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Effects of unsolvable anagrams on retention

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During Phase 1, 51 college students received 40 nonsense syllables to memorize (free recall). During Phase 2, 17 students received unsolvable anagrams (Group USA), 17 students received solvable anagrams (Group SA), and 17 received a blank piece of paper on which to write an autobiographical essay (Group E). During Phase 3, Group USA recalled significantly fewer Phase 1 nonsense syllables than did Groups SA and E, both of which recalled approximately the same number of nonsense syllables. The results support previous animal research, which shows that uncontrollable tasks interfere with the retention of a previously learned response.

Animals (rats and dogs) exposed to uncontrollable (inescapable) shocks have shown impaired performance with later escape learning (Phase 2) relative to subjects who have received an equal amount of prior escapable shock or no shock (Phase 1). This phenomenon has been called the learned helplessness effect (see, e.g., Maier, Albin, & Testa, 1973; Overmier & Seligman, 1967; Seligman & Beagley, 1975). The learned helplessness effect has also been obtained with rats when the reinforcement used during Phase 2 is appetitive rather than negative (Caspy & Lubow, 1981; Rosellini & DeCola, 1981; Rosellini, DeCola, & Shapiro, 1982); when noncontingent reinforcement or response-independent food rather than inescapable shock is used to produce uncontrollability during Phase 1 and deficits in appetitive learning during Phase 2 (Oakes, Rosenblum, & Fox, 1982; Seligman, 1975; Wheatley, Welker, & Miles, 1977); and when an unsolvable problem during Phase 1 is used as the uncontrollable situation to produce impaired learning in a solvable maze during Phase 2 (Bainbridge, 1973).

A number of learned helplessness human analogue studies have shown that when inescapable shock (Thornton & Jones, 1971); noncontingent reinforcement or response-independent food (O'Brien, 1967); unsolvable problems (Hiroto & Seligman, 1975); and failure at a prediction task (Albert & Geller, 1978) are used during Phase 1, a deficit in learning is experienced in experimental groups relative to controls (the learned helplessness effect).

Calef, Choban, Shaver, Dye, and Geller (1986) showed that inescapable shock interfered with rats' retention of a previously learned appetitive response. In other words, animals receiving inescapable shock during Phase 2 showed more "forgetting" (i.e., reduced speeds) than did controls during Phase 3 for a response previously attained (i.e., running in a straight alley) during Phase 1. The latter phenomenon was termed the learned helplessness retention effect by Calef et al. (1986).

In the present study, we investigated whether the learned helplessness retention effect could be obtained with human subjects. If so, the results would suggest that the effects of uncontrollability on a previously learned response are similar in humans and rats.

In the present study, college student subjects learned nonsense syllables during Phase 1. During Phase 2, they received unsolvable, solvable, or no anagrams. During Phase 3, all subjects were asked to recall the nonsense syllables learned during Phase 1. We hypothesized that those given unsolvable anagrams during Phase 2 would show poorer retention during Phase 3 than would subjects given solvable or no anagrams (i.e., a learned helplessness retention effect).

METHOD

Subjects

The subjects were 51 students at a small private 4-year liberal arts college. All subjects were volunteers from an introductory psychology course.

Apparatus

A list of 40 nonsense syllables was given to the subjects to memorize. The nonsense syllables included: TOX, NAS, MIK, SEN, DAX, WEF, PEM, CIB, GIF, RES, NAD, RUX, YID, FOT, VED, TEB, HUD, TAY, SOT, FUG, TEP, NAM, LEP, BIM, TAM, REG, BIX, FAM, NUK, REL, TAW, LER, VUT, ZAN, MEB, HOD, KIF, RAV, FAZ, MOX.

The solvable anagrams used were: EURKTY, LSEPE, HTBUM, ETCPIRU, EPLPA, SECLAPI, EKSCTH, RUTKN, MITNVAI, APOER, EBKSAT, RCODTO, WTOLE, AELCANDR, TBRABI, WASHDO, ETHWIG, ELVNO, HCTARIU, OKLANSWFE, RREANIG, LSGRI, ODVIE, NGSEIW, IEARFPLEC, RDEMA, RFMCOOL, YACDN, LOEFWR, RTNIA, ERUAQCT, LLAIELG, URNTALL, ETRSERCAY, ONHDU, YOMDAN, ZEPLZU, ECRANFGAR, EGOARN, FRREEVO.

The unsolvable anagrams list contained 35 unsolvable anagrams and 5 solvable anagrams. The latter were included so that the task would not seem impossible. The anagrams on this list were: EURKTY (solvable), LSEPE (solvable), HTBUM (solvable), ITCPIRU, APLPA, SICLAPI, IKSCTH,

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RATKN, MATNVAI, OPOER, ABKSAT, RCADTO, WTALE, AILCANDR, TBRABO, WISHDO, ATHWIG, ALVNO, HCTIRIU, AKLANSWFE, RREANIG (solvable), LSGRA, IDVIE, NGSAIW, IOARFPLEC, RDEMA (solvable), RFMCOAL, YICDN, OAEFWR, RTNIO, URUAQCT, LLOIELG, ORNTAAL, OTRSERCAY, ANHDU, YIMDAN, ZIPLZU, OCRANFGAR, AGOARN, FRRAEVO.

All of the anagrams were presented to the students in the above order.

