Learned Helplessness in Chess Players :
The Importance of Task Similarity and the Role of Skill

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Abstract

The effects of noncontingency between subjects' responses and outcomes were examined with respect to treatment/posttest similarity and skill in the task. The experimental design consisted of three groups. The first group had to solve chess problems with objective solutions and received veridical feedback; each member of the second group faced problems with no objective solutions, and received the same feedback as the member of the first group he was yoked with, but without any control on it; the control group received a waiting task. It was found that the group with unsolvable problems was more depressed than the two other groups at the end of the experiment. The mid-strength players were the most sensitive to the manipulation, and the weakest players showed little effect of learned helplessness. It was also found that the effects were proportional to the degree of similarity between the treatment and the posttest. The results limit the domain of applicability of the learned helplessness model.

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Research on learned helplessness with humans has investigated the effect of noncontingency on performance. Although the nature of this effect has not yet been clearly stated, several studies have identified variables that might influence performance within the learned helplessness context, such as the importance of task (Roth, 1980; Mikulincer, 1988), causal attributions made by subjects for a failure (Abramson, Seligman & Teasdale, 1978; Miller & Norman, 1979) and amount of experiences with uncontrollable outcomes (Thornton & Jacobs, 1971). The present study investigates the role of two other theoretically and practically important variables, task similarity between treatment and posttest, and skill in the domain.

Initial studies found that noncontingency between subjects' responses and outcomes produce cognitive, emotional and motivational deficits (see Seligman, 1975, for a review). These results supported Seligman's (1975) theory of learned helplessness, which proposes that subjects learn that they cannot control reinforcement. However, later studies (e.g.Trice & Wood, 1979; Thornton & Jacob, 1971) found that an improvement in performance followed noncontingent training. Such findings fit better with Wortman and Brehm's theory (1975), which proposes an integration of the theories of learned helplessness and reactance (Brehm, 1966), and pays special attention to the role of control expectancy and importance. These authors suggest that slight uncontrollability is prone to yield reactance, while strong uncontrollability causes learned helplessness. Roth and Kubal (1975) obtained results consistent with this hypothesis. These authors altered the amount of noncontingency and found that subjects initially responded with enhanced performance, but showed typical helplessness deficits after a longer exposure.

Seligman's (1975) theory predicts that deficits induced by exposure to uncontrollability would generalize to dissimilar situations. This hypothesis is only slightly supported by empirical evidence. Hiroto and Seligman (1975) found that uncontrollability learned with an instrumental task decreased posttest performance in both instrumental and cognitive tasks. However, learned helplessness induction with a cognitive problem showed significant negative effects only on an instrumental task. In three experiments, where the negative consequences were self administrated by the subjects, Trice and Woods (1979) varied the similarity between cognitive tasks (numerical sequences problems vs. anagrams). With different tasks between treatment and posttest, the unsolvable group showed better results than the solvable or control groups. On the other hand, the typical helplessness pattern was found with similar tasks.

Surprisingly, almost no attention has been given to the impact of skill in the uncontrollable domain on subsequent tasks. The exception is Trice and Woods (1979), who suggest that a long familiarity with the task could prevent the appearance of learned helplessness because of an uncontrolled immunization. As several researchers have presented the learned helplessness paradigm as a model of depression (e.g. Klein & Seligman, 1976, Seligman, 1975), this question has clear practical implications, especially in the prevention of depressive diseases.

A critical analysis of the literature shows that three characteristics impede the external validity of most learned helplessness studies in humans. First, the population under examination is made exclusively of undergraduate students or depressed people. Second, subjects are faced with tasks (such as anagrams or numerical sequence problems) which are of very little interest to them and, thus, are unlikely to provoke high motivation. Third, subjects' skill at the task has never been controlled. In my opinion, the use of the game of chess with chess players as subjects permits one to remedy these deficits. Chess players come from a variety of backgrounds, are highly motivated by this game, and their skill can be reliably estimated (Elo, 1978). Moreover, the use of chess allows one to check Trice and Woods' (1979) hypothesis concerning the role of task familiarity and to study the effects of a slight discrepancy between treatment and posttest tasks.

