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PRODUCING OR OBSERVING RESPONSE-OUTCOME CONTINGENCIES IN A TWO RESPONSE ALTERNATIVE TASK

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Repetition of "Right" and "Wrong" responses was measured as a function of whether the subjects performed (i.e., responding overtly and being provided with outcome "Right" or "Wrong") or observed (i.e., either watching a performer or listening to information given by the experimenter) on a preceding trial. Response repetition on Trial 2 by performers is a function of the recall of previously given responses and their outcomes. When the outcome is forgotten, repeating previous responses depends on the proportion of "Right" responses on Trial 1. On the other hand, observers' performance depends upon the recall of correct responses; when there is no recall of correct responses, random responding occurs. Experiencing outcomes following subject's own responses appears to be the crucial factor.

In the discussion of the law of effect, Thorndike (1931) proposed two alternative views regarding the nature of response consequences, especially the action of verbal reinforcers "Right" and "Wrong". One view, which he favored, assumed that rewarding aftereffects strengthen stimulus-response connections directly and automatically. According to the other view, aftereffects provide a basis for the acquisition of information. Recent interpretations of reinforcement favored more the second view (Buchwald, 1969; d'Ydewalle & Eelen, 1975; Estes, 1969; Nuttin & Greenwald, 1968). When learning is primarily a matter of storing in memory information about stimulus-response-outcome relationships, subject's overt responses followed by rewarding or punishing outcomes are no longer necessary for efficient learning. Information as to what response leads to what outcome, may be acquired either by watching the responses and their outcomes of another person, or by merely being instructed about the responses required to produce an intended outcome (Bandura, 1962).

Although several of these training procedures have already been compared (Hillix & Marx, 1960; Rosenbaum & Arenson, 1968; Van Wagenen & Travers, 1963), not much research has been done

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on the effects of "Right" vs. "Wrong" as a function of these learning paradigms (Cheyne, 1972; Marx & Witter, 1972). The purpose of the present study was to determine whether there are differences in repeating "Right" and "Wrong" responses when the same amount of information is available either through direct experience of the outcomes following subject's responses or through merely being informed about the response-outcome contingencies.

In the experimental task used, each stimulus was followed by two response alternatives. Training and testing were limited to one trial, each trial consisting of a single run through all the stimuli. In the perform conditions, the response to each stimulus during Trial 1 was given by the subject (working in pairs or individually). The experimenter called each response "Right" or "Wrong". In the observe conditions, the subjects were exposed to the same information with regard to responses and outcomes. They were either watching a performer or were instructed by the experimenter.

EXPERIMENT 1

METHOD

Subjects: The subjects were 68 (male and female) students from a large introductory psychology class at the University of Leuven (Belgium). None of them had previously participated in a psychological experiment. Subjects were randomly assigned to four equal-sized groups, defined by the 2×2 factorial combination of performing vs. observing, and individual vs. dyadic conditions.

Materials: A series of 17 slides was projected on a screen in front of the subjects. Each slide represented a number of objects or persons, and was shown for 4 sec, after which two numbers were projected, one on the left and the other on the right side of the screen. During the exposure of the two numbers, subjects selected one of them. Only those slides were used where no systematic preference for either one of the two numbers could be detected in preliminary experiments. In front of the subjects were two response buttons, marked with *L*(eft) and *R*(ight). Each button was connected with lights on a control panel in front of the experimenter, who sat behind the subjects.

