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THE REPORTED NUMBER AND THE REPETITION OF "RIGHT" AND "WRONG" RESPONSES [1]

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Previous experiments indicated that the repetition of responses called "Right" and "Wrong" was influenced by the preceding number of "Right" and "Wrong" responses: When the subjects were not able to recall the outcome, they were assumed to guess the outcome and repeat the response as a function of the number of preceding outcomes. Accordingly, their general impression about the relative number of "Right" and "Wrong" responses should mediate the subsequent response repetition. Correlations between the reported number of outcomes and the subsequent response repetition fail to substantiate the idea (Experiment 1). Experiments 2-5 tried to increase the correlations by reminding the subjects' responses on Trial 2, by taking into account the expectations before Trial 1, and by increasing the between-subjects variability: All attempts failed. Two explanations are put forward: Either Thorndike's view about the automatic action of reward was correct, or requiring the subjects to report the number of received outcomes is an inappropriate method to monitor higher-order cognitive processes.

Since about 1968 a number of studies (Buchwald, 1969; d'Ydewalle & Eelen, 1975; Estes, 1969; Nelson, 1976; Nuttin & Greenwald, 1968) have been trying to explain in more cognitive terms some basic findings of Thorndike. In these experiments typically, the subjects responded to a series of stimuli and the experimenter called each response "Right" or "Wrong" immediately after it had occurred. At a second presentation of the same series, responses that had been called "Right" were repeated substantially more often than would be expected by chance. However, the case of responses called "Wrong" was not clear. Thorndike (e.g., 1932) presented a few arguments indicating that the increase of the repetition of "Right" responses was due to the automatic and direct enhancing effect of the satisfying outcome "Right". Along with the recent upheaval of interest in cognitive processes, a few investigators went back to the original findings of Thorndike in order to find a more cognitive explanation than the reference to the mysterious and evasive concept of the automatic strengthening of responses called "Right". The key to the development of a cognitive explanation was the assumption that the effects of "Right" and "Wrong" on response repetition depend on what the subjects can recall from their former experience with the same series of stimuli. As the subjects are called upon to respond to a long list of stimuli before the same stimuli are presented again,

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the memory of their previous responses to the stimuli and the accompanying outcomes "Right" or "Wrong" will be less than perfect. Let us consider now what happens with less than perfect recall of the preceding events. If the response and its outcome are both recalled, the response will be repeated if it was called "Right" and will be altered if it was called "Wrong". If the response is not recalled, regardless of whether the outcome is or is not recalled, the subjects will select a response at random from among the k available response alternatives, i.e., the probability of repetition will be $1/k$. When the subjects can recall their previous response but no longer know the outcome ("Right" or "Wrong") of that response, Buchwald (1969) stated that in some proportion of those instances, g, the subjects guess that their response was correct and repeat it, while in the remaining proportion, $1 - g$, they guess that their response was incorrect and do not repeat it. No specific value was assigned to g, i.e., g was a free parameter. d'Ydewalle and Eelen (1975) hypothesized that the value of g will vary with the relative frequencies of "Right" and "Wrong" responses of the preceding trial. The proportion of "Right" responses was systematically manipulated on Trial 1 of the series. The response repetition on Trial 2 changed strongly as a function of the proportion of "Right" responses on Trial 1. With more "Right" responses on Trial 1, the subjects repeated the responses of Trial 1 more frequently, even if those responses had been "Wrong". In some experiments of d'Ydewalle and Eelen (1975), the subjects were required to recall overtly their past responses and the outcomes which followed the responses. Using the recall data, they tried to predict the response repetition. The recall of responses did not change as a function of the number of "Right" and "Wrong" responses of Trial 1. However, the overt recall of the outcomes was strongly influenced by the relative frequencies of "Right" and "Wrong" on Trial 1. In retrieving the outcome, the probability of recalling the outcome equals $1 - u$, u being the probability that the subjects do not recall the outcome and have to guess. If e is the probability that outcome "Right" is guessed, the probability of guessing the outcome "Wrong" equals $1 - e$. A combination of both parameters, u and e, gives the following equations for the probability of correct recall of the outcomes "Right" [P (Rec 0/r)] and "Wrong" [P (Rec 0/w)]:

$$P\ (\mathrm{Rec}\ 0/\mathrm{r}) = 1 - u + ue \qquad <1>$$

$$P\ (\mathrm{Rec}\ 0/\mathrm{w}) = 1 - u + u\,(1 - e) = 1 - ue \qquad <2>$$

An application of these equations to the recall data of d'Ydewalle and Eelen (1975) allows an estimation of the e value. In the reported experiments, the value of e is nearly equal to the proportion of "Right" responses on Trial 1. This means that, when the subjects are required to recall the outcome and they are unable to retrieve from memory, they guess the outcome according to their memory of the relative number of "Right" and "Wrong" responses at Trial 1. The conclusion from the outcome recall data is exactly the same as from the response repetition : When the subjects know which response they made on the preceding trial but do not know whether or not it is correct, they guess that their response was correct as a function of the relative frequencies of "Right" and "Wrong" on Trial 1. Hence, both parameters, g and e, are hypothesized to involve the same process.

In d'Ydewalle and Buchwald (1976), new experiments were presented to compare the repetition of responses (varying the proportions of "Right" and "Wrong" responses on Trial 1) under standard conditions and conditions designed to get perfect recall either of responses or of outcomes. The procedure which insures that Trial 1 responses are recalled perfectly on Trial 2, without affecting the recall of outcomes, should increase the number of stimuli for which the subjects can recall their responses but not the outcomes of these responses. Consequently, in these conditions the response repetition was much more affected by the proportion of "Right" responses at Trial 1. Again, the parameter estimation of g gives almost the same value as the proportion of "Right" responses at Trial 1. In contrast, when the outcomes are perfectly recalled at Trial 2, the relative frequencies of "Right" and "Wrong" responses no longer affected the subsequent response repetition.