The purpose of the following experiment is threefold. First to examine the possibility of inducing learned helplessness with a cognitive task; second to investigate the effects of differential skill levels at the task; and third to examine the role of the similarity between treatment and posttest. After subjects with different chess skill responded to a self-report inventory, they were given a pretreatment consisting of a computer taught chess theory, to present a cover story. They were randomly divided into the three experimental conditions, and were exposed to either chess problems with controllable feedback, chess problems with uncontrollable feedback or to further chess theory. Their performance was then assessed in two posttests, one similar to the treatment, the other consisting in a different task, but still related to chess. Finally, subjects had to respond to a second version of the self-report inventory.

My specific predictions were as follows :

1) subjects exposed to uncontrollable problems will perform worse in the posttests and increase their anxiety and depressivity scores;

2) the effects of uncontrollability are inversely proportional to the degree of skill at the task; and

3) the effects of uncontrollability are proportional to the degree of similarity between treatment and posttest.

Method

In order to isolate the effects of uncontrollability from the effects of the aversive stimuli themselves, the following "triadic design" (Seligman, 1975) was used :

- in the first group, subjects received normal feedback (normal feedback group).
- in the second group, each subject received exactly the same amount and the same order of aversive stimuli as a subject of the first group, but with no way to modify the outcome (learned helplessness group).
- a control group which received a waiting task.

Subjects

Forty-eight Swiss male chess players, all volunteers, participated in this experiment. Their age varied from 18 to 33. So that no subject would have difficulties with the use of chess diagrams and algebraic notation, the minimal rating of 1600 Elo was required.

Category I	Elo 2200-2450 (Master)
Category II	Elo 2000-2200 (Expert)
Category III	Elo 1800-2000 (Class A)
Category IV	Elo 1600-1800 (Class B)

The 12 players of each skill category were assigned randomly to the 3 experimental groups, holding group size constant. Therefore, each intersection cell between category and group contained 4 subjects.

Apparatus

A portable computer (HYPERION), a standard chess clock (GARDE), a chess board (47cm x 47 cm) and pieces (STAUNTON style) were used. Subjects' verbalizations were recorded during the "B" posttest . Twenty-eight chess positions were chosen from obscure[1] at-least-8-year-old games. They all included a White or Black isolated Queen’s pawn (an important aspect of high level chess strategy). In the whole set of positions, only three were recognized (0.4 %), each by different subjects.

Questionnaire. A shortened version of the EMI-B (Emotionalitätsinventar-Befinden, Ullrich & Ullrich de Muynck, 1978) questionnaire was used in order to measure the emotional effects of lack of control. I ruled out 3 factors from the initial version, and retained anxiety, depressivity, tiredness and aggressivity factors. The two last factors were used for exploratory goals.The questionnaire consists of 20 bipolar adjective pairs, to be weighted on a -3 to 3 scale (without zero). A first version was given in the beginning of the experiment, a second one at the end. The presentation of the two versions was counterbalanced.

Pretreatment. The pretreatment had two goals : to control the subjects’ experience with computers, and to level the knowledge of the isolated Queen’s pawn within the categories. Subjects were told that the researcher’s main goal was to study different ways to teach chess techniques. The pretreatment consisted of

15 explanation pages and 5 diagrams, and its mean duration was 7 minutes. The theoretical bases were taken from Nimzovitch (1929), and the technical level was aimed at players between 1800 and 2000 Elo.

Treatment of the normal feedback feedback group. The treatment comprised 14 chess problems, which appeared on the computer screen, and lasted 7 minutes. For all problems, the subjects played White. Two solutions were proposed as soon as the problem was given, and the subject had to express his choice by pressing on the "A" or "B" key. After a right choice, the computer would print "correct answer", and after a wrong one, "incorrect answer", followed by a 800 Hz and 1/4 sec. beep. Most subjects found this sound very unpleasant.