Procedure: The series of 17 slides was presented twice in each condition. The order was randomized for each trial and for each subject. The first and last slide on Trial 1 were buffer-items not used in gathering the data. All subjects were led to believe that only one of the two numbers was a good approximation of the number of represented objects, and that by choosing this one, the response would be called "Right"; otherwise, the response would be called "Wrong". In fact, any response to 7 stimulus-items was called "Right". Any

response to the remaining 10 slides was called "Wrong". For each subject the position of the items to be called "Right" or "Wrong" was randomly chosen, except for the buffer-items. The response to one buffer-item was called "Right", and the response to the other "Wrong" (randomly changing from one subject to the other). "Right" and "Wrong" were pronounced by the experimenter simultaneously with the presentation of the next slide. In all conditions, subjects had to learn the correct number for each slide. In the *performer-individual* condition, subject had to make his choice during Trial 1 by saying the number aloud and by pushing at the same time one of the two buttons, according to the position of the projected numbers. His choice was called "Right" or "Wrong". At Trial 2, subject was instructed to try to give as many as possible correct responses. The responses were given by pushing one of the buttons without saying the number aloud. About the same procedure was followed in the *performer-dyadic* condition. Subject, however, was watched during Trial 1 by a stooge. At Trial 2, a screen was placed to separate subject and the stooge, who had also two push-buttons at his disposal. Both were asked to select the correct number as much as possible by pushing the corresponding button. In the *observer-dyadic* condition, the performer was a stooge who selected randomly one of the two numbers. He was watched during Trial 1 by the subject. In the *observer-individual* condition, the same learning instructions were given as in the preceding conditions, but the experimenter told that during Trial 1 he would indicate on each stimulus-item either the number which is "Right" or the number which is "Wrong". The number and outcome indicated by the experimenter was randomly chosen, subject to the restrictions that 7 responses were called "Right" and 10 responses "Wrong" (one buffer-item was always called "Right" and the other "Wrong"). During Trial 1, subject had not to make any choice. At Trial 2, subject was asked to give as often as possible the correct number by pushing one of the two buttons. In all conditions, no outcomes were given on Trial 2.

RESULTS

The data of response repetition consisted of the number of instances in which the subject on Trial 2 gave the same ("Right" or "Wrong") response to a given stimulus as was given on Trial 1 by himself (both perform conditions) or by a stooge (observer-dyadic condition) or by the experimenter (observer-individual condition). Table 1 shows the proportion of response repetition in the several conditions.

The data were analyzed in a three-factor design with two between-subjects factors (performing vs. observing, and individual vs. dyadic), and one within-subjects factor (responses called "Right" vs. "Wrong" on Trial 1). The analysis indicated two significant main effects. As subject was required to choose correct responses, more "Right" responses were repeated than "Wrong" responses, $F(1, 64) = 74.837$,

$p < .001$. Also, observers repeated more responses as compared to performers, $F\ (1,64) = 5.895$, $p < .05$. However, the interaction between these two variables was significant, $F\ (1,64) = 13.580$, $p < .01$. The interaction resulted from the fact that much less "Right" responses, $F\ (1,64) = 19.125$, $p < .01$, and slightly more "Wrong" responses, $F\ (1,64) = 1.445$, $p > .10$, were repeated by performers as compared to observers. As is apparant in Table 1, the proportion of "Right"

condition	responses	
	right	wrong
performer		
individual	.510	.412
dyadic	.637	.425
observer		
individual	.794	.379
dyadic	.716	.359

TAB. 1. PROPORTION RESPONSE REPETITION FOLLOWING THE OUTCOME "RIGHT" AND "WRONG" IN THE VARIOUS CONDITIONS

responses repeated in the performer-individual condition was near at chance-level, defined as .50 in tasks with two response alternatives. Working in pairs vs. individually interacted with performing vs. observing, $F\ (1,64) = 4.789$, $p < .05$. Further analysis indicated that in the performer-dyadic condition, subjects repeated more "Right" responses than in the performer-individual condition, $t\ (64) = 3.076$, $p < .05$. No other significant effects emerged.

DISCUSSION

There was no difference between the observer-dyadic and observer-individual conditions, while more "Right" responses were repeated in the performer-dyadic condition as compared to the performer-individual condition. The lack of difference between the two observing conditions strongly suggested that learning from watching others may be considered as equivalent to learning from verbal instructions, and that both forms of modeling are likely to produce same levels of observational learning (Bandura, 1970). It is however not clear why performing, while being watched by another, resulted in more repetition of "Right" responses than performing alone.

