165.25$, $MS_e = .1414$, $p < .001$), with the liberty dime being recalled better (M = .809 lenient; M = .688 strict) than the U. S.

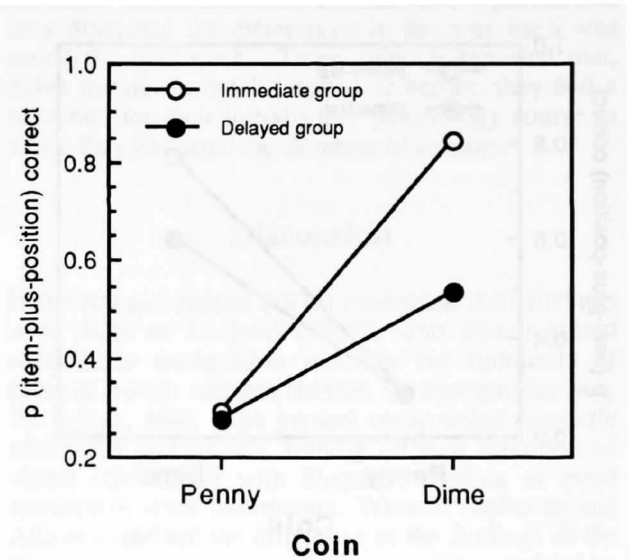

Figure 2. Mean proportion of items both included and correctly positioned as a function of retention interval group and coin by the strict scoring method.

penny (M = .611 lenient; M = .285 strict). This finding illustrates the rather remarkable fact that one minute of intentional study of an unfamiliar coin is a sufficient amount of time to retain its features better than those of a familiar coin, even after a one-week delay.

There was a main effect of test order condition (penny-first, dime-first) by the strict scoring method ($F(1,28) = 4.72, MS_e = .2118, p < .05$). To understand this effect fully, it is necessary to examine the interaction between test order condition and coin (for strict scoring, $F(1,28) = 7.07, MS_e = .1414, p < .05$; for lenient scoring, $F(1,28) = 11.83, MS_e = .0647, p < .01$). As shown in Figure 3, by the strict scoring method, the recall of the dime (but not that of the penny) is better when the penny is recalled first, perhaps because the subjects' method of studying the dime is enhanced after they see what they cannot remember about the penny. Further, there is a cross-over interaction, shown in Figure 4, for the lenient scoring method, revealing not only that the recall of the dime is aided by the prior recall of the penny, but also that the recall of the penny is aided by the prior recall of the dime. This latter effect, however, cannot be attributed to an improved method of study because the penny was never studied. It may be due, instead, to the fact that the items on the dime (but not their positions) are the same as those on the penny.

Because subjects in the immediate group drew a dime both the first and second week, we were able to examine the long-term retention of item and item-plus-position information of a liberty dime. As before, we used lenient and strict scoring methods with the lenient method reflecting memory for item information and the strict method reflecting memory for item-plus-position information. The lenient method showed significant forgetting of item information from the first week (M= .88) to the second week (M = .76), $F(1,14) = 18.91, MS_e = .0531, p < .001$. In addition, there was significant forgetting of item-plus-position information from the first week (M = .84) to the second week (M = .54), $F(1,14) = 33.22, MS_e = .2024, p < .001$. Interestingly, although the nine specific features were forgotten differentially in both the item analysis ($F(8,112) = 11.48, MS_e = .1157, p < .001$) and in the item-plus-position analysis ($F(8,112) = 8.23, MS_e = .1765, p < .001$), only in the item-plus-position analysis did this factor interact with retention interval ($F(8,112) = 2.51, MS_e = .1008, p < .05$). Figure 5 shows this interaction; it appears that the effect is due largely to the fact that item-plus-position information was retained for the front and back figures but lost for the other features. This finding agrees with Shepard's (1967) general conclusion that pictures are remembered better than words. The apparent loss of item-plus-position information for the word "liberty" is remarkable given that the dime was explicitly referred to as a "liberty" dime and that this word was emblazoned across the top of the coin. Nonetheless, the position of this word on the dime does appear to be forgotten quite easily.