All problems had an objective solution, that is, one and only one of the two proposed moves led to White advantage (in 11 problems) or maintained the balance (in 3 problems). Each problem was presented for 30 seconds. After 25 seconds, the message "Give your answer" appeared at the bottom of the screen. No answer after 30 seconds counted as a wrong answer. Every problem was characterized by the presence of an isolated Queen's pawn, on White's or Black's side. Eight problems were judged by the chess literature as easy, and six as difficult.

Treatment of the learned helplessness group. The presentation and duration were the same as for the normal feedback group. All 14 problems included an isolated Queen's pawn. The crucial difference was that the problems had no objective solution (see Figure 1 for an example of a problem used in this treatment). The proposed moves both had exactly the same influence on the position, that is both of them either gave an advantage to White (in 10 problems) or led to an equal or unclear position (4 problems). Only positions where the moves were explicitly judged as equivalent by the annotator were selected. The degree of typicality of these positions, as defined by Goldin (1978), was similar to the normal feedback group positions. Finally, the subjects of this group were yoked with those of the normal feedback group with respect to the amount and quality of feedback.

Insert Figure 1 about here

Control group. Because the computer exposure time of this group had to be the same as the other groups, the control group received theoretical instruction about "hanging pawns", a strategical chess theme not directly related to the isolated Queen's pawn. This presentation, based on Nimzovitch (1929), consisted of 15 text screens and 6 diagrams. Three problems (the first 3 of the normal feedback group), were given at the end of the theoretical part, in order to avoid a habituation time in the "A" posttest .

Posttest "A". The presentation mode is the same as in the treatment of the normal feedback and learned helplessness groups. This posttest is composed of 10 solvable problems, in relation to the isolated Queen's pawn, of which 3 can be considered as easy, 5 as of medium difficulty, and 2 as difficult. The number of correct choices and the response times were recorded.

Posttest "B". The subjects were presented the position "A" of de Groot (1965), given in Figure 2, and were asked to think aloud, without moving the pieces. Their verbal production was taped, and the investigated moves were written down by the experimenter. Analysis time was limited to 30 minutes. This limitation is unlikely to have caused any bias on the experiment, as all of de Groot's (1965) subjects gave their choice in less than 28 minutes. Three subjects, who knew the position, were dropped from the experiment and replaced.

Insert Figure 2 about here

The protocol analysis generally followed the procedure proposed by de Groot (1965). In addition to the quality of the chosen move, the following measurements were taken in order to evaluate subjects cognitive behavior : total time, amount of verbal production (length of the protocol, in number of lines in the typed protocol), maximal depth (counted in half-moves, i. e. in a White's <u>or</u> Black's move), mean depth, number of fresh starts (re-analysis from the initial position), number of pauses, number of different moves considered from the initial position and number of re-investigations.

<u>Procedure</u>

All the subjects participated in the experiment individually and were tested by the same experimenter. After being instructed on how to answer the prequestionnaire and given an example, the subjects completed it. The cover story of testing a chess tutor was then presented and the use of the computer was explained. After subjects asked any questions they had, the pretreatment started. At the end of the pretreatment, it was checked whether the normal feedback and learned helplessness subjects had understood the instructions given in the last text screen about the way to answer the problems, the diskette was changed and the treatment program started . The control group received the waiting task without any external intervention. At the end of the treatment, half of the subjects received the posttests in the order A-B, the other half in the order B-A.

For the "B" posttest , subjects received instructions similar to those of de Groot (1965). Then, subjects were invited to sit in front of the board, and the chess clock was started. If subjects had trouble expressing themselves, they were reminded during the first 2 minutes to verbalize as much as possible. If troubles persisted, only one reminder was given (usually during the first 5 minutes). The instruction to speak louder was not considered a reminder. This limitation on the number of recalls surely impoverished the quality of the protocols, but was necessary as the verbal production was measured as a dependent variable. The "B" posttest was considered finished once the subjects played their move or clearly expressed their choice.

