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Motivated memory: Dissociation between performance data and subjective reports

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Summary. Three experiments are reported to test a claim by previous subjects that lack of motivation for performing well in memory experiments yielded less than optimal performance. In each experiment the subjects of one group were informed of monetary incentives prior to study; in a second group they were informed of these incentives after study but prior to the test; no mention of incentives was made to the subjects of a third group. Recall and recognition procedures were used to assess memory performance. The data of all three experiments demonstrated no differences between the three groups with respect to performance. The claim that subjects in regular memory experiments would typically perform less than optimally is thus rejected. Subjective reports, however, revealed that incentives had affected the amount of effort put into the memory tasks. This dissociation between performance data and subjective reports is discussed in relation to the concept of motivation.

From time to time one hears statements saying that traditional memory experiments carried out in laboratory settings have little, if anything, to tell us about how memory really works. Some of the arguments for such a view are sophisticated and well-founded, and they are usually stated by fellow researchers in the field. Most of these colleagues have long experience with laboratory experiments themselves and often, on seemingly good grounds, they have arrived at the conclusion that there is a need to approach situations that more closely reflect everyday use of memory (e. g., Neisser, 1978). Hence, many researchers have tried to develop representative and ecologically valid methods to replace those used in traditional research. Important discoveries have certainly been made using this new ecological approach, and valuable insights have been obtained, which at least cast some doubt on previously established facts in the field.

Another type of critique emanates from students and from others who participate as subjects in these laboratory experiments. For obvious reasons this critique is less sophisticated; yet, there are reasons to take this critique into account as well. After all, one might think; who better than the subjects themselves would know the extent to which the experiments they participate in actually tap the memory functions they feel they use in real-life situations outside the laboratory? A major reason for claiming that these experiments have little to say about memory is that the subjects report that they experience poor motivation for doing their best, when the task requires them to remember artificially constructed lists of unrelated words or CVC trigrams and the like. Such claims seem compelling and if they are valid, they may perhaps shake the very foundations of established empirical regularities and theories in the field.

Much research has been conducted in this field (for reviews see, e. g., Eysenck, 1985; Weiner, 1966 a, 1966 b). As of yet, however, there is hardly any general consensus about the effects of motivation on memory and other cognitive processes. Although the present study certainly relates to this previous research, the basic question is not to review the literature or to develop a new theory. Rather, the question at stake here is an empirical one. Is it really the case that allegedly low-motivated laboratory subjects produce a result different from that of highly motivated subjects?

The primary purpose of the present experiments was to study whether an increase in general motivation for doing well in a memory experiment results in an increase in performance. The basic reasoning behind the experiments was simply that subjects who had been offered some kind of highly attractive incentive would perform better than subjects who had not been offered any such incentive. More specifically, it could be the case that subjects who were offered an incentive at the time of study would work harder to learn the to-be-remembered (TBR) information. However, it could also be the case that incentives can have a differential effect on encoding and retrieval. Consequently, for another group of subjects the incentive was offered after study but before the test. On the basis of the claims made by previous subjects it was expected that the subjects in both these groups would remember the TBR information better than a group of subjects that was uninformed about any incentives. Furthermore, we thought that if incentives do improve memory performance, this improvement should be more pronounced for those subjects who were given instructions about incentives at the time of study than for those who were not given these instructions until test.

Experiment 1

Method

Subjects. A total of 30 subjects participated in this experiment. These subjects were 12 male and 18 female under-

graduate students of psychology at the University of Uppsala. The subjects were randomly divided into three groups with 10 subjects (four males and six females) in each. The age range of the subjects participating in the expeiment was 19 to 24 years.

Materials. Ten lists of unrelated Swedish nouns were constructed to be the TBR information in the experiment. Each of these 10 lists was composed of 12 common words selected from category norms of Swedish nouns (Nilsson, 1973). The words appearing in each list were instances of different semantic categories. The word lists wee recorded on tape and were presented to the subjects at a rate of one word per s.