To examine whether recall during the second week was influenced by a prior recall attempt, we performed a third analysis which compared immediate and delayed retention interval groups on their recall of the liberty dime in the second week as a function of feature and test order condition using both the strict and lenient scoring methods. By the lenient method, no significant

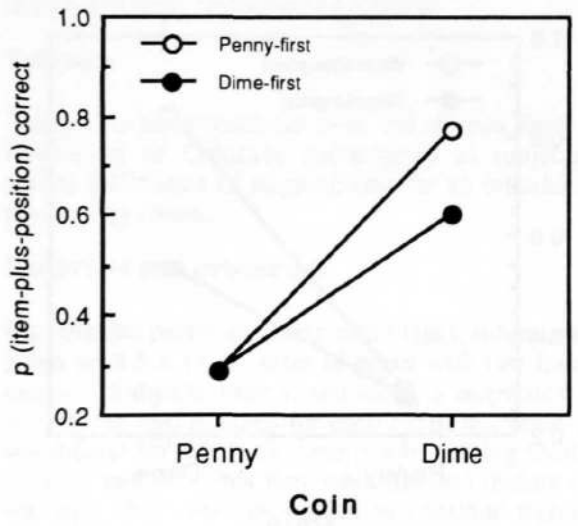

Figure 3. Mean proportion of items both included and correctly positioned as a function of test order condition and coin by the strict scoring method.

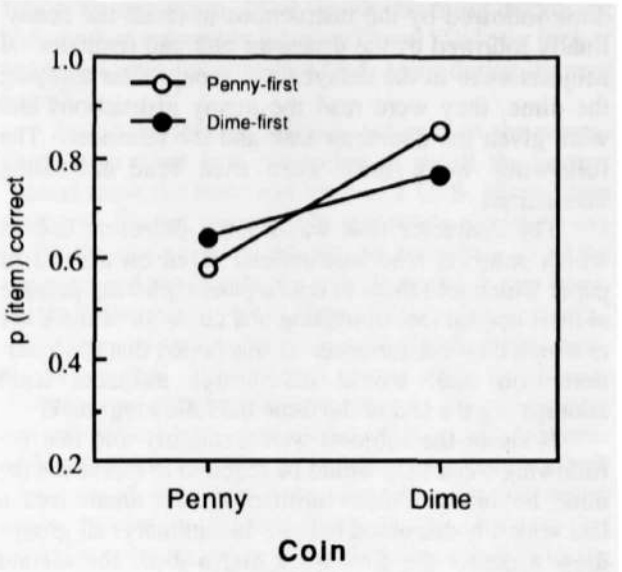

Figure 4. Mean proportion of items included as a function of test order condition and coin by the lenient scoring method.

differences were found as a function of a prior recall attempt (i.e., retention interval group), F < 1, but the to-be-expected feature differences were again found ($F(8,224) = 16.11$, $MS_e = .1314$, $p < .001$). By the strict scoring method, feature differences were also found ($F(8,224) = 11.95$, $MS_e = .1716$, $p < .001$), but prior recall attempt (i.e., retention interval group), interacted with feature, $F(8,224) = 2.19$, $MS_e = .1716$, $p < .05$, as well as with both feature and test order condition ($F(8,224) = 2.14$, $MS_e = .1716$, $p < .05$). As illustrated in Figure 6, showing the former interaction, prior recall of some features (e.g., the front figure) helped in the recollection of their correct placement. In contrast, recall of other features (e.g., the date) was hampered by a prior recall attempt relative to no prior recall attempt.

Subject retrospective reports

Of the 32 subjects, 24 reported that they had done something in addition to using U. S. coins in their currency interactions during the week interval. Ten of these 24 subjects reported doing more than one thing. Specifically, of these 24 subjects, 16 reported that they had looked at a penny on the day of the first trial to check their performance on the penny drawing they had done. Five subjects reported that they had studied U. S.. coins during the week interval, including a U. S. dime, nickel, and penny; one subject even studied a dollar bill. Six subjects reported that they had some idea that the dime was to be recalled but made no effort to study for the second week. Three subjects reported that they had some idea that the dime was to be recalled and made an effort to remember the liberty dime during the week interval. Of these three subjects, two discussed the liberty dime together during the week interval. These same two subjects also reported that they discussed the differences in the way each was tested the first week. Three subjects reported that, either during the week interval or before, they had a recitation for their introductory psychology course in which they discussed the elements of a penny.