After the completion of the two posttests, subjects received the post questionnaire and were debriefed. The mean duration of the experiment was 45 minutes.

Results

Posttest "A"

Two dependent variables were investigated in this posttest : the score obtained in the 10 problems and the mean solving time. As the "A" - "B" posttest presentation order did not show any effect, the data were combined across these conditions.

Subjects of the learned helplessness group did not perform as well as those of the two other groups. Only one of them obtained a score greater than 7 (out of 10), vs. nine in the normal feedback group and eight in the control group. Group means confirm the inferiority of the learned helplessness group ($M_{LH} = 6.31$, $M_{NF} = 7.5$, $M_C = 7.125$). The difference is statistically significant : $F(2, 45) = 4.34$, $p < .05$.

Insert Figure 3 about here

The pattern of means suggests that an interaction may exist between treatment and players' strength on score. The weakest players (category IV) were less sensitive to the manipulation, performing even better than subjects belonging to categories II and III of the same group (see Figure 3). However, an analysis of variance of treatment x strength does not show a significant effect (F (6, 36) = .58, ns.) . There is no particular difference between the solving time of the three groups: M_{LH} = 26.55 sec., M_{FN} = 26.84 sec., M_{C} = 27.53 sec.

Posttest "B"

Because the presentation order showed no difference between the 1st and the 2nd position, the results are evaluated globally.

Move choice is the most objective criterion for the cognitive performance of the "B" posttest . Table 1 presents the moves chosen by the subjects, classified by treatment and strength. The given value for each move stands in brackets. It is worth noting that the best move, 1.Ba2xd5, which gives a winning position to White (de Groot, 1965), appeared 15 times. This represents almost 33% of all the choices. There is no significant difference between the treatments, and no treatment x strength interaction. Related to this, it is interesting to note that the weakest players (category IV) of the learned helplessness condition obtained good results, closer to results of the experts (category II) of the control group than to results of the weakest players of the control or normal feedback group.

Insert Table 1 about here

The means suggest that the treatment influences maximal depth of search for the categories II and III, but not for the categories I and IV, although this is not statistically verifiable with the sample size available. The results obtained with the mean depth are similar to those obtained for the maximal depth. The manipulated group tended to anticipate fewer moves, which appears first of all with the category III. Verbal production analysis, operationalized by the number of lines in the typed protocols, shows that learned helplessness subjects verbalized less than those of the other groups. This tendency is however not significant.

The effect of the treatment on the number of pauses was surprising. As expected, the manipulated group was more silent than the normal feedback group. This is also the case for the control group, which presents the same symmetrical distribution as the normal feedback group, whereas the learned helplessness group exhibits a positive skewness. It seems sensible to suggest that the extra theory teaching received by the control group provoked the presence of more integrative phases. However, a difference can be noted between these two groups : the control group had a rather long total thinking time ($\underline{M}_C$ = 1030 sec.), whereas the learned helplessness group had a rather short thinking time ($\underline{M}_{LH}$ = 790 sec.). The shorter protocol length of the learned helplessness group is consistent with these observations.

No significant differences were found for the following variables : total thinking time, number of fresh starts, number of different starting moves and number of re-investigations. An analysis of this last variable shows that the manipulated group performed fewer re-investigations than the other groups in the categories I, II, III, but again this difference was not statistically significant .

Questionnaire analysis

Sample homogeneity between groups was confirmed by an analysis of variance applied to the results of the prequestionnaire. No inter-groups differences in anxiety, depressivity, tiredness and aggressivity were found. The initial -3 to 3 scale (without zero) was translated into a 1 to 6 scale, in order to facilitate computation.

