Buildup and Release From Proactive Interference in a Rhesus Monkey

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The potential of the buildup and release from proactive interference (PI) technique in the study of animal categorization was demonstrated with a rhesus monkey. A serial probe recognition task was used with a list of 4 consecutive slide pictures (upper screen) followed by a single probe picture (lower screen). The monkey moved a lever to indicate whether the object was contained in the list. PI built up over 40 consecutive trials tested with either flowers or primate faces. PI was released on category change and then built up again during 40 trials with the second category. The first 2 serial positions showed somewhat greater PI buildup and release, supporting conclusions from human studies that the effects occur primarily in secondary memory. A second experiment provided 2 replications of the main effect and showed through color border changes and elimination of color differences that color was not a critical feature.

The phenomenon of buildup and release from proactive interference (PI) was discovered in the early 1960s with demonstrations that recall performance dropped over successive trials (Keppel & Underwood, 1962) and that recall performance was elevated again if some critical stimulus attribute (e.g., flower names to bird names) was changed (Wickens, Born, & Allen, 1963). A large number of studies of this effect were conducted between 1963 and 1978. In a typical procedure (e.g., Wickens, Dalezman, & Eegemier, 1976) a list of three words was presented, followed by a retention interval (filled with a distractor task according to the characteristic Brown-Peterson distractor-task method), followed in turn by a recall test, and then the entire procedure (trial) was repeated three more times. For the experimental group, the words in the first three trials were from the same category, and the words in the fourth trial were from a different category. Release from PI was assessed by the amount of improved performance on the fourth trial judged against a control group for which all words, including those of the fourth trial, were from the same category.

The phenomenon of buildup and release from PI has been said to represent one of the most systematic and coherent bodies of evidence on coding dimensions in human short-term memory (Gardiner, Klee, Redman, & Ball, 1976). A wide variety of stimulus features have been studied with this procedure including changes in category (e.g., door, window, and cellar to bread, carrots, and potatoes), gender (e.g., queen, noodles, and cow to butter, rooster, and tuxedo), parts of speech (e.g., verbs to adjectives, verbs to nouns, or present to past tense of verbs), type case (uppercase to lowercase nouns), figure/ground (white on black to black on white), modality of presentation (auditory to visual), and many others. The results from these experiments, when taken as a whole, form a coherent picture. "One generalization which seems clear...is that changes in the semantic content [e.g., categories] produce a considerable amount of release from proactive inhibition, whereas the physical characteristics of words—their lengths and sounds—produce only a slight effect" (Wickens, 1970, p. 8). We can add to this generalization that syntactical changes (parts of speech) have a little effect, particularly when compared to semantic changes, and that physical changes such as background area, figure/ground, or type case have little effect too (this evidence will be discussed later in Experiment 2). Thus, characteristics that change the meaning of the words produce the greatest release from PI effect.

The release from PI procedure should be particularly appealing to researchers in animal cognition because it is one of the most replicable and objective of human cognition procedures, even though it has not been an actively investigated during the last decade. It is a "projective technique of cognitive organization; a way of asking the subject what classes are being employed without requiring him to identify and label them—or even...being aware of them" (Wickens, 1970, p. 3).

If release from PI experiments could be done with animals (e.g., monkeys), then a technique might exist for determining which stimulus characteristics are meaningful to monkeys and which are not. Results from such experiments could function as independent and converging sources of evidence along with results from other experiments that have provided evidence for categorical processing by animals (e.g., Bhatt, Wasserman, Reynolds, & Knauss, 1988; Cook, Wright, & Kendrick, in press; Herrnstein, Loveland, & Cable, 1976; Sands, Lincoln, & Wright, 1982).

The purpose of the experiments reported in this article was to determine the fruitfulness of the buildup and release from PI technique in the study of categorization by monkeys. Because this paradigm has been effective in dissecting individual features responsible for human categorization, one prominent feature of the picture stimuli—their color—was evaluated in order to assess the role that color might have in producing the categorical PI and its release.

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When this research began, there were a number of encouraging indications that buildup and release from PI could be demonstrated in monkeys. With human subjects, it had been shown that recognition, in addition to recall, would also produce the buildup and release from PI effect (Gorfain & Jacobson, 1972, 1973; Petrusic & Dillon, 1972; Wickens, Moody, & Dow, 1981). These successful demonstrations with recognition were important because a recognition procedure was to be used with the monkey subject. In addition, with monkey subjects, PI had been shown to occur (but from item repetitions) in the same recognition procedure that was to be used in these experiments (Jitsumori, Wright, & Cook, 1988; Sands & Wright, 1980a, 1980b; Wright, Urucioli, & Sands, 1986), and performance rapidly recovered from the PI buildup in changes in the picture items.