Design and procedure. All 10 subjects of each group were asked to appear in the experimental room at the same time. The subjects of all three groups were given general instructions about the number of lists to be presented, the number of items per list, that their task was to recall as many words as possible from each list immediately following list presentation, and that they were to recall as many words as possible from all lists presented in a final test subsequent to the presentation and immediate test of the 10th list. In addition to these general instructions, the subjects in two experimental groups were given further information regarding incentives. In one group (*S*) the subjects were told prior to study that the subjects who could correctly recall the greatest number of items in the final free recall test would receive the sum of SK 100 (approximately equivalent to $ 10). The subjects in the other experimental group (*T*) were given the same instruction after the presentation and test of all study lists but prior to the final free recall test. The subjects in the control group (*C*) were not given any monetary incentives.

In all other respects the procedure was the same for the three groups: Presentation rate was one word per s, time allowed for written free recall in the immediate tests was 30 s, time allowed for written free recall in the final test was 7 min, and there was a period of 2 min between the immediate free recall test (IFR) of the 10th list and the final free recall (FFR) test. During this 2-min period the experimenter talked informally to each group about a neutral topic not related to the experiment. The experimenter also asked the subjects to write their names and addresses on the back of the last page of the booklet they had used for the immediate free recall tests. As a final piece of information during this interval, the subjects in Group *T* were told about the SK 100 incentive.

Results and discussion

Mean proportion of correctly recalled words per list in the IFR and FFR tests for the three groups of subjects are presented in Table 1. As can be seen from this table essentially the same amount of TBR information is recalled for each group in the IFR test. A one-way analysis of variance confirmed this impression of the data by showing no differences between groups. The manipulation made in this experiment was aimed at the FFR test, so it may not be surprising that the three groups did not differ in performance for the IFR test. However, it can also be seen from Table 1 that there is not much of a difference in recall between the three groups for the FFR test either. The one-way analysis carried out on these data also failed to demonstrate any differences between groups.

Table 1. Mean proportions of words correctly recalled in the immediately free recall (IFR) test and the final free recall test (FFR) for groups *S*, *T*, and *C*

Group	IFR	FFR
S	.39	.17
T	.41	.18
C	.38	.17

In order to find out whether the manipulations made have affected some finer details of the data, serial position analyses were carried out for all three groups in both tests. Although not shown here the serial position curves for the three groups in the IFR test were very similar, as were the three curves for the FFR test. It should be mentioned that there was a slight superiority for Group *S* in the recency portion of the curve in the IFR test and there was a slight superiority for Group *T* in the recency part in the FFR test. However, these small differences did not achieve statistical significance. Separate 3×12 split-plot analyses of variance for the two tests with serial position as the additional factor in each did not reveal any interaction between instruction and serial position. Thus, the conclusion to be drawn on the basis of these data is that the instructions given about incentives for subjects in Group *S* and *T* did not affect memory performance.

After the subjects had completed the final free recall, they were questioned about the experiment. Of main interest here was, first, that most subjects in Group *S* (six subjects out of ten) and Group *T* (seven subjects out of ten) reported that they did try harder to remember the words than they thought they would have if there had not been a monetary reward. Secondly, it is also noteworthy that six of these seven subjects in Group *T* said that they probably would have tried even harder to remember the materials if they had been told already at the time of study that they could earn SK 100 for a good performance. Thirdly, it should be noted that seven subjects in Group *C* said that they thought that they probably would have been able to learn and remember the materials better if they had had a monetary incentive. Thus, a majority of the subjects in this experiment thought that the incentive of SK 100 had (in the case of Groups *S* and *T*) or would have (in the case of Group *C* subjects) made them perform better. These subjective data are in line with the general contention mentioned initially as having been reported by subjects in previous experiments. As should be clear from the recall data of the present experiment this general contention, however, does not show up in recall level.

Supposedly, this dissociation between subjective reports and actual performance could mean at least two things. First, it could simply be that the results of the present experiment are just another demonstration of the fact that subjects normally have relatively poor knowledge of their actual performance in memory tests. This discrepancy between metacognition and acutal performance would then hold true when motivational variables are manipulated. Secondly, the discrepancy obtained here could mean that the subjects actually knew that they performed much better after having been motivated to do so, but that the experimental method used here was not sensitive enough to detect any potential effects of motivation. For the time

being the first of these two alternatives is set aside and we focus on the second possibility. The next experiment attempted to improve on the experimental technique used here.