In general, when the subjects don't recall the outcomes, they guess the outcome according to the proportion of "Right" and "Wrong" responses on Trial 1. In order to respond in this way, the subjects must keep in mind a general impression of the number of outcomes "Right" and "Wrong" received on Trial 1. It is clear that in this kind of experiments the subjects are unable to report from memory the exact number of preceding "Right" and "Wrong" responses. The present paper presents a few experiments which attempted to get empirical evidence that the general impression mediates the response repetition when the outcomes are forgotten.

Experiments which measure directly the impression of the number of outcomes "Right" and "Wrong" in a serial task have recently been published in English by Nuttin and his collaborators (Janssens & Nuttin, 1976; Nuttin & Greenwald, 1968; Vreven & Nuttin, 1976). In a typical experiment, the subjects are given a series of short estimation tasks : Each response is immediately followed by a clearly communicated "Right" or "Wrong". Immediately afterwards, the subjects are requested to estimate the number of "Rights" and "Wrongs" they got. The subjects had not received any preliminary instruction to count the outcomes. The reported number of "Rights" and "Wrongs" has proved to be influenced by social as well as situational factors. Using this standard paradigm, but without any social or situational manipulation, individual differences were found. Nuttin believes that the individual distortions of the reported number of outcomes are reliable and reflect the presence of personality factors. Assuming that these distortions are indeed due to more than chance fluctuations, our purpose is to correlate these distortions and the subsequent repetition of "Right" and "Wrong" responses in Thorndikian experiments. The hypothesis that the general impression about the number of preceding "Right" responses mediates the response repetition will be confirmed when a positive correlation is found between the reported number of preceding "Right" responses and the subsequent response repetition, with subjects receiving the same proportion of "Right" and "Wrong" responses on Trial 1.

EXPERIMENT 1

The procedure of Experiment 1 follows from the above considerations. We just repeat one of the previously published experiments on the repetition of "Right" and "Wrong" responses. Before Trial 2, the subjects were requested to report how often they had got the outcomes "Right" and "Wrong". As the question could interfere with the subsequent repetition of responses, the repetition data were compared to conditions where the subjects were not requested to report the number of "Rights" and "Wrongs".

METHOD

Subjects: One hundred fourteen students (54 males and 60 females) from an introductory psychology class at Indiana University (Bloomington, U.S.) served as subjects for the investigation. The subjects received credit toward a course requirement of research participation. None of them had previously made an experiment of this type. They were randomly assigned to four groups defined by the 2×2 factorial combination of k (two or five response alternatives) and whether the number of outcomes on Trial 1 was to be reported or not.

Materials and procedure: Materials and procedure closely corresponded to what had been used by d'Ydewalle and Eelen (1975). The learning material consisted of two equivalent sets of 24 slides, one set for each trial. A different letter and either two digits (3 and 5) or five digits (3, 4, 5, 6, and 7) appeared on each slide, with the letter placed above the digits. About half of the subjects had two digits available as response alternatives, while the other subjects had five digits available. The stimuli and the two or five response alternatives were projected on a screen. The projected surface of the letters and the digits was made objectively equal. In Experiments 1-4, the subjects had to associate one of the digits with each stimulus letter. The surface equality was only important for Experiment 5.

The subjects were run individually. They were instructed to call one of the digits each ime a slide was shown. They were told that the experimenter would say "Right" or "Wrong", immediately, to inform them whether their responses were correct or incorrect. They would have to guess on Trial 1 because the correct responses had been chosen by chance. The same series would be repeated and they would be expected to choose as many "Right" responses as possible on later trials.

The rate of presentation was self-paced. In order to minimize the opportunities for rehearsal, the experimenter attempted to leave no time gap between the subject's response, the experimenter saying "Right" or "Wrong", and the presentation of the next slide. Any response to 6 letters was called "Right" and any response to the remaining 18 letters was called "Wrong"; i.e., 25 percentage of the responses were called "Right". For each subject, the position of the items to be called "Right" or "Wrong" was randomly chosen. Before Trial 2, half the subjects received the unexpected question on the number of outcomes at Trial 1 : Given the fact that there were 24 slides altogether, how many of them were followed by the outcome "Right", and how many by the outcome "Wrong". On Trial 2, the subjects had to state the correct digit with each of the same 24 slides. No further trials were presented. A different permutation of the slides was used on both trials for each subject.

RESULTS

For descriptive purposes only, all data were transformed to proportions. The reported number of the outcome "Right" and the repetition of "Right" and "Wrong" responses from Trial 1 to Trial 2 are given in Table 1.

	two digits	five digits
reported outcome "Right"	.286	.224
repetition		
"Right" responses	.511	.331
"Wrong" responses	.458	.220

TAB. 1. PROPORTION OF REPORTED OUTCOME "RIGHT", AND THE REPETITION OF "RIGHT" AND "WRONG" RESPONSES : EXPERIMENT 1

Separate analyses of variance were made on the reported number of outcome "Right" and the repetition data, with as main effects in both analyses : Two or five response alternatives, and the sex of the subjects. There were two additional factors for the analysis of the repetition data : Conditions either requiring or not the number of outcomes of Trial 1, and the repetition of "Right" vs. "Wrong" responses (a within-subjects variable). Throughout the experiments of this paper, the subjects were randomly assigned to the different conditions. However, sometimes the number of subjects was not exactly the same in each condition. Besides, there was an unequal number of male and female subjects. Therefore, all analyses were made on the unweighted means of each condition. Also, the repeated "Right" and "Wrong" responses were weighted for opportunity of occurrence on Trial 1. Only F values exceeding the 5% significance level were mentioned.

Only one finding emerged from the reported number of outcomes: The subjects believed to have received more "Right" responses with $k = 2$ than with $k = 5$, $F\ (1, 70) = 10.957$, $MS_e = 3.629$. As the subjects don't have a perfect memory of the number of "Right" responses received, they probably take into account their general impression about their number of "Right" and "Wrong" responses at Trial 1, and the number of "Right" and "Wrong" responses they could expect to receive on Trial 1 by merely guessing. The reported number of outcomes should be influenced by the chance expectation. The chance expectation with $k = 2$ (50%) is higher than the percentage of "Right" responses actually received (25%): From Table 1, one can see that the subjects in this condition overestimate the number of "Right" responses. With $k = 5$, the chance expectation (20%) is lower than 25%, and the subjects underestimate the number of "Right" responses.