Although the PI effects with monkeys just discussed are, in some sense, buildup and release from PI effects, they are different from those previously discussed for human subjects. In those human studies, the items themselves were not repeated. The proactive interference accrued from the similarity of the items to one another (e.g., items of the flower category). Indeed, identifying salient features was the purpose of many buildup and release from PI studies with humans, and procedures were designed to index the degree of salience in terms of meaningfulness for human memory processing. In this sense, an experiment on the multidimensional scaling (MDS) of same/different judgments by monkeys is probably more similar to the human buildup and release from PI experiments (Sands et al., 1982). Although PI was not targeted directly in the MDS category experiments, the similarities of features that produced the categories did so through interference; similar category membership interfered with monkeys correctly identifying two items as physically different. Scaling techniques showed that six items from each of five human categories tended to cluster, and such clustering identified these as categories for monkeys. Two of the categories tested and identified were flowers and primate faces, and these were the two categories used in the experiments of this article to evaluate the buildup and release from PI technique as a method for studying categorization.

Experiment 1

Pictures were used as stimuli because words are not a viable possibility to be used as stimuli with monkey subjects. Although pictures, to the best of our knowledge, have not been used in any buildup and release from PI experiments with humans, they do function well in the repeated-item PI paradigms with monkeys and humans. Experiments with humans typically have used three or four list items per trial, but lesser and greater numbers have also been used (Bennett & Bennett, 1974; Kintsch & Bushke, 1969; Wickens et al., 1981). The monkey in this experiment was tested with lists of four items (a number similar to that in many human experiments and one with which the monkey had considerable experience). Pilot research had shown that about 40 trials were required for the complete buildup of PI, so 40 trials were used for the buildup of PI with each category. The particular assessment procedure was dictated somewhat by the within-subject design of this experiment and by the decision to study the complete PI buildup with each of two categories. Release from PI was assessed as a performance difference between the asymptotic PI buildup with one category and performance recovery when a new category was introduced, a procedure that has been used successfully in several human experiments (e.g., Bennett & Bennett, 1974; Loess, 1967; Wickens et al., 1981).

The basic experimental design entailed 40 trials with each of two categories, primate faces and flowers. Each trial contained four list items. Because items were not repeated in a daily session and the different trials required different probes, there were 180 items shown in each category. The buildup of PI was assessed over the 180 items of the first category, release was assessed at the category change, and then the buildup of PI was assessed over the 180 items from the second category.

Method

Subject

The subject, Linus, was a 7-year-old male rhesus monkey (Macaca mulatta). He had extensive experience of over 1,500 daily sessions in serial probe recognition (SPR) tasks with a wide variety of slide picture stimuli. Linus’s food intake and liquid consumption were restricted prior to each daily experimental session and for about 4 hr after each session. A single daily session was conducted at about the same time each day. Supplemental food (Purina Monkey Chow and fruits) and water were given in the home cage. Linus had no experience with real flowers and probably had seen only a very few species of monkeys other than rhesus.

Apparatus

A converted monkey housing cage (62 cm × 62 cm × 92 cm) constructed of aluminum (1-cm-diameter grid bars spaced 2.75 cm apart) was used to test the unrestrained subject. The cage was located in a sound- and light-attenuated room equipped with a ventilation fan. A rheostat-controlled houselight, mounted to the outside of the cage, was adjusted to dimly illuminate the cage and room. Outside the test cage was a three-position response lever (left, right, and down) within easy reach of the monkey. The bars of the cage in front of the lever were spread to facilitate access to the lever. Correct responses were reinforced with either a 5 mL of Tang orange drink or a 1-g Noyes banana pellet (pseudorandomly determined with equal probability). The spot for the drink delivery was positioned for easy access when the lever was being manipulated. The food well was positioned 20 cm to the left of the lever and 25 cm from the cage floor. The pellet dispenser (Gerbrands Model GS210) and drink bottle were located outside of the cage and out of reach of the subject.