Experiment 2

For the general purpose of investigating the role of incentives on memory performance in laboratory experiments there were three aspects of the experimental method used in Experiment 1 that we thought could be improved. First, instead of presenting a series of lists with an immediate free recall test after each list and a final free recall of all words presented, only one list was used in Experiment 2. In Experiment 1, the presentation and test of several lists prior to the critical final test might have neutralized any potential effect of motivation in recalling the words in this final test. It was thought that the presentation of one list and the manipulation of motivation for this particular list might involve a more direct influence of motivation on memory. A second change of the method used in Experiment 1 was to employ a recognition test in addition to a recall test. It is conceivable that potential differences between the three groups used in Experiment 1 might have been disguised by the recall technique, but that such differences would show up in recognition. For one thing, the performance level in the critical final free recall test of Experiment 1 was quite low, almost approaching a floor level. The third change made was to include categorized materials in the TBR list. The rationale behind this was that motivation may affect metacognition more than lower level functions and that it may require metacognitive processing to take advantage of such lists for improving recall. Thus, by using one list of TBR items only (including categorized materials), and by using both recall and recognition, the basic aim was to make the present experiment more sensitive to any performance differences that might exist.

Three groups of subjects participated in the experiment; the subjects in one group were instructed about the incentive prior to study (Group *S*), the subjects in another group (Group *T*) were given these instructions after study but prior to the test, and in the third group (Group *C*) there were no incentive instructions given to the subjects. The predictions made here were the same as those made for Experiment 1. That is, Groups *S* and *T* were expected to perform at a higher level than Group *C*, and, if one were to expect any differences between Group *S* and Group *T*, such a difference was expected to be in favor of Group *S*.

Method

Subjects. There were 30 subjects participating in the experiment, 10 subjects in each of the three groups (*S*, *T*, and *C*). The subjects were 9 male and 21 female students of a high school in the city of Västerås. The age range of these students was 16 to 20 years. The students were assigned randomly to the three groups with the restriction that sex distribution should be the same in the three groups.

Materials. One list of 64 nouns was constructed. The first two and the last two words of the list served as buffer items to minimize primacy and recency effects, and were not included in later scoring. Of the remaining 60 words, 30 were "unrelated words" and 30 were spread over five semantic categories with six instances of each. The words were tape-recorded in a random order and presented to the subjects at a rate of 2 s per word.

A list of 120 words was prepared for the recognition test. Half of these words were the 60 critical words from the study list, and 60 "new" words from the same categories served as distractors. All 120 words were taken from Nilsson's (1973) noun list.

Design. A one-factor design was used with three levels of the independent variable. These were: instructions at the time of study about the incentive (Group *S*), instruction at the time of test about the incentive (Group *T*), and no incentive (Group *C*).

Procedure. All 10 subjects of each group were asked to appear in the laboratory at the same time. The subjects of all three groups were given general instructions about the presentation of a list of 64 common Swedish nouns at a rate of 2 s per word and that they were supposed to remember as many of these words as possible for a later free recall test. The instructions about incentives differed between groups in the same way as in Experiment 1.

After the presentation of the study list the experimenter talked informally to the subjects of each group for approximately 2 min. During this period of time the subjects of all three groups were asked to fill out a personal data sheet. At the end of this 2 min period the subjects in Group *T* were told about the reward to be given to the subject in that group who could remember the most words from the list just presented.

The subjects were allowed 7 min for recall. When this period ended the subjects were asked to hand in their recall protocols. They were then given a sheet containing the 120 words, randomly ordered, for the recognition test. The subjects were told to circle each word they thought had been presented in the study list. Finally, the subjects were questioned about how they thought they were affected by the incentives given.

Results and discussion

The mean performance data of this experiment are presented in Table 2. The recall data for all words and for related and unrelated words are given in the first three columns of this table. The differences between groups are small for each of these three comparisons. The 2×3 analysis of variance (related vs. unrelated words by *S*, *T*, or *C* instructions) carried out on these data did not reveal any differences between the three groups, and there was no interaction, Fs < 1.