Figure 4 shows the change in anxiety as a function of treatment. The normal feedback and control group curves have a slight increase, whereas the one of the learned helplessness group indicates a stronger anxiety augmentation (half a standard deviation) between the times of the two questionnaires. However, the difference is not significant. A category analysis within the learned helplessness group shows a slight anxiety diminution for the strongest and weakest players, and a larger (but ns.) anxiety augmentation for the players belonging to the two mid-strength categories.

Insert Figure 4 about here

Stronger effects were obtained with the depressivity factor (Figure 5). As expected, there is a large increase (+ 20 %) with the learned helplessness group, whereas the control group shows only a slight increase (+10%) and normal feedback group even shows a diminution. Interaction effect time x group is significant : $F(2,45) = 3.42$, $p < .05$. Within the learned helplessness group, only the category IV did not show any increase in this factor.

Insert Figure 5 about here

The <u>tiredness</u> factor presents a surprising result. All groups showed a decrease in tiredness after this experience, which required a lot of concentration and stamina. This effect is significant for all the groups : $F(1, 45) = 6.48$, $p < .05$. Even when it is part of a psychological experiment, chess players really seem to find the game relaxing ! <u>Aggressivity</u> factor shows a slight increase for the learned helplessness and normal feedback groups, and a slight decrease for the control group.

In sum, the learned helplessness group (and especially subjects in categories II and III) showed an anxiety and depressivity increase. All group exhibited a tiredness decrease.

Discussion

On the whole, the results of this research support the first hypothesis : it seems possible to induce learned helplessness with a cognitive task. However, if the "A" posttest and the depressivity factor of the questionnaire provided clear evidence, the "B" posttest did not show any significant difference between the three different treatment groups. Due to this lack of difference in the latter posttest, it was not possible to investigate more closely the effects of learned helplessness on the chess players' thinking mechanisms. Such an investigation might have shed some interesting light on the cognitive implications of depressive diseases, as described by Beck (1967).

The results of the experiment did not present significant evidence for the second prediction, derived from Trice & Wood's (1979) hypothesis. It was predicted that the effects of learned helplessness would be inversely proportional to the degree of skill with the task. First, at variance with the proposed hypothesis, manipulated masters (category I) showed poorer performance than the other masters (cf posttest "A"). Second, experts (category II), who are obviously quite familiar with the game, were very sensitive to learned helplessness. Third, no effect was found with the weakest players (category IV) of the learned helplessness group. A first explanation could be that the latter players did not perceive the noncontingency reaction (R) - consequence (C), because of their limited chess capacities. It could also be argued that there is some ceiling effect : no difference was found because of the globally low level of these players.

In my opinion, these alternative explanations do not stand up under a closer analysis. It seems obvious that these players were competent enough to catch the absence of R-C contingency. Their Elo (mean : 1694) is far from a beginners' rating (estimated Elo : 1200), and their performances in posttest "B" testify in favor of a more than basic understanding of chess. The ceiling effect explanation can be discarded for the same reasons. A third hypothesis seems more likely to explain this result, which reminds one of the so called reactance behavior described by Wortman and Brehm (1975). I suggest that the lack of expectancy of these subjects played an immunization role against the learned helplessness. These subjects had probably given up any chess ambition, which could not be the case for the subjects belonging to categories II and III; the latter had progressed enough to still hope for a further progression. Future research should investigate the possibility that both a high or a low level of competence is immunizing against learned helplessness.

This research confirms the third hypothesis, related to the importance of the treatment/posttest similarity. It was proposed that the effects of learned helplessness are proportional to the degree of similarity between treatment and posttest.The performance of the manipulated group was significantly inferior in the "A" posttest whereas only weak tendencies could be found in the two other groups. However, this study does not replicate altogether Trice and Woods' (1979) results. They observed that manipulated subjects obtained better scores when the posttest was different from the treatment. Although reactance cases were present in the present study, it was also possible to provoke learned helplessness in some cases. Thus, it seems that the importance of individual differences should not be neglected in the research on learned helplessness.