Considering the repetition data, two effects are significant. More responses are repeated with fewer response alternatives, $F\ (1, 106) = 75.931$, $MS_e = 28.444$. This can be explained by the different chance levels as a function of k. As the subjects are requested to repeat their "Right" responses and to alter their "Wrong" responses, more "Right" responses are repeated than "Wrong" responses, $F\ (1, 106) = 13.612$, $MS_e = 27.319$. In Experiment 1, an important aspect concerning methodology was to examine any possible interfering effect of the question of the number of outcomes on the repetition data. Neither the main effect nor the interaction of the question with other effects approached significance: All F ratios were near to unity.

We calculated Pearson and Kendall correlations in order to study the existence of a link between the reported number of "Right" responses of Trial 1 and the repetition of "Right" and "Wrong" responses on Trial 2. In all experiments reported in this paper, the parametric correlations were calculated after removal of all variances due to the several factorial combinations of the independent variables (see Cooley & Lohnes, 1971, p. 182). The Kendall correlations were calculated as well in an attempt to avoid problems concerning the lack of variances in the data and the small number of independent observations. As the Kendall correlations only occasionnally departed from the findings with the parametric Pearson correlation, we only

	two digits	five digits	overall
r_{NR}	−.084	+.069	−.010
r_{NW}	−.205	−.077	−.164
r_{RW}	−.342	+.074	−.192
$R^2_{N.RW}$	.069	.012	.029

TAB. 2. PEARSON (r) AND SQUARED MULTIPLE (R^2) CORRELATION COEFFICIENT BETWEEN THE REPORTED NUMBER (N) OF "RIGHT" RESPONSES ON TRIAL 1 AND THE REPETITION OF "RIGHT" (R) AND "WRONG" (W) RESPONSES: EXPERIMENT 1

present the Pearson correlation. Looking at Table 2, the Pearson correlations do not promise to give substantial evidence on the hypothesized relationship between the reported number of outcomes and the response repetition. To maximize the relationship a multiple correlation between the reported number of outcomes and the repetition of "Right" and "Wrong" responses was calculated but it never reaches considerable strength either. The highest multiple correlation is to be found with $k = 2$, $R = .263$, but it is not significant.

EXPERIMENT 2

In Experiment 1 we failed to demonstrate any relationship between the reported number of outcomes and the repetition data. The basic idea of our hypothesis was that on some items the subjects are able to recall the previous response, but not its outcome. The subjects are assumed to guess the outcome as a function of the number of "Right" responses on Trial 1. This guessing would be mediated by the cognition of the number of "Right" and "Wrong" responses. Perhaps we found no cognitive mediation because there was no guessing. The absence of the effect of guessing the outcome on the response repetition could occur when no previous responses are recalled on Trial 2. (Theoretically, the absence is also predicted when there is perfect recall of outcomes, as demonstrated in d'Ydewalle and Buchwald, 1976, but that never happens in the usual standard conditions.) In Experiment 2, we checked whether the effect of guessing the outcome on the repetition data actually occurred. Therefore, we manipulated the number of "Right" responses on Trial 1. When obtaining more "Right" responses on Trial 1, more responses should be repeated. From previous experiments (Buchwald, 1969; d'Ydewalle & Buchwald, 1976; d'Ydewalle & Eelen, 1975), the estimation of the recall of responses and outcomes never gives values much larger than 20%. This means that only on 16% of the items, the effect of guessing the outcome on the response repetition could occur : 16% results from the product of the probability of recalling the response (about 20%) and the probability of not recalling the outcome (about 80%). In addition to the standard conditions, we used response-reminder conditions in order to increase the number of items where the effect of guessing the outcome could occur : In a response-reminder condition, the subjects on Trial 2 are informed of their previous responses to the items before making a new choice. As the subjects in the response-reminder conditions always know which response they made on Trail 1, the effect of guessing the outcome will occur every time the outcome is not recalled : 80% of the items instead of 16% in the standard conditions.

Even if we find now a substantial correlation between the reported number of outcomes and the response repetition, it does not mean that the cognition of the number of "Right" and "Wrong" responses really mediates the repetition : No causal link can be made from a correlation. Therefore, we manipulated in Experiment 2 the cognition about the number of "Right" responses of Trial 1. In some conditions, the reported cognition about the number of outcomes was corrected by the experimenter. The experimenter told the subjects how many times they really got "Right" responses. As only 20% of the subjects (29% with $k = 2$; 9% with $k = 5$) correctly reported the number of outcomes on Trial 1 in Experiment 1, it means that the correction really changes the cognition of about 80% of the subjects. If the assumed number of "Right" responses influences the response repetition, the correction should influence the repetition.

METHOD

Subjects and design: The subjects were 144 first-year students from the Law School, University of Leuven (Belgium), who volunteered for the experiment. The subjects were randomly divided into 16 groups of 3 female and 6 male persons each. The 16 groups were defined by a $2 \times 2 \times 2 \times 2$ factorial combination of the number of response alternatives (2 vs. 5), standard vs. response-reminder conditions, the number of "Right" responses on Trial 1 (25% vs. 75%), and whether the reported number of "Right" responses on Trial 1 were corrected or not. None of the subjects knew the purpose of the experiment.

Materials and procedure: The materials and procedure were identical to those of Experiment 1, except as noted below. One group of subjects had the same proportion of "Right" responses on Trial 1 as in Experiment 1. A second group had a much larger proportion of "Right" responses (75%). As in Experiment 1, the position of the items to be called "Right" or "Wrong" was randomized for each subject. After Trial 1 all subjects were unexpectedly required to state how many "Right" responses they had received on Trial 1. For half of the subjects, the experimenter immediately gave the exact number of "Right" responses (either 6 or 18). No such a correction was given for the other subjects. Within these subgroups, half of the subjects went through Trial 2 using the standard conditions and half went through Trial 2 using the response-reminder conditions. The procedure of the response-reminder condition has been fully described in Buchwald (1969) and d'Ydewalle and Buchwald (1976).