Two rear-projection screens (12 cm × 18 cm), arranged vertically (16 cm from center to center) and positioned 61 cm from the normal position of the monkey’s eyes, were located just beyond the response lever. The screens were defined by cutouts in a matte black painted plywood rectangle (77 cm × 182 cm) mounted on a relay rack. Kodak Carousel projectors (760-H autofocus), positioned 80 cm behind each screen (on a separate relay rack), projected 35-mm color slide stimuli. Durations of slide presentations were controlled by solenoid-operated shutters (Copal Model 20) mounted on the front of the projector lenses. A 100-W light (which was turned on during a time-out period) and a speaker were located directly above the top screen. A Camecno Z-2D microcomputer controlled experimental events, collected responses, and was used to analyze data.
Stimuli

The 180 primate pictures were slide photographs of a wide variety of monkeys and apes (primarily facial pictures): rhesus monkeys, Japanese macaques, baboons, gibbons, chimpanzees, orangutans, gorillas, and others. Some were photographs from books and magazines, and others were real-life photographs. There were both front and side views of faces. The 180 flower pictures were photographs from books, magazines, and real-life flowers. Figure 1 shows the range of the different types of flowers and monkeys faces. Of the 360 stimuli, about 25% of the flower pictures and 40% of the primate-face pictures had been seen once or twice by Linus approximately 8 months earlier; the others, he had never seen before.

Stimuli used in the 20 warm-up training trials, conducted at the beginning of each session, were from 450 travel slides showing mountains, seascapes, buildings, and miscellaneous objects. These particular travel slides had been seen only once or twice prior by the monkey.

Procedure

Test sessions. Sixteen daily test sessions were conducted. Each daily session began with 20 warm-up trials. Pilot research had shown that a few preliminary trials were necessary to get the monkey efficiently performing the SPR task. The next 40 trials were test trials with items from one of the two categories. The particular category tested first, flowers or primate faces, varied pseudorandomly with a maximum of 2 consecutive days with the same order of testing. The last 40 trials of the daily session were tests with items from the other category. The limited capacity of the projector slide trays necessitated slide-tray changes every 20 trials, requiring a 3-5 min break in the session.

A trial began with a 2000-Hz ready tone. A downward press of the lever terminated the ready tone, and after a delay of 0.3 s, presentation of the list began on the top rear-projection screen. Each list item was presented for 5 s with a 1-5 s dark interval between items. After the list was presented, there was a 1-s retention interval, and then the probe item was presented on the lower screen. The probe item remained in view for a maximum of 3 s or until a choice (right/left) response was made. When the probe item was identical to one of the four list items, the correct response was a lever movement to the right, same. When the probe item was different from the list items, the correct response was a lever movement to the left, different. Correct choices were followed by a tone (4000 Hz, 0.25-s duration) and either 5 mL of Tang orange-drink or a 1-g banana pellet. If the 3-s probe viewing time expired before the subject made a response, the trial was aborted. Errors and aborts turned on the light above the top screen for a 5-s time-out period. A 5-s intertrial interval separated trials and followed time-outs or reinforcements.

Organization and reorganization of test items. The 450 travel pictures used in the initial 20 warm-up trials each day were randomly placed into five sets, and each set was organized into two slide trays to produce 20 warm-up trials. The particular warm-up set presented each day was selected according to a randomized block design, and the probe items of each set were changed for each 5-session block. The 180 pictures of each test category were randomly divided into two 20-trial subsets. Each 20-trial set was organized into two slide trays, one containing the list items and one containing the probe items. The trial sequences (same/different) were determined pseudorandomly with a maximum of 3 consecutive trials of the same type, and the four serial positions were each tested five times within the 40 trials generated by both subsets for each category. Combinations of which category was tested first and which of two subsets was tested first produced eight different testing sequences. Tests were conducted in two different blocks of these eight sequences for a total of 16 sessions. The items within each subset were rescheduled to provide different item combinations for each test day, and at the beginning of each 8-session block, all the items of a category were rescheduled together and randomly selected. These procedures were conducted to thwart any possibility of the subject developing strategies of memorizing the correct responses to individual items (see Wright, Cook, & Kendrick, in press).

Results

Figure 2 shows the buildup of PI for the two categories tested daily as a function of blocks of eight successive trials. Preliminary analyses showed no important differences as a function of which category was tested first, and the results are pooled over this variable. There was a buildup of PI of 14.8% in each category.