The absence of cross-situational transfer of uncontrollability does not support Seligman's (1975) claim of learned helplessness generalization. On the contrary, the results suggest that subjects encode specifically the situation where uncontrollability experience happens, therewith preventing themselves from inappropriate generalization. As the tasks used in this study were both related to chess and therefore quite close, the encoding specificity should be very high. It remains an open question whether this lack of generalization persists after an exposure to a larger amount of uncontrollable stimuli or after an exposure to diverse sources of uncontrollability.

In sum, the results of this study strongly indicate that learned helplessness can be induced by a manipulation of cognitive contingencies. However, they also restrain the domain of applicability of the theory, as defined by Seligman (1975). Besides factors such as the importance of task, the causal attributions made by the subject and the amount of uncontrollable stimuli, the conditions for the development of the learned helplessness seem to require 1) a high similarity between the noncontingency learning situation and the following situations, and 2) an average skill in the domain.

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Author Notes

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Footnotes

[1] The positions most likely to be recognized were presented with reversed colors.

Figures caption

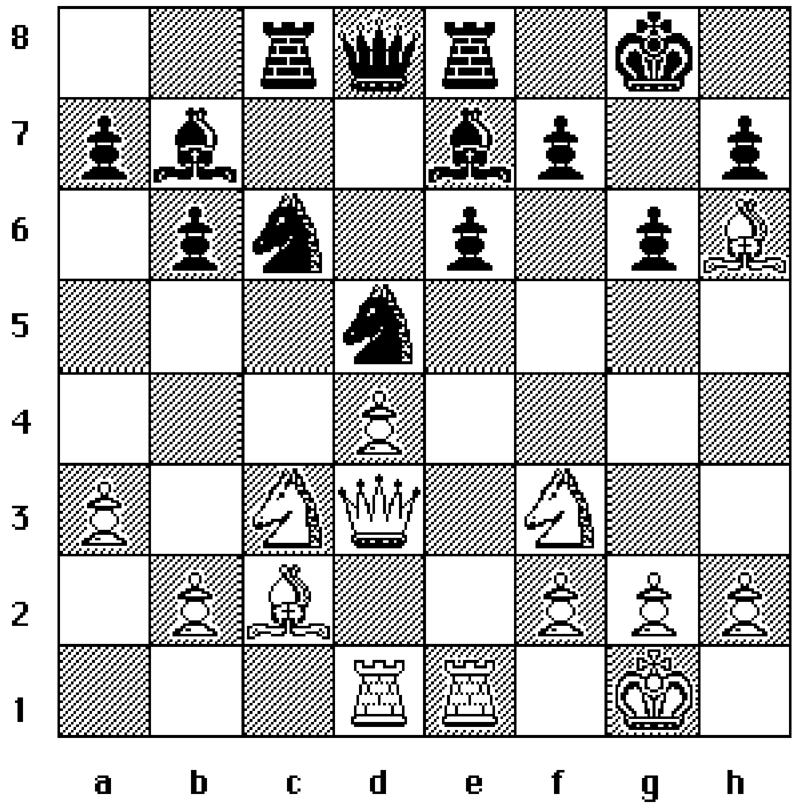
Figure 1. Example of a problem used in the learned helplessness treatment. Both 1.h2-h4 and 1.Bc2-a4 lead to a slight advantage for White.

Figure 2. The position "A" of de Groot (1965).

Figure 3. Mean proportion of correct answers in posttest "A" for the normal feedback, learned helplessness and control group as a function of skill category.

Figure 4. Mean anxiety rate for the normal feedback, learned helplessness and control group groups as a function of time.