RESULTS

As the correction of the reported number of outcomes, and the introduction of the response reminding occurred after the subjects' indications as to how many "Right" responses they thought to have received on Trial 1, the reported outcome data of those subgroups were pooled in Table 3. The same Table gives the proportion of subjects having reported the number of both outcomes correctly.

An analysis of variance with the number of response alternatives, the sex of the subjects, and the proportion of outcomes "Right" at

Trial 1, gives two significant main effects on the reported number of "Rights" (MS_e = 3.415). The number of "Right" responses reported is much higher when more "Right" responses have been chosen in Trial 1, F (1, 136) = 888.823. Besides, a larger number of "Right" responses is reported with fewer response alternatives, F (1, 136) = 18.536, extending the same pattern of findings in Experiment 1 to

	two digits	five digits
reported outcome "Right"		
25% "Right" at Trial 1	.297	.223
75% "Right" at Trial 1	.688	.644
subjects correctly reporting		
25% "Right" at Trial 1	.139	.278
75% "Right" at Trial 1	.194	.220

TAB. 3. PROPORTION OF REPORTED OUTCOME "RIGHT", AND THE PROPORTION OF SUBJECTS REPORTING CORRECTLY : EXPERIMENT 2

conditions with 75% "Right" at Trial 1. With 25% "Right" responses at Trial 1, the subjects with $k = 2$ overestimate the number of "Right" responses and the subjects with $k = 5$ underestimate it. On the other hand, with 75% "Right" responses all subjects underestimate the number of "Rights", but more underestimation occurs with $k = 5$. The pattern of findings can be accounted for by referring to the explanation given at Experiment 1 : Due to the imperfect recall of the outcomes and the subsequent impossibility of counting the frequency of occurrence of both outcomes, the subjects report a compromise between their general impression and the chance expectation. With $k = 5$, the chance expectation is always lower than what actually occurred (20% vs. 25 and 75%) producing an underestimation in all conditions. With $k = 2$. 25% "Rights" is lower, but 75% "Rights" higher, than the chance expectation, giving in the former case an overestimation and in the latter an underestimation.

The proportion of "Right" and "Wrong" responses that were repeated are shown in Table 4. The main factors in the analysis of

	two digits		five digits	
	"Right"	"Wrong"	"Right"	"Wrong"
standard conditions				
25% "Right" at Trial 1	.492	.503	.300	.159
75% "Right" at Trial 1	.612	.495	.328	.342
response-reminder cond.				
25% "Right" at Trial 1	.425	.281	.392	.259
75% "Right" at Trial 1	.728	.533	.695	.550

TAB. 4. PROPORTION OF REPETITION OF "RIGHT" AND "WRONG" RESPONSES : EXPERIMENT 2

variance were the procedure (standard vs. response-reminder), the correction (with vs. without correction of the reported number of "Right" responses on Trial 1), the proportion of "Right" responses on Trial 1 (.25 vs. .75), the sex of the subjects, the number of response alternatives (two or five), and the outcomes (responses called "Right" or "Wrong" : A within-subjects variable). The mean squares of error for the between-subjects and within-subjects comparisons are 8.362 and 7.766.

The term of particular interest was any possible effect of the correction by the experimenter on the reported number of "Right" responses upon the response repetition. The main effect failed to give an F ratio exceeding unity. As in Experiment 1, more responses are repeated with two digits than with five, $F\ (1, 112) = 29.352$, and "Right" responses are more repeated than "Wrong" responses, $F\ (1, 112) = 20.933$. With more "Right" responses on Trial 1, more responses are repeated from Trial 1 to Trial 2, $F\ (1, 112) = 58.320$,

	r_{NR}	r_{NW}	r_{RW}	$R^2_{N.RW}$
without correction – overall	—.005	—.005	+.002	.001
standard conditions	+.112	—.180	+.065	.048
response-reminder conditions	—.131	+.177	—.241	.040
with correction – overall	—.273	—.176	+.116	.096
standard conditions	—.255	—.258	+.241	.106
response-reminder conditions	—.312	—.067	+.019	.101

TAB. 5. PEARSON (r) AND SQUARED MULTIPLE (R^2) CORRELATION COEFFICIENT BETWEEN THE REPORTED NUMBER (N) OF "RIGHT" RESPONSES ON TRIAL 1 AND THE REPETITION OF "RIGHT" (R) AND "WRONG" (W) RESPONSES : EXPERIMENT 2

confirming the effect of guessing the outcome on the response repetition. As predicted, the effect is stronger in the response-reminder conditions than in the standard conditions, producing a significant interaction between procedure and the proportion of "Right" responses on Trial 1, $F\ (1, 112) = 18.437$.

d'Ydewalle and Buchwald (1976) predicted that the difference in repetition of "Right" and "Wrong" responses would be larger for the response-reminder conditions than for the standard conditions, and that under the response-reminder conditions there should be equal amounts of response repetition, regardless of the number of response alternatives available to the subjects. This is exactly what happened in the present experiment, as indicated by two significant interactions: The interaction Procedure × Outcome [$F\ (1, 112) = 4.257$], and the interaction Procedure × Number of response alternatives [$F\ (1, 112) = 21.795$]. The reader is referred to d'Ydewalle and Buchwald (1976) for a further explanation of both interactions.