Procedure

The subjects were randomly assigned to three groups of 17 subjects per group. Each group contained approximately equal numbers of males and females. During Phase 1, all subjects assembled in a large classroom and were each handed a page with 40 nonsense syllables and the following instructions printed on it:

> You will be given 15 min to memorize these nonsense syllables in any order. You may use any method you wish to memorize the syllables. If you would like to have a pencil and paper to work on, raise your hand and we will give them to you.

Immediately after the 15-min period, the instructions, nonsense syllables, and any worksheets the subjects had were collected and they were given a clean sheet of paper and asked to write down as many of the nonsense syllables as they could recall in 3 min. At the end of the 3-min period, the papers were collected.

During Phase 2 (which immediately followed Phase 1), Group SA was given a list of solvable anagrams, Group USA was given a list of predominantly unsolvable anagrams, and Group E was asked to write an essay about themselves. All three groups were given 30 min to complete their tasks. The SA group and USA group received the following printed instructions:

> It has been determined that a person's ability to solve anagrams may be directly correlated with that person's IQ. In 30 min, try to solve as many anagrams as possible. You may find some of them difficult, but continue to try solving them until time runs out.

Subsequently, the SA group received a page containing a list of 40 solvable anagrams, and the USA group received a page with a list of 35 unsolvable and 5 solvable anagrams.

Group E subjects were given a blank sheet of paper and a page with the following instructions in it: "Please write an essay about yourself. You will be given 30 min to do so. Try to use correct spelling and sentence structure."

At the end of the 30-min period, the worksheets were collected from all three groups.

During Phase 3 (which immediately followed Phase 2), all subjects were given a sheet of paper and asked to write down as many Phase 1 nonsense syllables as they were able to recall in 5 min. At the end of the 5-min period, the subjects were thanked for their help, and the hypotheses of the study were explained.

RESULTS

Phase 1: Nonsense Syllables

At the end of Phase 1, Group SA, Group USA, and Group E recalled a mean of 27, 30, and 25 nonsense syllables, respectively. A one-way analysis of variance showed no significant difference in recall among the three groups ($p > .05$).

Phase 2: Anagrams

Group SA solved an average of 13 out of 40 anagrams in 30 min, and Group USA solved an average of 4.7 anagrams out of the 5 solvable anagrams. The essays ranged in length from three to eight pages.

Phase 3: Recalling Nonsense Syllables

Group SA and Group E recalled approximately the same average number of nonsense syllables (15.3 and 17.3, respectively). Group USA recalled the fewest nonsense syllables (10.0).

A one-way analysis of variance was performed on the number of nonsense syllables recalled. The analysis yielded a significant treatment effect [$F(2,48) = 5.05, p < .025$]. Tukey paired comparison tests showed Group SA to have recalled significantly more nonsense syllables than did Group USA ($p < .05$); Group E remembered significantly more nonsense syllables than did Group USA ($p < .05$); and Group SA recalled approximately the same number of nonsense syllables as did Group E ($p > .05$).

DISCUSSION

The results of the present study supported the hypothesis that subjects given unsolvable anagrams during Phase 2 would show poorer retention of material previously learned than would subjects given solvable or no anagrams. In other words, a learned helplessness retention effect was shown, analogous to findings by Calef et al. (1986) with rats. More specifically, Calef et al. showed that an uncontrollable task (inescapable shock) interfered with rats' retention of a previously learned runway response. The fact that the present human findings corroborate the findings of Calef et al.'s rat study suggests that the effects of uncontrollability on a previously learned response are similar in humans and rats.

While Calef et al.'s (1986) rats were subjected to an uncontrollable aversive unconditioned stimulus in Phase 2, the human subjects in the present study were given insoluble cognitive problems (perhaps aversive conditioned stimuli) in Phase 2. This suggests that both types of intervention are capable of producing the learned helplessness retention effect. This parallels the findings reported by Hiroto and Seligman (1975), which show that both treatment with an uncontrollable aversive unconditioned stimulus and exposure to insoluble cognitive problems produced the learned helplessness effect in human subjects.

The fact that perceived failure at a problem-solving task adversely affected the retention of previously learned information has significant implications for educational settings. It might be, for example, that a perceived failure could result in a general disruption of previously learned material, possibly generalizing to subsequent poor performance in other areas as well.

It should be noted that the interventions used by Calef et al. (1986) and in the present study to produce the learned helplessness retention effect are directly analogous to the interventions used by others (e.g., Bainbridge, 1973; Hiroto & Seligman, 1975; Maier et al., 1973; Overmier & Seligman, 1967; Seligman & Beagley, 1975; Thornton & Jones, 1971) to produce the learned helplessness effect. This means that exposure to uncontrollable aversive stimuli or unsolvable cognitive tasks probably produces both the learned helplessness effect and the learned helplessness retention effect. In other words, the effect seems to be both proactive and retroactive; both new learning and previous learning appear to be disrupted. It is conceivable that at least some of the poor performance seen in academic settings might be accounted for by this model.

Future research is needed to demonstrate both a learned helplessness effect and the learned helplessness retention effect from the same intervention. Also, a cross-modal study of the learned helplessness retention effect, analogous to Hiroto and Seligman's (1975) study of the learned helplessness effect, would be instructive. More specifically, researchers should try to determine whether experience with an unsolvable cognitive task interferes with a previously learned operant, motor response and whether experience with an uncontrollable aversive stimulus interferes with a previously learned cognitive task.

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