A two-way analysis of variance (ANOVA) (2 × 5 × 16, Categories × Trial Blocks × Sessions/Replications) showed that the main effects of categories and trial blocks (but not interaction) were significant, F(1, 150) = 5.44, p < .02, and F(4, 150) = 4.22, p < .01, respectively. Comparisons among individual means (weighted-contrast tests; see Sokal & Rohlf, 1969, or Keppel, 1973) showed that the performance difference at the category change (Trial Block 5 of Category 1 vs. Trial Block 1 of Category 2) was highly significant, F(1, 150) = 12.8, p < .001. Furthermore, additional comparisons showed that release was complete, because performance on the first block of the second category was as accurate as that on the first block of the first category, F(1, 150) = 0.56, p = .455, and that PI buildup was comparable in the two categories according to each category's lowest performance, F(1, 150) = 0.56, p = .455.

These PI-buildup results are in contrast to results obtained when travel slides were used instead of flowers and primate faces. One would not expect a buildup of PI with travel slides because the items are a wide variety of scenes and objects and are not confined to particular categories. The procedures were identical to those of Experiment 1, including four list items per trial, except that travel slides were used in place of primate-face and flower slides. Ten sessions were conducted just prior to Experiment 1, and each session contained 40 trials. A two-way ANOVA comparing performance under the three conditions (travel-slide control, PI buildup with Category 1 from Experiment 1, and PI buildup with Category 2 from Experiment 1) showed a significant difference among the conditions, F(2, 195) = 5.9, p < .01. The travel-slide control function was relatively flat (even slightly increasing) across the five 8-trial blocks (78.8, 81.3, 76.3, 85.0, and 83.8, respectively). Linear regression showed that the slope (1.38) of this function was not different from zero, t(48) = 1.06, p = .29, but by comparison, the slope (−2.70) for the PI-buildup results, combined for both categories from Experiment 1, was significantly decreasing, t(158) = 3.17, p < .01.

An analysis was performed to determine whether there were differential effects according to the serial position of the item being tested. Table 1 shows performance for the first and last eight-trial block of each category for the first two and the last two serial positions and for the different trials. Comparing the last trial block to the first trial block, we found a performance
Figure 1. Black and white reproductions of 9 examples (out of 180) from each of the two categories studied, flowers and primate faces. (Beginning in the upper left-hand corner, left to right from top row down: red flower with yellow center; purple flower; small yellow flowers on green stems; purple flower with yellow center; yellow flowers with ring of rust-colored petals; light pink flowers with yellow centers; bluish-purple flowers; red flowers with yellow centers; bouquet of white flowers with red centers plus sprigs of small yellow flowers; black snout, beige fur, white teeth, and pink tongue; black face with white snout; black fur and face; brown fur and brown face; black and white slide photograph of monkey group; flaming orange fur; pink face with snow speckled fur; white fur and black face; brown primate.)
Discussion

Multiple list items create a task that is not easy for monkeys or for other animal species. In human studies, multiple list items probably avoid ceiling effects that might otherwise be encountered if humans were to recall single items. With animals, however, ceiling effects are usually not a problem, and maybe even single list items would be viable in studying PI buildup and release. What would be lost with single list items would be the serial position effects, the opportunity to explore the locus of the proactive interference effect, and the ability to relate these results to those from the human research.

The PI locus question, as it relates to the field of human memory, is part of a somewhat larger issue involving whether the PI buildup occurs during encoding or during retrieval. Accumulated evidence indicates that encoding (by humans) is a fairly automatic process, occurring largely beyond the subject's control and often without the subject's awareness (e.g., Gardiner & Cameron, 1974; O'Neill, Sutcliffe, & Tulving, 1976; Wickens, 1970). Several very clever experiments have established rather conclusively that PI buildup occurs at retrieval, not at encoding (Gardiner, Craik, & Birtwistle, 1972; O'Neill et al., 1976; Watkins & Watkins, 1975).

Retrieval is thought to be a process related primarily, and even exclusively, to secondary memory. The items in secondary memory are not immediately available, as are those from primary memory, and must be retrieved in order to be considered. Because of the evidence implicating retrieval, the effects of the buildup and release from PI should be largely relegated to the secondary memory component (the portion of the serial position function not including the recency effect; Craik & Birtwistle, 1971; also see Stern, 1985). Although the type of serial position analysis conducted by Craik and Birtwistle on recall performance has not been conducted with human recognition, a somewhat different analytic approach indicates that in human recognition, too, the locus of PI effects are in secondary memory (Wickens et al., 1981). The results of the present study using a rhesus monkey are encouraging in this regard and show that the majority of the monkey's buildup and release from PI effects also resides in secondary memory. Because these effects were shown with a rhesus monkey, and such animal species have no evidence of language as we know it, one implication is that the mechanisms responsible for the secondary memory locus of buildup and release from PI are not language dependent. Another implication is that apparently storage and retrieval (for these effects in this situation) are not language dependent.