The small proportion of response repetition in the performer-individual condition may appear puzzling. In the Thorndikian experiments, responses that have been called "Right", were usually more often repeated than would be expected on the basis of chance. In our performer-individual condition, however, "Right" responses were repeated at about chance-level. An explanation for the present finding was offered by d'Ydewalle and Eelen (1975). As Buchwald (1969), they assumed that the probability of a given response being

repeated from one trial to the next depends upon whether the response and/or the outcome is recalled or not. If subject recalls both the response and the outcome, it is assumed that he will repeat any response that had the outcome "Right" and alter any response that had the outcome "Wrong". If subject does not recall his response, regardless of whether he recalls the outcome or not, the response will only be repeated by chance. When subject recalls a response but does not recall the outcome, he will be uncertain whether to repeat the response or not. d'Ydewalle and Eelen (1975) found that, in those cases, subject repeats the response with a probability which approximates the proportion of "Right" responses in the previous trial. In Experiment 1 the proportion of "Right" responses on Trial 1 was small (.41). It follows that the probability of repeating the same response when the outcome is forgotten, will be low (or at least, lower than chance level, i.e., .50). This will decrease the repetition of "Right" and "Wrong" responses.

The difference in response repetition between observers and performers cannot be due to a difference in the tendency to repeat recalled responses when the outcome is forgotten (Cheyne, 1972). It would imply that there should be more repetition of "Right" and "Wrong" responses in the observing conditions. Actually, the observers repeated more "Right" responses than the performers, but slightly less "Wrong" responses. One may hypothesize that the memory processes are differentially involved when a person is performing as opposed to when he is observing someone else. In a two response alternative task, "Right" and "Wrong" are equally informative with regard to the correct response. Observers presumably concentrate more on retaining the correct response. Although the time interval between the announcement of the outcome and next stimulus was minimized, the indication of a "Wrong" response may still have eventuated in a covert correcting response. Therefore, response repetition in the observe conditions could be a function of recalling the correct response, and not a function of two separate memories (i.e., for responses and outcomes) as in the perform conditions.

EXPERIMENT 2

In perform conditions, response repetition is a function of recalling the responses and their outcomes (Buchwald, 1969; d'Ydewalle & Eelen, 1975). When the outcomes are forgotten, the probability of repeating a response approximates the proportion of "Right" responses on the previous trial (d'Ydewalle & Eelen, 1975). Experiment 1 suggested that response repetition in the observe conditions is mainly a function of recalling the correct response; i.e., whatever the proportion of responses indicated as "Right" or "Wrong", the observer will try only to remember the correct response. The above considerations lead to the following hypothesis. While in the perform conditions response

repetition will be influenced by varying the proportion of "Right" responses of Trial 1, the same manipulation will have no effect in the observe conditions.

METHOD

Subjects: The subjects were 80 (male and female) students at the University of Leuven (Belgium) who did not participate previously to any psychological experiment. They were randomly assigned to four equal sized groups, defined by a 2×2 factorial combination of performing vs. observing, and the proportion of "Right" responses on Trial 1 (.24 and .76).

Materials and Procedure: The materials and the procedure were identical with those used in the two individual conditions of Experiment 1. The responses on the first and last slide (buffer-items) in one series of conditions were called "Wrong", and from the remaining items, 4 responses were called "Right" and 11 were called "Wrong"; i.e., 24% of the responses were called "Right". In the other conditions, 76% of the responses were called "Right": the 2 buffer-items and 11 remaining items were called "Right". Except these restrictions, the position of the items to be called "Right" and "Wrong" were randomized for each subject.