Figure 5. Mean depressivity rate for the normal feedback, learned helplessness and control group groups as a function of time.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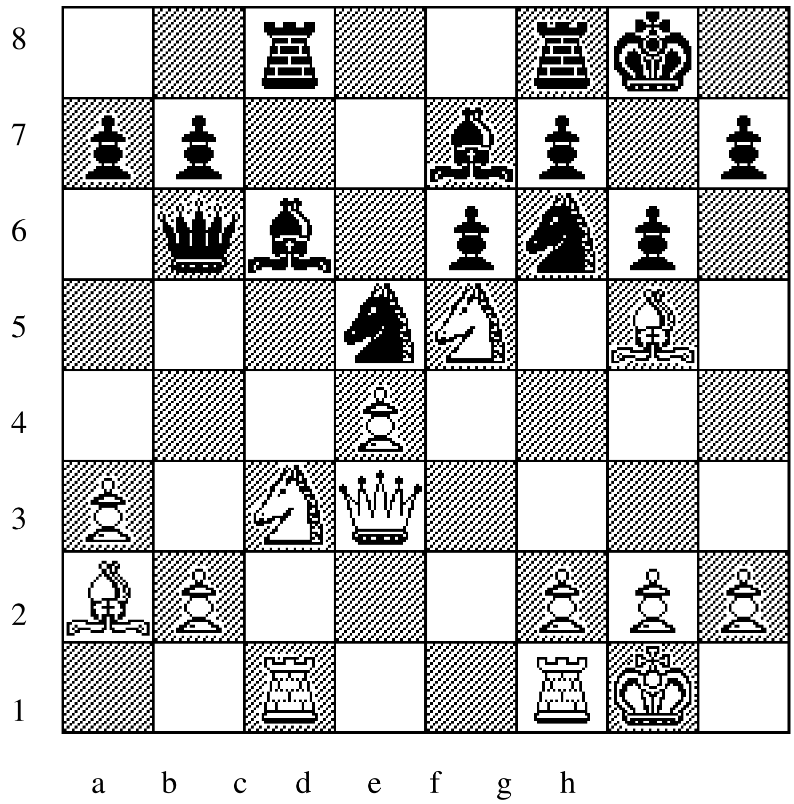
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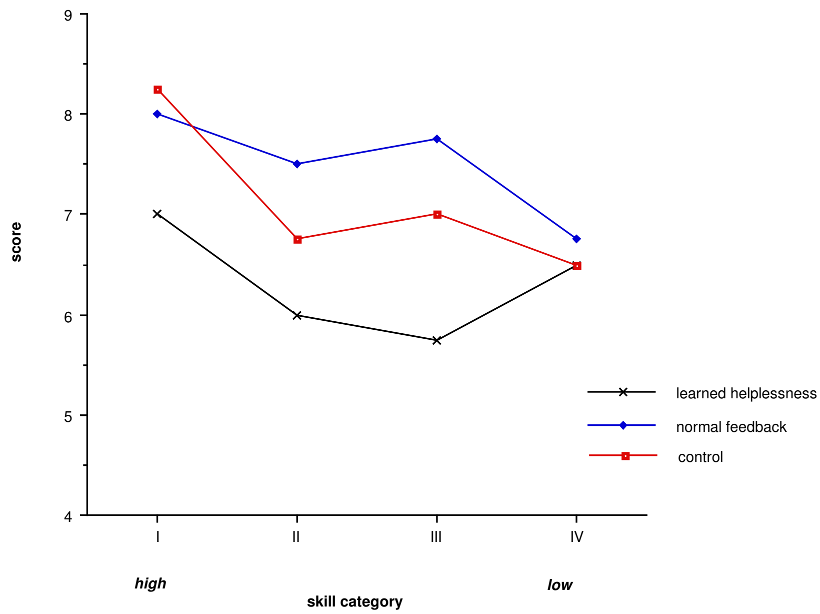