One reason for introducing the categorized material in the TBR list used in the present experiment was to see

Table 2. Mean proportions of words correctly recalled for all words, related words, and unrelated words, and mean hit and false alarm rates for groups *S*, *T*, and *C* (Experiment 2)

Group	Recall			Recognition	
	All words	Related words	Unrelated words	Hit	False alarm
S	.32	.43	.21	.57	.17
T	.34	.44	.24	.57	.13
C	.35	.47	.23	.64	.05

whether the subjects in the three groups differed in the extent to which they could make use of such a list structure for improving recall. It was hypothesized that metacognitive processing might be required in order to take advantage of such a structure and that motivation would affect such metacognitive processing rather than lower level cognitive functions. The extent to which the subjects tried to make use of this particular list structure for improving recall was evaluated by analyzing the degree tho which the subjects of each group organized the TBR list according to semantic category. The adjusted ratio-of-clustering (ARC) measure (Roenker, Thompson, & Brown, 1971) was used to evaluate this type of organizational performance in each group. An ARC score of zero expresses chance organization while an ARC score of one indicates perfect clustering. The mean ARC scores for Groups *S*, *T*, and *C* were .17, .11, and .13, respectively, suggesting an advantage in the degree of organization for Groups *S*. However, *t*-tests showed none of these values to be statistically different from chance organization, nor were there any differences between the values themselves.

The final two columns of Table 2 present the hit and false alarm rates obtained in the recognition test. As can be seen, the pattern of results is, by and large, the same as for recall. Although the mean hit rate is somewhat higher for Group *C* than for Groups *S* and *T* and the mean false alarm rate is lower for Group *C* than for Groups *S* and *T*, the analyses of variance carried out on these data did not reveal any statistically significant differences between groups, Fs < 1 for both hit and false alarms.

Thus, the main conclusion to be drawn from this experiment is the same as that for Experiment 1. The manipulations used to motivate the subjects to learn and to remember the TBR information did not have any effect on performance. In spite of the efforts to design a more sensitive experiment than the previous one, the supposedly motivated subjects did not perform any better than those who did not get any incentive instructions.

The subjective data obtained did actually show that a majority of the subjects had been motivated by the incentives given. Seven out of the 10 subjects in Group *S* said that they tried harder to learn and to remember the TBR items than they thought they would have done had nothing been said about incentives in the instructions. In Group *T* there were five subjects who said that they tried extra hard to remember the list items when told that a good performance could result in a monetary gain. When asked, these subjects and another two subjects in this group said that they would have tried still harder, if they had been told prior to study that they could earn money for a good performance. Nine of those 10 subjects who were not offered any incentive (Group *C*) thought that they would have been able to perform better, had they been offered any incentives.

One further aspect of these subjective data should also be mentioned. A few subjects (two subjects in each of Groups *S* and *T*) explicitly said that they did not find it worthwhile trying to make any extra effort to perform well in these experiments. The reason for this, they said, was that they more or less took for granted that the money would be won by somebody else anyhow, because their own cognitive resources were relatively poor.

Comments of this sort had also been given by one or two subjects in Experiment 1, and it is reasonable to assume that such attitudes could have reduced the overall means for Groups *S* and *T*. For this reason, the memory scores were reanalyzed for those subjects who had stated explicitly that they did not make any extra effort. This reanalysis did in fact show these subjects to have obtained very low recall and recognition scores. Actually, the four subjects of Experiment 2 who made such claims were found to have the four lowest recall scores in that experiment and for two of these subjects the scores were extremely low.

In the final experiment to be reported the methodological aim was to try to reduce the risk that subjects would react in the way just described.

Experiment 3

Experiments 1 and 2 were carried out as group experiments and the general assumption was that the competitive aspect of the situation would foster a high motivation in all subjects involved. However, as mentioned, such competition can apparently have the opposite effect at least in some subjects. With the purpose of maintaining high motivation in each subject but at the same time avoiding this negative effect, the subjects participated in the experiment individually rather than in a group. Each subject in Groups *S* and *T* was instructed that he or she should try as hard as possible to remember as many words as possible to be able to win a monetary reward. The subject in each group who would get the highest score would then get the reward. The subjects were not told who else had been assigned to each group. As a means of increasing the motivation still further as compared to Experiment 2 and as a means of minimizing the potentially negative effect mentioned, each subject was told that he or she had been assigned to a group in which most other subjects were younger. So, if they tried hard they would have quite a reasonable chance of receiving the reward. A further step taken to increase motivation involved pointing out that the reward to be paid to the most successful subjects was large, in view of the short time required to do the experiment.

Method

Subjects. Another group of 30 high school students from Uppsala and Västerås participated in the experiment. As before, the subjects were randomly assigned to the three groups. The age range and sex distribution of the subjects was similar to Experiment 2.