RESULTS

The proportion of repeated responses in the various conditions are shown in Table 2. A three-way analysis of variance was carried out with perform vs. observe, proportion of "Right" responses on Trial 1, and "Right" vs. "Wrong" responses (within-subjects factor) as main factors.

condition	responses	
	right	wrong
performer		
24% "Right" responses	.562	.441
76% "Right" responses	.709	.538
observer		
24% "Right" responses	.712	.368
76% "Right" responses	.655	.400

TAB. 2. PROPORTION RESPONSE REPETITION FOLLOWING THE OUTCOME "RIGHT" AND "WRONG" IN THE VARIOUS CONDITIONS

As expected from Experiment 1, the main effect of "Right" vs. "Wrong" responses, and the interaction between "Right" vs. "Wrong" responses and perform vs. observe were both significant, $F(1,76) = 63.485$, $p < .001$, and $F(1,76) = 7.455$, $p < .01$. The main effect of

performing vs. observing was no longer significant ($F < 1$), but the same factor interacted with the proportion of "Right" responses on Trial 1, $F(1,76) = 3.659$, $p < .05$. The proportion of "Right" responses on Trial 1 had no effect in the observe conditions ($F < 1$), but affected response repetition in the perform conditions, $F(1,76) = 5.967$, $p < .025$: more "Right" and "Wrong" responses were repeated when more responses were called "Right" on Trial 1.

DISCUSSION

The obtained interaction between perform vs. observe and the proportion of "Right" responses on Trial 1 is in accord with the prediction. The effect of the proportion of "Right" responses on Trial 1 in the perform conditions is similar to the findings of d'Ydewalle and Eelen (1975). In the observe conditions, presenting information on Trial 1 focuses subject's attention on the correct alternative, irrespective whether the experimenter indicates the "Right" or the "Wrong" alternative.

The question remains why performers do not follow the same proficient way of information processing as observers. It may be attributed to detrimental effects of interfering responses evoked by overt performance (Rosenbaum, 1967; Rosenbaum & Schutz, 1967). Decision making and perceptual-motor activities by the performer may be regarded as activities which interfere with optimal learning. In the perform condition, it also seems reasonable to suspect interference from the various emotional reactions evoked by "Right" and "Wrong" (Bower, 1962). Experiment 3 tested the feasibility of attributing the learning difference between performing and observing to one of those sources of interference.

EXPERIMENT 3

Experiment 3 consisted of an attempt to eliminate the activity demanded of performers for overt responding, as a factor affecting the difference between observers and performers. Performers were made observing subjects, but of their own performance. The experimenter mentioned on each stimulus the response alternative which was given by the subject on a previous practice trial (wherein no outcomes were given), and called it "Right" or "Wrong". Learning in this group (*aware* condition) was compared with a condition in which the same procedure was used, with the exception that the subjects did not know that the experimenter was giving feedback on their own given response (*no-aware* condition). They were led to believe that the experimenter arbitrarily indicated a "Right" or a "Wrong" alternative, just as in the observe condition of Experiment 2. Two other conditions were essentially a replication of the observe and perform conditions of Experiments 1 and 2, except for the fact that a practice trial preceded the information trial.

METHOD

Subjects: Eighty (male and female) students at the University of Leuven (Belgium) volunteered for the experiment. They were randomly assigned to four equal sized groups. None of them had previously served in an experiment of the present type.