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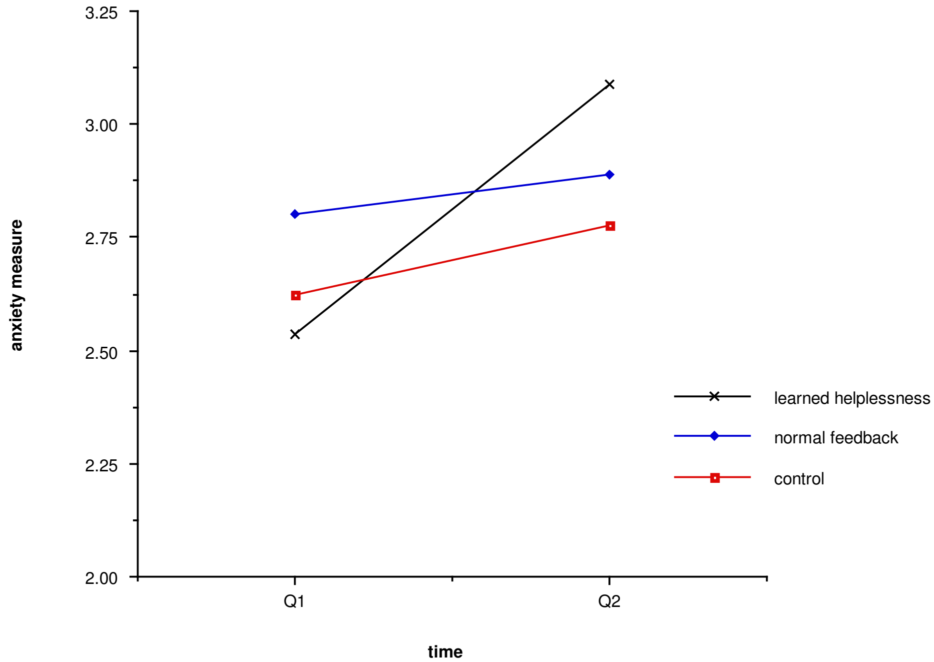
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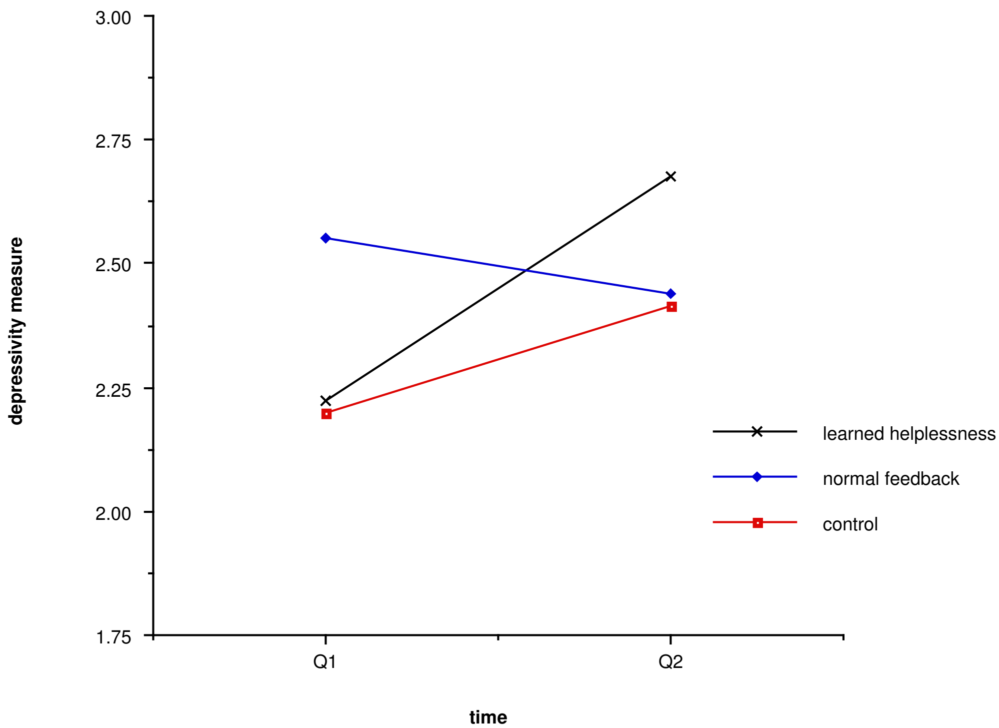
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