As in Experiment 1, Pearson and multiple correlation coefficients were computed for the several conditions (see Table 5). To increase the reliability of the correlations, we pooled the variance/covariances matrices as a function of the several manipulations. Looking first at the conditions with no correction on the reported number of "Rights", the coefficients fail again to show a correlation between the reported number of "Rights" and the repetition of "Right" and "Wrong" responses. When correcting, a marginal significant overall multiple correlation is found [$R = .310$, $.05 < p < .10$]. However, the interpretation of this finding is extremely difficult to make. As it may be seen from Table 5, the overall Pearson correlations in the conditions with correction suggest a negative relation between the reported outcomes and the repetition of "Right" and "Wrong" responses. Moreover, the Pearson correlations in the several subconditions with correction vary unsystematically from positive to negative values.

EXPERIMENT 3

The first two experiments indicated that the reported number of "Right" responses on Trial 1 was strongly influenced by $1/k$; i.e., the number of "Right" responses which should be chosen by chance. As the instructions before the experiment clearly stated the nature of the task (on Trial 1, the only requirement is to guess), the subjects must have some expectation about the number of responses which will be called "Right". In guessing tasks, the expectation is assumed to approximate the value of $1/k$. Although a few authors (e.g., Kahneman & Tversky, 1972, 1973) showed that people do not always follow the principles of probability theory in judging the likelihood of uncertain events, the law of chance is the only heuristic available in this guessing task.

The distortions of the reported number of "Rights" have often been explained in terms of expectancies (Lietaer, 1966; Janssens & Nuttin, 1976; Vreven & Nuttin, 1976, especially footnote 2, p. 737). As about the same distortions occur when the series of items does not involve ego-involved outcomes of subject's behavior (Experiment 6, Vreven & Nuttin, 1976), it was assumed that the expectation is of purely cognitive, non-ego involved type, functioning as a frame of reference for the judgment task on the number of outcomes. Actually, this cognitive nature distinguishes the concept of expectation from the studies on aspiration (Zajonc & Brickman, 1969). Aspiration implies motivational forces at work : The subjects set a goal which they wish to attain; so, their future achieving performance will be influenced by their aspiration.

In Experiment 3, we are studying whether the expectation and its effect upon the reported number of outcomes are related to the subsequent response repetition. The subjects are required to state before Trial 1, but after some familiarization with the stimulus material, how many "Right" responses on Trial 1 they expect to obtain. We are well aware that several assumptions underlie the use of this procedure. One is that the reported expectancies are simply overt records of ongoing cognitive activities. In other words, individuals are assumed to formulate expectancies spontaneously even when they are not asked to do so. Moreover, the individual's performance following overt statement of expectancies is assumed to be the same as it would have been had the statements not been made. Those first two assumptions are also involved in the basic issue of the paper: The cognitive mediation of the number of preceding outcomes and its effect on response repetition are assumed to be the same either when the subjects have to report the number of outcomes, or not. Further, we assume that it is the expectation setting before Trial 1 that will influence either the reported number of outcomes and/or the response repetition: We are however not sure whether the expectation doesn't change during the performance of Trial 1.

Although it is well established that the solicitation of an expectancy statement arises achievement motivation (i.e., the expectation becomes an aspiration; e.g., Dweck & Gilliard, 1975; Zajonc & Brickman, 1969), we didn't consider as important the addition of a few control conditions without the expectation statement: Our subjects with either high or low expectations could not influence their performance on Trial 1 as the only requirement was to guess. Also, Vreven (1974) showed that the expectation requirement doesn't change the subsequent impression of the number of outcomes.

METHOD

The subjects were 63 (45 male and 18 female) University of Leuven third-year students from the Medical Schoool. They all volunteered to participate and were randomly assigned to four groups defined by the factorial combination of 2 vs. 5 response alternatives, and the reported number of "Right" responses either corrected or not. The material and the general procedure were similar to those of Experiment 1, except on what follows. After the learning instructions and the presentation of a few items of the stimulus material, the subjects were required to state how many "Rights" they expected to obtain on Trial 1. On this Trial, as in Experiment 1, 25% of the responses were called "Right". Before Trial 2, all the subjects reported the number of "Right" responses they believed to have chosen. The reported number of outcomes was corrected by the experimenter for half of the subjects. Trial 2 was exactly the same as in the standard conditions of Experiments 1 and 2.

RESULTS

The averaged proportion of "Right" and "Wrong" responses expected, reported, and repeated is summarized in Table 6. It is apparent that the expectations of the subjects don't follow exactly the chance expectations. Although all the subjects know that "Right" responses of

Trial 1 can only be chosen by guessing (as clearly stated by all the subjects in a postexperimental questionnaire), it appears that with $k = 2$ they expect less "Right" responses than 50% [t (31) = 4.361].

	without correction		with correction	
	two digits	five digits	two digits	five digits
expected outcome "Right"	.414	.236	.414	.232
reported outcome "Right"	.245	.211	.229	.232
response repetition				
"Right"	.512	.360	.488	.288
"Wrong"	.442	.271	.483	.183

TAB. 6. PROPORTION OF EXPECTED AND REPORTED OUTCOME "RIGHT", AND THE REPETITION OF "RIGHT" AND "WRONG" RESPONSES : EXPERIMENT 3

However, in conditions with $k = 5$, more "Right" responses are expected than the chance level, 20% [t (30) = 2.393]. It has often been found that the average expected probabilities for lower probability events are larger than the objective chance probabilities, whereas the average expected probabilities for the higher probability events are smaller than the objective chance probabilities (Lee, 1971).

More confusing is the reported number of "Right" responses. The F ratio fails to give significance to the difference between the conditions with two and five response alternatives [F (1,59) = 1.134, n.s.]. In Experiments 1 and 2, more "Right" responses are reported with $k = 2$, than with $k = 5$. When comparing the average reported number of "Right" responses in the several experiments, it appears that in Experiment 3, the subjects state less "Right" responses with $k = 2$ than in the previous experiments. One possible reason for the divergence may be related to the requested expectation setting before Trial 1 in this experiment. Vreven (1974) indicated no difference of the reported number of "Right" responses when the expectation was either requested or not. However, the difference between the expectation and the obtained number of "Rights" on Trial 1 was quite small in his experiments. The difference between the stated expectation and the obtained number of "Rights" on Trial 1 was large in Experiment 3 with $k = 2$, making the difference between the expectation and the obtained number more salient. Janssens and Nuttin (1976) predicted that the reported number of "Rights" follows the expectation as long as there isn't too much contrast. The contrast between the expectation and the general impression of the number of "Rights" is enhanced here by requiring from the subjects to state their expectation. Accordingly, the effect of the expectation on the reported number of "Rights" disappears: With $k = 2$, the reported number of "Rights" is no longer situated somewhere between the expected and received number of "Right" responses.