A question that could be (and has been) raised regarding the results shown in Table 1 is why the performance decrements are not confined to different trials. Consider that PI interferes with correctly judging that a probe item is not in the list being tested (cf. Wright et al., 1986). This adverse effect on different trials should create a same bias, and so the PI effects should be largely manifested in different-trial performance, not in same-trial performance. A same bias does tend to occur early in PI testing, but for reasons that are probably shared with the human experiments, this bias tends to become more neutral as subjects gain experience in dealing with the high PI conditions; the monkey receives feedback after each choice.

Table 1

<table>
<thead>
<tr>
<th>Category/Trials</th>
<th>Same-trial serial position</th>
<th>Different trials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-2</td>
<td>3-4</td>
</tr>
<tr>
<td>Category 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-8</td>
<td>80.8</td>
<td>77.7</td>
</tr>
<tr>
<td>32-40</td>
<td>51.5</td>
<td>61.7</td>
</tr>
<tr>
<td>Category 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41-48</td>
<td>90.6</td>
<td>86.1</td>
</tr>
<tr>
<td>73-80</td>
<td>73.8</td>
<td>82.3</td>
</tr>
</tbody>
</table>

Note. The data are given as percentage of correct responses.
Perhaps the most important result of Experiment 1 was that buildup and release from PI can be demonstrated with animal subjects. Although the experiment was conducted with only one monkey subject, this subject's results appear quite clear and robust. Originally, the experiment began with two subjects, but the other subject suffered from problems (unrelated to the research) that tended to disrupt his task performance. So, despite similar trends in the data from this second monkey, the decision was made to present only the results from Linus, and Linus was the only monkey tested in Experiment 2.

Experiment 2

Changes in stimulus features have been useful in delimiting different human categories (e.g., Wickens, 1970) and identifying those with semantic meaning (Gardiner et al., 1976; Reutner, 1972; Turvey and Egan, 1969). The purpose of Experiment 2 was to begin a similar analysis for monkeys by manipulating a prominent feature of the slide picture stimulus—color. In the first phase (the border test), a small change was made in the color of some of the stimuli to see what effect this might have on performance and the buildup and release from PI. A 3-cm color border was placed around the perimeter of the probe pictures, and in order to determine what effect, if any, this might have on the buildup and release from PI, the color of the border was changed in the middle of each category tested. In the second phase (the overlay test), a much larger change was made in the color of the stimuli. Color differences among the stimuli were effectively eliminated by placing color filters over both list and probe stimulus screens. This latter phase tested the possibility that some or all of the PI buildup and release was due to flowers having bright colors and primate faces having brown fur.

Procedure

Linus was tested for 11 daily sessions in the border test, followed by 11 daily sessions in the overlay test. The general methods used to compose test sequences, the frequency of testing, and the methods used to reorganize the tests, as well as other parameters of Experiment 2, were identical to Experiment 1, except for the addition of color borders and overlays.

The order and combination of test colors (blue, green, yellow, or red) used in the border test were counterbalanced to the degree permitted in the 11 daily test sessions. The first color was used on warm-up trials and the first 20 test trials, a second color was used on the next 40 trials (Test Trials 21–60), and a third color was used on the last 20 trials (Test Trials 61–80). Thus, three different border colors were tested each day.

In the overlay test, the colors were tested in a randomized block design of the four colors (blue, green, yellow, and red). The same color filter was used throughout an entire session, on both screens, including warm-up trials. Other experimental procedures (including picture stimuli, number of list items, trial parameters, trials per category, and category changes) were the same as those of Experiment 1.

Results

The percentage of correct responses in the border test and in the overlay test are shown in Figure 3. The overall accuracy was 66.1% in the border test and 72.1% in the overlay test, which was slightly less than the 75.4% correct in Experiment 1. Although mean performance was somewhat lower, the first trial block performance was equivalent to that in Experiment 1.

The results from Experiment 2 were analyzed in two-way ANOVAs (2 × 5 × 11, Categories × Trial Blocks × Sessions/Replications). Both border and overlay tests showed significant trial block effects, $F(4, 100) = 4.61, p < .01$, and $F(4, 100) = 3.31, p < .02$, respectively. As in Experiment 1, weighted-contrasted tests showed that there was substantial release from PI on introduction of the second category. When performance on the first trial block of the second category was compared to performance on the last trial block of the first category, there was a significant difference in both border and overlay tests, $F(1, 100) = 5.87, p < .02$, and $F(1, 100) = 5.67, p < .02$, respectively.