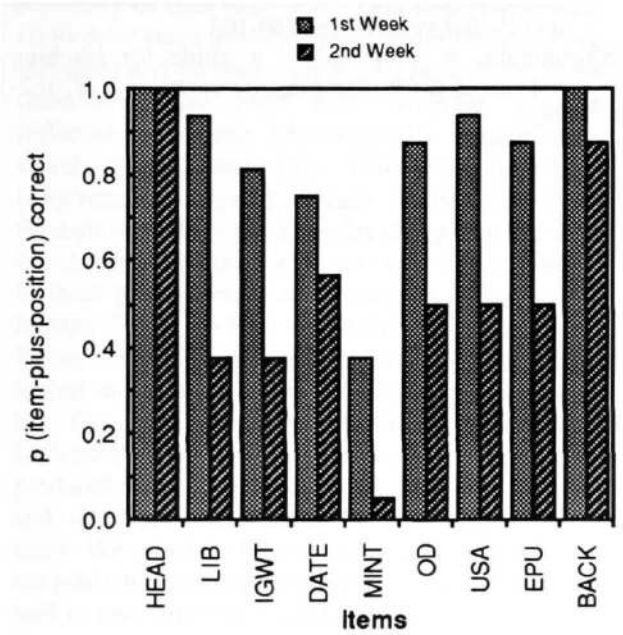

Figure 5. Mean proportion of items both included and correctly positioned as a function of test week and feature for both tests of the dime by subjects in the immediate test group. LIB = word "LIBERTY," IGWT = words "IN GOD WE TRUST," OD = words "ONE DIME," EPU = words "E PLURIBUS UNUM."

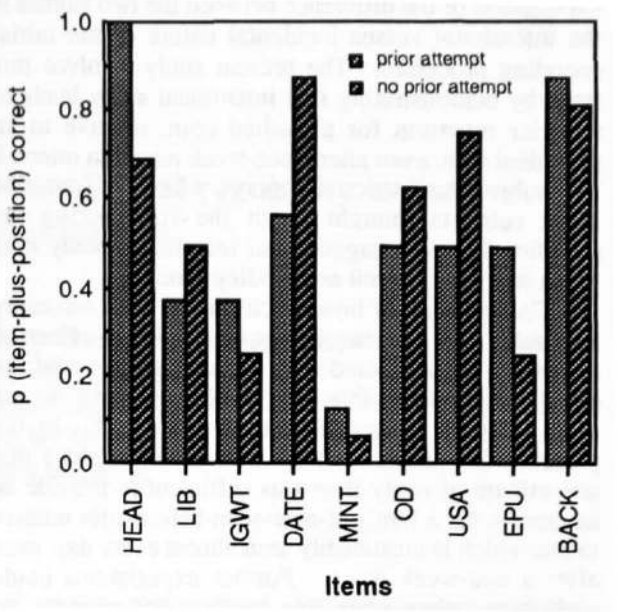

Figure 6. Mean proportion of items both included and correctly positioned on the dime in the second week only as a function of occurrence of a prior recall attempt.

Discussion

Nickerson and Adams (1979) contrasted their findings with those of Shepard (1967), who demonstrated remarkable recognition memory for hundreds of pictures, which subjects studied, on average, for only 5.9 sec (p. 160). The present study helps reconcile Nickerson and Adams' finding of poor retention of visual information with Shepard's finding of good retention of visual information. Whereas Nickerson and Adams explained the difference in the findings of the two experiments in terms of the many cues provided by Shepard's relatively complex pictures, the meaningfulness of feature relationships, and

interference from other coins, perhaps the better explanation of the difference between the two studies is the intentional versus incidental nature of the initial encoding processes. The present study resolves this issue by demonstrating that intentional study leads to superior retention for a studied coin, relative to an unstudied coin, even after a one-week retention interval. The subject retrospective reports, which indicate that some subjects thought about the coin during the retention interval, suggest that intentional study may affect rehearsal as well as encoding processes.

The question of how much time is both necessary and sufficient to demonstrate a long-term retention advantage for a studied coin remains unanswered but could shed considerable light on how familiar we are with ordinary objects in our environment. In the present experiment, we were able to demonstrate that one minute of study time was sufficient to provide an advantage for a rarely-if-ever-seen-before coin relative to one which is presumably seen almost every day, even after a one-week delay. Further experiments could yield some other interesting results. For example, an experiment could compare the amount of study time required to remember a liberty dime relative to the amount of study time required to remember a familiar U. S. penny. Assuming subjects' day-to-day contact with the penny has aided them by making the objects and word placements more familiar relative to those of the liberty dime, one may expect the study times required to remember the U. S. penny to be significantly less than those required to remember the liberty dime.

In addition, future studies using a simpler design could also address some of the issues raised about the specific features retained and lost over the retention interval. For example, one question that could be addressed concerns the relative forgetting rates of words, dates, and pictorial information.

In summary, although it appears that memory for common objects can be quite poor, the situation can be remedied quite easily with only a short study period. Nickerson and Adam's (1979) conclusion that memory for common objects was based on the utility (or necessity) for remembering the details of common objects was a logical first step. Rubin and Kontis (1983) have suggested that a schema, or modal representation pattern, exists for common U. S. coins. The present study is consistent with this idea as well. Importantly, the present study goes beyond the earlier investigations by documenting the importance of intentional study on memory for details of a common object. With intentional study, retention is very good, even for the details of common objects that provide minimal cues and little meaningfulness of feature relationships such as U. S. coins.

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