Materials. As in Experiment 2.

Design and procedure. Both the design of the experiment and the procedure were essentially the same as in Experiment 2. The only differences were as follows. The subjects participated in the experiment on an individual basis rather than in a group. The subjects in each of Groups *S* and *T* were told that they were competing with others who were younger and who also had been assigned to this group. As in Experiment 2, the subjects of all three groups were given general instructions about the presentation of a list of 64 common Swedish nouns at a rate of 2 s per word and that they were to remember as many of these as possible for a subsequent free-recall test. The instructions about incentives differed between groups in the same way as in the previous two experiments. For the subjects in Groups *S* and *T* of the present experiment, however, it was pointed

out explicitly that the reward of SK 100 could be seen as relatively large, taking into consideration that the experiment would last only for a short period of time. No mention was made to the subjects of Group *C* about any monetary incentive.

After the presentation of the study list there was a filled interval as in Experiments 1 and 2, followed by a recall test. The subjects were allowed 7 min for recall. When this period ended each subject was first given a recognition test and then questioned about the incentives in the same way as in Experiment 2.

Results and discussion

The performance data of Experiment 3 are summarized in Table 3. The first three columns of this table present the collapsed data for all words and are separated for related and unrelated words. As can be seen, the mean scores for the three groups are essentially the same. The 2×3 analysis of variance (unrelated vs. related words by *S* vs. *T* vs. *C* instructions) did not reveal any significant main effect of instruction, nor any significant interaction between the two variables.

The ARC scores calculated in this experiment as an indication of organization were of the same order of magnitude as in Experiment 2. These ARC scores were .16, .21, and .10 for Groups *S*, *T*, and *C*, respectively. As in the previous experiment these values were not found to be statistically different from zero, indicating chance organization and there were no significant differences between the three values themselves.

The hit- and false-alarm rates of the recognition test are presented in the two right-most columns of Table 3. As can be seen the differences between groups are again relatively small, although hits for the recognition test show an effect in line with the general hypothesis of these experiments since the hit rate for Group *S* is somewhat higher than that of the other two groups. However, again it was found that differences did not approach statistical significance. This was also the case for the false alarm data. Once more it has to be concluded that the manipulations made to increase motivation have not improved memory performance.

The subjective data obtained in this experiment were also very similar to those obtained in the previous two experiments. In Group *S*, 8 out of 10 subjects said that they tried harder to learn and remember the items than they thought they would have done, had they not been told about any incentives. In Group *T* there were seven subjects who said that they tried harder than they thought they otherwise would have done. In Group *C* all 10 subjects reported that they probably would have tried harder to learn and to remember the TBR list if they had been told about incentives before study.

Thus, although the performance data failed to show any differences between groups, the subjective data of all three experiments certainly have demonstrated that the subjects of Groups *S* and *T* were motivated by the incentive. In Group *C*, apparently, all subjects thought that they would have been more motivated and successful if they had been given the incentives as well. Hence, as in Experiments 1 and 2 there is a dissociation between objective performance data and subjective reports.

Table 3. Mean proportions of words correctly recalled for all words, related words, and unrelated words, and mean hit and false alarm rates for groups *S*, *T*, and *C* (Experiment 3)

Group	Recall			Recognition	
	All words	Related words	Unrelated words	Hit	False alarm
S	.27	.41	.14	.59	.09
T	.28	.42	.13	.50	.10
C	.31	.50	.12	.52	.06

General discussion

As was discussed, subjects sometimes claim that the laboratory experiments they participate in have very little to say about real-life memory. These subjects complain that they do not experience any real motivation to perform optimally in these experiments. If this is true, it was thought, the data obtained in many memory experiments may not be valid and the theories developed on the basis of such experiments may have been built on completely wrong premises. Thus, it seemed important to determine empirically whether subjects would perform differently if they were highly motivated for the task. The three experiments reported in this paper seem to make a clear case that motivation (at least as it was manipulated here) does not affect memory performance. Thus, on the basis of these three experiments, we can disregard this type of critique from subjects participating in our laboratory experiments on memory.