Materials and Procedure: The same series of 17 slides was used. In front of each subject was a portable IBM key punch with two push-buttons, marked with *L*(eft) and *R*(ight). Each time a button was pressed, the response was registered on a punch card. Unknown to the subjects, the two buttons were also connected to a recording equipment behind the experimental room. All subjects were instructed that they would be shown a series of slides, each representing a different number of objects or persons, and each followed by two numbers as response alternatives. Their task was to indicate which of the two numbers gave the best approximation of the number of represented objects. The purpose of the experiment was explained as a check to see whether students could make an objective estimation of a number of objects or persons. They were instructed to give their choice only by pressing one of the two push-buttons whereby the response would be recorded on the punch card. The experimenter told that the punch apparatus was used in order to analyze the results afterwards with the aid of a computer. After the presentation of the whole series, the subjects were instructed that Trial 1 was only a practice trial, and that the series would be represented again until they would give a correct response on each slide. In the *standard-performer* condition, subjects were instructed to select again one of the response alternatives by pressing the corresponding button and by calling out the chosen number, and that their choices would be called "Right" or "Wrong" by the experimenter. In the *standard-observer* condition, the experimenter indicated randomly one of the two alternatives, and called it "Right" or "Wrong". In the *aware* condition, the experimenter removed the punch card on which subject's responses of the practice trial were recorded. Every time a stimulus appeared, the experimenter reminded which response the subject gave on that stimulus during Trial 1, and called it "Right" or "Wrong". Also, in the *no-aware* condition, the experimenter removed the punch card after Trial 1, and gave it to the subject as a gift. The same instructions were then given as in the standard-observer condition, but on Trial 2 (information trial) a collaborator of the experimenter in the second room instructed the experimenter on each stimulus which response the subject gave on Trial 1 (with the aid of two lamps, marked *L*(eft) and *R*(ight), which were only visible by the experimenter). This response alternative was called by the experimenter "Right" or "Wrong". Subjects were led to believe that the indicated response was arbitrarily chosen by the experimenter. In all conditions, 4 responses were called "Right" and 13 responses were called "Wrong". The response to the first and the last stimulus-items were called "Wrong",

and were not used in gathering the data. After Trial 2 (information trial), a test trial was given wherein all subjects attempted to respond correctly to all stimuli by saying the number aloud, and by pressing the corresponding button. No outcomes were given during the test trial. For each trial, a different order of slides was used. The left-right position of the numbers on each slide was changed from one trial to the next.

RESULTS AND DISCUSSION

Table 3 shows the proportion of response repetition in the various conditions. The data were subjected to a two-way analysis of variance

condition	responses	
	right	wrong
standard-performer	.475	.336
standard-observer	.738	.276
aware	.525	.268
no-aware	.675	.276

TAB. 3. PROPORTION RESPONSE REPETITION FOLLOWING THE OUTCOME "RIGHT" AND "WRONG" IN THE VARIOUS CONDITIONS

with the main effects being the various learning conditions, and "Right" vs. "Wrong" responses, which was a within-subjects factor. Both main effects were significant, $F\ (3,76) = 3.225$, $p < .05$, and $F\ (1,76) = 112.408$, $p < .001$. The interaction between both factors was also significant, $F\ (3,76) = 6.006$, $p < .05$. As seen in Table 3, "Wrong" responses were repeated at about the same level in all conditions. Differences were apparent for the "Right" responses. Comparing the mean proportions of "Right" responses repeated under the various conditions, a significant difference is found between the two standard conditions, $t\ (76) = 4.419$, $p < .01$, providing essentially a replication of Experiment 1. Also, subjects in the no-aware condition repeated more "Right" responses as subjects in the aware condition, $t\ (76) = 2.525$, $p < .05$. The personal involvement in the response given prevents the subjects in the aware (and perform) conditions from using the same proficient strategy as the less involved no-aware (and observing) subjects. Experiencing an outcome for one's own response does appear to be an important factor affecting learning.

CONCLUSION

Providing the subjects with the same amount of information did not produce the same results in perform and observe conditions. As predicted by Buchwald (1969) and d'Ydewalle & Eelen (1975),

performers' choices reflected the existence of two separate memories: recall of previous responses and recall of received outcomes. The results obtained in observe conditions suggested that subjects were using a strategy which decreased the memory loading. They only retained the correct alternative. The conclusion is that information processing is under a higher degree of control by the subjects when "Right" and "Wrong" does not function as consequences of subjects' choices.

A study by Cheyne (1972) is nearly similar to the present experiments. Half of his subjects selected on Trial 1 one of two words, each choice being called "Right" or "Wrong". The others observed the responses and outcomes of a confederate. No differences appeared. In Cheyne's study, however, second-grade children were used. The adoption of a more efficient learning strategy by observing subjects, may be a function of age and intellectual development.

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