An analysis of variance was performed on the response repetition data. The main effects were whether the reported number of "Rights" was corrected or not, the number of digits available, and the outcomes "Right" and "Wrong" (as a within-subjects variable). As in the previous experiments, "Right" responses were repeated more often than "Wrong" responses, F (1, 59) = 5.383, MS_e = 5.908, and more responses were repeated with k = 2 than with k = 5, F (1, 59) = 44.223, MS_e = 6.780. No other effects approach significance.

As we wanted to get the maximal correlation between two sets of two variables (the expected and reported number of "Right" responses on Trial 1, and the repetition of "Right" and "Wrong" responses), a canonical correlation was computed. Table 7 gives the several

	without correction		with correction	
	two digits	five digits	two digits	five digits
r_{EN}	+.703	+.201	+.228	+.272
r_{ER}	+.434	+.168	—.091	—.065
r_{EW}	—.088	—.352	—.373	—.342
r_{NR}	+.515	—.036	+.065	+.005
r_{NW}	—.112	—.373	+.000	+.083
r_{RW}	—.058	+.103	+.007	+.334
$R^2_{EN.RW}$	.261	.237	.158	.154

TAB. 7. PEARSON (r) AND SQUARED CANONICAL (R^2) CORRELATION COEFFICIENT BETWEEN THE EXPECTED (E) AND REPORTED (N) NUMBER OF "RIGHT" RESPONSES ON TRIAL 1 AND THE REPETITION OF "RIGHT" (R) AND "WRONG" (W) RESPONSES : EXPERIMENT 3

Pearson correlations which were used to compute the canonical correlation. The resulting canonical correlation failed again to substantiate the idea of a cognitive mediation. No signification relationship is to be found. Looking at the several separate Pearson correlations, no clear pattern of findings emerges except a significant correlation between the expected and reported number of "Right" responses [overall r (58) = .405].

The failure to relate the expected and reported number of "Right" responses to subsequent response repetition is perhaps due to the lack of meaning of the task. Implicity referring to d'Ydewalle and Eelen (1975), Nuttin (1976) suggests that randomly guessing and being "rewarded" and "punished" for each guess may have small behavioral effects when compared with failures and successes in important ego-involved tasks. Whatever the merits of these remarks on the applicability to daily life psychology, the following arguments limit the implication from Nuttin's reasoning to the present experimentation. The effect of a different proportion of "Right" responses on Trial 1 on subsequent response repetition has been assessed in experiments requiring at Trial 1 either random guessing or "estimation" responses where outcomes are assumed to be perceived as ego-involved successes and failures (d'Ydewalle & Eelen, 1975; Eelen & d'Ydewalle, 1976). In both types of tasks, random guessing and more ego-involved activities, the repetition of "Right" and "Wrong" responses varied directly as a function of the proportion of "Right" responses on Trial 1. Accordingly, in both cases a positive correlation between the reported number of "Right" responses and the response repetition could be predicted. Secondly, one can hypothesize that a stronger (either positive or negative) correlation between the expectation and the reported number of "Rights" should be found in more ego-involved tasks. Therefore, the absence of an influence of the expectation on the repetition is perhaps due to the use of less ego-involving responses, i.e., the random guessing on Trial 1. We considered this possibility more deeply, and went back to previous experiments by Nuttin and his collaborators where data on the expectation and reported number of "Rights" in ego-orienting tasks were available. A brief description in English of the procedures used by Lietaer (1966) and Vreven (1974) can be found in Vreven and Nuttin (1976). The French text of d'Amorim and Nuttin (1972) is preceded by a summary in English. We pooled the covariances after removal of the effects of the several independent variables. Correlations of +.309 and +.332 between the expected and reported number of "Right" responses were obtained in the two experiments of Lietaer (1966), while in d'Amorim and Nuttin (1972) and Vreven (1974), $r = +.451$ and $+.362$ were found. Looking back at our Table 7, the overall correlation is not so different from correlations with more ego-orienting tasks. Different lines of research have provided support for the position that people take responsibility for chance outcomes, even in gambling situations (Jenkins & Ward, 1965; Langer, 1975; Wortman, 1975). Self-defensive attributional bias has been observed in tasks that would seem to be non-involving (Stevens & Jones, 1976). Moreover, the instructions for intentional learning as given before Trial 1 provide motivational significance to the random guessing on Trial 1.

EXPERIMENT 4

Looking at the analysis of variance on the reported number of "Right" responses, it appears clearly that the error variance is quite small. Most subjects have an almost accurate impression of the number of "Right" responses. As the variance due to the several experimental manipulations has been subtracted before computing the correlations, the failure to relate the reported number of "Rights" to the repetition of "Right" and "Wrong" responses is perhaps due to the insufficient between-subjects variability. It must be reminded, however, that the remaining variance in the preceding experiments was at least large enough to produce significant correlations with other variables: The correlation between the expected and the reported number of "Rights" was significant in Experiment 3. Nevertheless, Experiment 4 was an attempt to increase the error variability.

In Experiment 4, the procedure of calling a response "Right" or "Wrong" on Trial 1 was different. Instead of defining before the experiment which item would be called "Right" or "Wrong", one response alternative for each stimulus was chosen as the correct choice. Therefore, not all the subjects gave the same number of "Right" responses on Trial 1. This was assumed to increase the variance of the reported number of "Rights" in each condition.