We acknowledge, of course, that the results could have been different had the incentive been larger, the task been different, and so forth. By student standards, however, the amount of money used did affect the subjects in the experimental conditions in the expected direction. A majority of the subjects in Group *S* and *T* in all three experiments said in their subjective reports that the incentives had made them try harder to remember the items. As shown by the recall data this did not, however, increase actual performance. As witnessed by the control subjects in their subjective reports, they had not been particularly motivated to try extra hard in the experiment, to remember the items, but they said that they probably would have done so had they also been told about incentives at study or test. Thus, there is a dissociation between subjective data and performance data.

Whereas the subjective reports indicate that subjects in Groups *S* and *T* really had the intention to do well, the performance data demonstrate that this intent did not affect processing efficiency. Viewed this way the present data conform to the pattern found in experiments having explicitly manipulated intent to learn by means of comparing recall performance after incidental and intentional learning instructions. It is well established on the basis of such experiments that intent per se has no relevance for learning provided that study time is kept constant (e. g., Cermak, 1972; Nilsson, 1976; Postman, 1964). Since study time was kept constant in the present experiment one might argue that the finding of no positive effect of motivation actually was the result to be expected. Future research may find it worthwhile to study the effects of motivation under conditions in which study time is determined by the subjects themselves.

Thus, the effect that motivation might have on memory performance is indirect rather than direct. Incentives may increase the time spent on a certain task, which in turn results in a higher performance. This hypothesis can be illustrated by a thought experiment (see Baddeley, 1982). The experiment could be set up such that a group of subjects is asked to study and recall a list of words from two semantic categories, say, animals and professions; the subjects would be given a certain sum of money for any animal word from the list that they could recall, whereas recall of professions would not result in any monetary payoff at all. As a result subjects would spend more time studying the animal words than the professions, thereby producing higher recall of the former than the latter words. Although incentives in such a case would be effective, their effect on recall would be indirect rather than direct. As suggested by many authors (e. g., Baddeley, 1982; Broadbent, 1971; Cohen & Nilsson, 1974; Simon, 1967), motivation may have the effect of an increasing attention and thereby a longer time spent on the task. In the thought experiment mentioned subjects are more motivated to learn the animal words, therefore they attend to those more carefully and spend more time learning them than they do the professions. In principle, one could apply the same type of reasoning for such a within-subjects experiment on motivation as has been used for interpreting the data from studies on directed forgetting (cf. Cohen, 1983).

Although we have concluded that motivation, as manipulated in the present experiments, did not influence memory performance in general, it is probably fair to stress one more aspect of the data. As mentioned earlier the subjective data of Experiments 1 and 2 seem to suggest that there are individual differences in susceptibility to motivational factors of this kind. And indeed there is at least slight evidence for some correlative relationship to recall performance. Those subjects of Experiment 2 who said that they were unaffected by the manipulations made were actually those who showed the lowest recall scores as well. If this is the case, that is, that there are individual differences in susceptibility to motivational effects in memory, the effects do, however, seem to be relatively small.

The aim of this paper was limited in scope in the sense that we wanted to settle an empirical question emanating from subjects who had complained about the lack of motivation experienced for experiments they had to participate in. However, the underlying question is of course much broader, namely, the question of the role of motivation on learning and memory in general. As is well known this is a problem of long standing in psychology. Although this broader question in its whole complexity is far beyond the scope of this paper a few general remarks might be in order.

In spite of the fact that much research has been conducted in this field, there is hardly any general consensus about the effects of motivation on memory and other cognitive processes. And really, this lack of consensus is hardly surprising. It is of course an oversimplification to believe that one would be able to establish a general law of motivation. Many factors interact to produce this complexity. As noted by many (see e. g., Weiner, 1966 a, 1966 b, for reviews) several classical factors in learning research have to be taken into account, for example, magnitude of incentive, quality of incentive, nature of activity intervening between stimulus onset and recall, place in sequence at which the motivational factor is introduced, type of stimuli, and type of experimental design.

Moreover, it is crucial to take into consideration the interactions between the demands of the memory task, the incentive, and various "states" of the individual (Eysenck, 1985). Also, as was mentioned earlier in this paper, individual differences may play an important role in motivation. Finally, it should be observed that most of the actual research conducted has been concerned with extrinsic motivation. However, there is certainly much more to motivation than external incentives. In contrast to extrinsic motivation, intrinsic motivation is directly related to the activity itself, which is to be improved. For example, interest in a certain topic would seem to be closely related to increased feelings of competence. This, in turn, should reasonably be a cardinal motivating factor for improving performance.

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