As in Experiment 1, release from PI was shown to be complete because of no significant differences between the first trial blocks of the two categories in both border and overlay tests, $F(1, 100) = 0.42, p = .52$, and $F(1, 100) = 0.63, p = .43$, respectively, and there were no significant differences between the last trial blocks of the two categories in both border and overlay tests, showing equivalent PI buildup, $F(1, 100) = 0.24, p = .63$, and $F(1, 100) = 0.04, p = .84$, respectively.

The effect of the color border changes was further analyzed by computing difference scores between the four trials immediately preceding (Trials 17–20 or 57–60) and the four trials immediately following (Trials 21–24 or 61–64) each color change. A comparison of these difference scores to

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1 This possibility was suggested to us by Herbert Roitblat.
difference scores for these same trial blocks from Experiment 1 showed that there was a slight performance increment (6%), but that this increment was not significant, $F(1, 52) = 0.47$, $p = .50$.

**Discussion**

The results from border and overlay tests replicate the main effect of buildup and release from PI shown in Experiment 1 for the two categories of picture items. The results also show that the border color change that occurred in the middle of each category produced no apparent release from PI effect. Although this was a small change in the item features and limited to the probe items, it does demonstrate that at least some item features can be changed without incurring a release effect.

The results from the overlay test show that the release from PI effect of Experiment 1 was not the result of color changes between the flower and primate-face categories. Thus, color is not a critical feature for categorization of the picture items. At the very least, because the stimuli were pictures, there has to be some visual feature that unifies the objects of the category. This is an inescapable conclusion, and one that is not shared by the release from PI experiments with humans. With humans, letters and numbers are used. The letters form words, in some cases, and these are symbolic representations. In a sense, pictures are symbolic representations, too. Pictures are two-dimensional representations of the three-dimensional world. Even humans apparently may require training to perceive the real-world object in picture stimuli (Deregowski, 1972). Few would disagree that there is more of a correspondence between a picture (symbolic representation) and the real object than between its name (symbolic representation) and the real object. The issue, however, is not the abstractness of the representation but rather the basis for the categorization of the different items as shown by the buildup and release from PI results. If the pictures were perceived by the monkeys as a collage of color blobs, and the release effects were based on flowers having bright colors and primate faces having brown fur, then the categorization (the basis of the PI buildup) would be rather trivial. By eliminating color as a difference cue (overlay test), this test showed that object perception and categorization were based on some other visual feature, probably something in the shape of the object.

**General Discussion**

One difference between these monkey experiments and the human experiments was that pictures, instead of words, were used as stimuli. Because pictures seem to be less symbolic than words in their object representations, they may have contributed (along with the somewhat less difficult recognition procedure) to the slowness of PI buildup in relation to that for words. Although we are unaware of any direct evidence of this issue, pictures are so rich in detail that items from the same category (e.g., flowers) may be better remembered as distinct from others of the same category than the words that represent them (e.g., dandelion, daisy). Any attribute that keeps the members of a category distinct would be expected to slow the buildup of PI. In any case, similar tests can be conducted with humans, and the buildup and release from PI can be documented for these same pictures in the same SPR task.

The experiments in this article have demonstrated the applicability of the release from PI paradigm to an animal subject, that is, a monkey. These results, taken together, add...
to the converging evidence that monkeys do have the ability to perceive the real-world objects in pictures (e.g., Butler & Woolpny, 1963; Davenport & Rogers, 1971; Hayes & Hayes, 1953; Redican, Kellicutt, & Mitchell, 1971; Sackett, 1965, 1966; Swartz, 1983) and to categorize them (e.g., Sands et al., 1982; Schrier, Angarella, & Povar, 1984).

Other approaches to the study of categorical structures in animals typically train the categories through a go/no-go discrimination paradigm (e.g., Herrnstein et al., 1976; Schrier et al., 1984). Categorization is measured by the animals' transfer to new items, some items containing the critical object/feature and others not containing it. The animals are reinforced for correctly identifying instances of a category that are predetermined by the experimenter and are trained by the experimenter. In contrast, the buildup and release from PI technique does not, a priori, train or define the categories. As in the multidimensional scaling of categories (cf. Sands et al., 1982), only same responses to physically identical stimuli and different responses to physically different stimuli are reinforced. The categorical nature of the stimuli are revealed through confusions in the buildup of PI within categories and its release on the category change. Thus, the buildup and release from PI is an objective technique, and one that appears to be fruitful in exploring animal categorization.

References


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