PROCEDURE

The subjects were 116 (42 female and 74 male) first-year volunteers from the Law School at the University of Leuven. One random third of the subjects were required to report the number of "Rights" after Trial 1 : No correction by the experimenter followed. The reported number was corrected in a second random third of the sample, while in a third group no report about the number of "Rights" was requested. Within each group, half of the subjects received two digits, and half received 5 digits. For each subject, one digit for each stimulus was randomly chosen to be correct. In other respects, the procedure was exactly the same as in the preceding experiments.

RESULTS

Table 8 describes the pooled proportion of "Right" responses obtained during Trial 1 and reported, and the repetition of "Right" and "Wrong"

	two digits	five digits
obtained outcome "Right"	.503	.193
reported outcome "Right"	.467	.172
repetition		
"Right" responses	.561	.381
"Wrong" responses	.471	.224

TAB. 8. PROPORTION OF OBTAINED AND REPORTED OUTCOME "RIGHT", AND THE REPETITION OF "RIGHT" AND "WRONG" RESPONSES : EXPERIMENT 4

responses. Obviously, the average obtained number of "Right" responses closely follows $1/k$. The data on the reported number of "Right" responses are puzzling for our hypothesis concerning the effect of the expectation. In both conditions, the reported "Rights" are significantly lower than the obtained number of "Right" responses : $t\ (37) = 2.475$ with $k = 2$, and $t\ (37) = 2.666$ with $k = 5$. This rules out our hypothesis that the reported number of "Rights" is situated somewhere between the expected and obtained number of "Rights", as it is known from Experiment 3 that with $k = 5$ the expectation exceeds $1/k$. Perhaps the difference between the expected and obtained number of "Rights" was too small with $k = 5$ to have any effect :

Only a general underestimation of the reported number of "Rights" can be concluded from the present data.

The analysis of variance on the repetition data does not provide any new information: More responses are repeated with $k = 2$ than with $k = 5$, F (1, 104) = 63.598, MS_e = 383.179, and "Right" responses are repeated more than "Wrong" responses, F (1, 104) = 17.982, MS_e = 454.898. Reporting the "Rights" and the correction by the experimenter do not influence the response repetition ($F < 1$).

The main purpose of the present experiment was to increase the variance of the reported number of "Rights" within each condition in order to rise the absolute strength of the correlation coefficients.

	without correction	with correction
r_{ON}	+.735	+.763
r_{OR}	—.004	—.182
r_{OW}	+.037	—.058
r_{NR}	—.047	—.121
r_{NW}	+.245	+.090
$R^2_{ON.RW}$	.110	.071

TAB. 9. PEARSON (r) AND SQUARED CANONICAL (R^2) CORRELATION COEFFICIENT BETWEEN THE OBTAINED (O) AND REPORTED (N) NUMBER OF "RIGHT" RESPONSES ON TRIAL 1 AND THE REPETITION OF "RIGHT" (R) AND "WRONG" (W) RESPONSES : EXPERIMENT 4

From Table 9 it is immediately apparent that we failed to get substantial correlations between the reported "Rights" and the response repetition. The canonical correlation between the obtained and reported number of "Rights", and the repetition of "Right" and "Wrong" responses is never significant. High correlations are only found between the obtained and reported number of "Rights".

EXPERIMENT 5

Considering the preceding findings we began to doubt seriously whether the general impression of the preceding "Rights" mediated the subsequent response repetition. We considered the case when no outcomes are given on Trial 1, but before Trial 2 the experimenter tells the subjects how many "Right" responses they made on Trial 1. As for each stimulus on Trial 2, the subjects don't know which outcome was appropriate for each response of Trial 1, they can only refer to the overall number of "Right" responses as communicated by the experimenter between the two trials. We hope to find at least in these conditions a relationship between the number of "Rights" as communicated by the experimenter and the response repetition. It is clear that the mediation hypothesis as suggested in d'Ydewalle and Eelen

(1975), and d'Ydewalle and Buchwald (1976) can completely be dismissed if we don't find the expected relationship in next experiment: When the subjects only have the knowledge about the overall number of "Rights" at their disposal, altering or repeating a response cannot be due to the outcome of that response.

METHOD

The subjects were 121 volunteer male (84) and female (37) third-year students from the Medical School in Leuven. The stimulus materials were identical to those used in the preceding experiments. However, the task on Trial 1 was different: The subjects had to choose the projected surface of the digit which best matched the projected surface of the stimulus letter (d'Ydewalle and Eelen, 1975, showed that these incidental learning instructions do not alter the relationship between the number of "Right" responses on Trial 1 and the subsequent response repetition). No outcomes were given, and only $k = 5$ was used. Before Trial 2, the experimenter communicated in three different groups of subjects that either 6, 12, or 18 responses of the subjects were correct (25, 50, or 75% "Rights"). On Trial 2, all subjects were asked to give as many "Right" responses as they could. For half the subjects in each group, the experimenter repeated the subject's response from Trial 1 as each slide was being shown, and then the subject responded (response-reminder condition). In the standard condition, each slide was presented without the experimenter saying anything before the subject's responses.

RESULTS

Table 10 contains the average proportion of responses repeated in the several conditions. The increase as a function of the number of

	standard	response-reminder
25% "Right" at Trial 1	.290	.424
50% "Right" at Trial 1	.341	.651
75% "Right" at Trial 1	.373	.679

TAB. 10. PROPORTION RESPONSES REPEATED: EXPERIMENT 5

"Right" responses on Trial 1 emerges clearly in the response-reminder condition as well as in the standard condition. The error mean squares for all subsequent F ratios is 5.681. The main effect of the increase is significant, $F(2, 109) = 18.502$. Although the linear and quadratic components in the trend analysis are both significant [$F(1, 109) =$ 32.514 en 4.491], 88% of the variance is due to the linear increase. As the interaction between the standard-reminder conditions and percentage "Right" responses on Trial 1 is significant [$F(2, 109) =$

5.696], we looked further whether the increase would be significant in both conditions. Although the linear trend component is in both cases well beyond the 5% level [F (1, 109) = 3.979 and 36.834], the increase is more important in the response-reminder condition. A larger number of responses was repeated under the response-reminder condition than under the standard condition, F (1, 109) = 103.307. No other effects are significant.

DISCUSSION

d'Ydewalle (d'Ydewalle & Buchwald, 1969; d'Ydewalle & Eelen, 1975; Eelen & d'Ydewalle, 1976) repeatedly found strong relationships between the proportion of "Right" responses on Trial 1 and the repetition of "Right" and "Wrong" responses. The use of Buchwald's (1969) model and its extension by d'Ydewalle gave hints to what possibly happened: The relationship was to be explained by what occurs when a response to an item is recalled but the subjects are not able to recall its outcome. Two kinds of experimentation by d'Ydewalle brought forward the same evidence: When the subjects no longer know the outcome of the response, they guess the outcome as a function of the number of "Right" and "Wrong" responses of the previous trial. In the first technique (d'Ydewalle & Eelen, 1975), the subjects were required on Trial 2 to recall the outcome of Trial 1: An estimation of parameter e, i.e., the probability of guessing the outcome "Right", gives a value almost identical to the proportion of "Right" responses of the previous trial. With the second technique (d'Ydewalle & Buchwald, 1976), the subjects on Trial 2 were reminded of their previous responses and had to choose the correct response (response-reminder conditions): The value of parameter g, i.e., the probability of repeating a response when the outcome is not recalled, again closely follows the proportion of the preceding "Rights".

As Nuttin and his collaborators indicated that the subjects keep a reasonably accurate knowledge of the number of preceding "Rights" and "Wrongs", a tentative hypothesis was made that the repetition of response is mediated by this knowledge. To get empirical evidence we required the subjects to report this mediating knowledge. However, our attempt to prove the hypothesis clearly failed. As we are still convinced that the hypothesis is not incorrect, we shall try to indicate why the attempt to get empirical evidence had to fail.

Our reasoning rested upon the nearly identical, averaged values of g and e, and the proportion of "Right" responses on Trial 1. Therefore, we thought that there was a strong link between the proportion of "Right" responses, the mediating knowledge, and the repetition of responses. Any deviation of the mediating knowledge from the correct number of preceding "Rights" was assumed to be more than chance fluctuation, and would change the response repetition. This assumption was corroborated in Experiment 3 as the obtained significant correlation between the expected and reported number of "Right" responses is only possible with reliable differences on the reported number of "Rights". However, we now believe that these differences, as reliable as they may be, are not large enough to produce significant correlations with the repetition data.

Although no direct causal conclusions can be made from correlations, it is clear that a significant correlation *within* each condition with 25, 50, or 75% "Right" responses on Trial 1 would have strengthened our causal interpretation of the cognitive mediation on the response repetition. Reporting about 25, 50, or 75% "Right" responses (as a function of the several conditions with 25, 50, or 75% "Rights" on Trial 1) without doubts will correlate substantially with the response repetition, but that should not prove the causally mediating cognition. The endeavor to prove that the knowledge on the number of "Rights" really mediates the response repetition was important to us, for three reasons:

The experiments by Buchwald (1969) and d'Ydewalle (d'Ydewalle & Buchwald, 1976; d'Ydewalle & Eelen, 1975) were designed to give a cognitive interpretation of the basic findings of Thorndike: They substituted the theory about the automatic strengthening of rewarded responses by an explanation in terms of the learner's memory of (a) the previous response made to a given stimulus, and (b) the outcome "Right" or "Wrong" received for that response. Thorndike (e.g., 1932) seriously considered such a framework but rejected it finally, mainly because so many "Wrong" responses were repeated on subsequent trials. There is no doubt that some responses are repeated or altered because of the subjects' knowledge of their past responses and the corresponding outcomes: In those cases, "Right" responses will be repeated and "Wrong" responses changed. Even Thorndike should have agreed with this. But what happens when memory fails to give information about the outcomes previously given? Following Thorndike, the automatic enhancing effect of the feedback "Right" should increase the repetition of "Right" responses, but there should be also an increase of the neighbouring "Wrong" responses (see the spread of effect; e.g., Thorndike, 1933). Therefore, when more "Right" responses are given on Trial 1, all responses, "Right" and "Wrong", should be repeated more often. Accordingly, it was important for us to show that the observed increase of repeating "Right" and "Wrong" responses as a function of the proportion of "Right" responses on Trial 1 is due to the subjects' general impression about the number of outcomes received on the previous trial. Does our failure to indicate this cognitive mediation mean that after all, Thorndike was right?

A second reason for our experimentation was the conviction that the hypothesized cognitive processes should be externalized before being firm about their influences. With the growing interest in cognitive variables as mediatiors of behavior, an increasing number of investigators have begun to make regular use of certain procedures asking the subjects an introspective access to higher-order cognitive processes.

However, our faith in the subjects' ability to report phenomena that are otherwise difficult to have access to, was exaggerated. An examination of the literature on dissonance, attribution, and problem-solving research (Nisbett & Wilson, 1977) indicates that the subjects ability to report accurately on the influence of changing cognitions on their inferences or inference-produced behavior is very poor. Our failure to find cognitive mediation is probably not due to the absence of the presumed cognitive processes. The verbal reports are perhaps simply not appropriate to tap the higher-order cognitive processes.

A final reason was the attempt to give a behavioral relevance to the long series of studies by Nuttin and his collaborators on the subjects' general impression of a series of successes and failures. The interest in those studies originated partially on the belief that the general impression would affect further performance. Our failure, however, does not necessarily diminish the relevance of Nuttin's findings. First, most (but not all) of our studies on "Right" and "Wrong" do not have any affective meaning of success or failure, whereas Nuttin (1976) explicitly wants to study the impact of successful and unsuccessful outcomes in ego-oriented activities. On the other hand, studies on the distortion of the relative number of successes and failures as a function of personality factors as well as of social and contextual conditions may bear interest for their own sake. Thirdly, we still believe that our hypothesis is not wrong, but only difficult, if not impossible, to prove.

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