Lay Supplement No. 11

HOW ALCOHOL AFFECTS PSYCHOLOGICAL BEHAVIOR

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Editorial Office: Laboratory of Applied Physiology, Yale University
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HOW ALCOHOL AFFECTS PSYCHOLOGICAL BEHAVIOR

NEARLY 200 separate investigations have been carried out by psychologists on men to whom they had given various amounts of alcoholic beverages. The purpose of these experiments was to find out whether alcohol, particularly in small and medium amounts,* improved or impaired muscular strength, skill, memory, judgment, and other functions which are generally called psychological. These experiments concerned behavior within a few hours after drinking but not the possible long-range effect of continued excessive drinking which is primarily a medical problem.

Recently two scientists reviewed all the published reports on such experiments and came to the conclusion that the essence of the psychological effect of alcohol is that of reduced efficiency. That is, the majority of men gave, on test after receiving alcohol, poorer performances of muscular strength, skill, memory and other measurable psychological functions. An eminent psychiatrist, on reading the review, said that men did not drink in order to be more or less efficient in performing tasks but in order to obtain relaxation, in order to feel differently, to gain confidence and relief from anxiety. The two scientists on the one hand and the psychiatrist on the other were perhaps both right and wrong. The two scientists were right in their description of the effect of alcohol on the performance of strength and skill and judgment of the average normal man. They may have been wrong in assuming that efficiency of these functions was, under all conditions, the only relevant question, and also in not accounting for an apparent increase of efficiency by alcohol in some not-quite-average

*The alcohol is usually administered to the men on whom the experiments are performed in a diluted form either as some alcoholic beverage or mixed with water. In this Supplement, however, when an amount of alcohol is mentioned, it will refer to the alcohol only, regardless of the amount or kind of fluid with which it may have been diluted. Small amounts would mean ½ to 1½ ounces of absolute alcohol, and medium amounts, 2 to 3 ounces, corresponding to about twice these volumes of whisky.

individuals. The psychiatrist was right in pointing out a motive for the use of alcohol which has nothing to do with skill and the performance of tasks, but he was wrong in altogether disregarding the question of efficiency. The results of psychological experiments, correctly interpreted, do not permit sweeping conclusions and dogmatic statements. Instead, they should lead to a rephrasing of questions in a form which permits specific answers.

Many men drink alcoholic beverages in the belief that alcohol increases strength, alertness and brilliance—that is, general adequacy. In regard to this belief, the question for investigation is whether alcohol increases or decreases adequacy of normal functions, that is, increases or decreases efficiency. Many men take a drink or two for an entirely different reason: to be less alert, to relax, to overcome preoccupation, to obtain a feeling of well-being. In regard to them, the proper question for the investigator would not be whether their efficiency for a certain task was increased or decreased but whether alcohol actually helped them achieve the desired relaxation. It would be an entirely different question, and one beyond the scope of psychological investigation, to inquire whether they could afford to relax and lose efficiency for tasks.

It would appear rather obvious that alcohol could not, through any fundamental action, give at one and the same time increased alertness and decreased alertness, increased efficiency for performance of tasks and decreased efficiency. The preponderance of evidence from psychological experiments is that alcohol decreases alertness and decreases efficiency for performing tasks, yet for some men it does seem to work in the opposite way and thus to have this double and opposing action. But again, before drawing any conclusion as to this action of alcohol from such observations, it is well to study the men in whom alcohol seems to increase efficiency for the performance of tasks. On such an examination it will be found that these men have little confidence in themselves, are so shy, so greatly subject to anxieties, that they are hindered, or as the psychologists like to say, they are inhibited in doing what they truly are capable of doing. Alcohol may lessen these inhibitions, increase their confidence, and make it possible

for them to perform better than they usually can, even though the performance is less than they would be capable of if their inhibitions were removed in some other way. This sounds complicated and paradoxical, but an illustration may make it clearer:

John Smith is fond of shooting at a target; when he is alone and on those rare instances when he has full confidence in himself—forgets himself—he can hit the bull's-eye 9 times out of 10 shots. But when he enters a competition he becomes inhibited, he has a feeling of being tied, and he can hit it only 4 times out of 10. Two highballs remove his anxieties and his shyness in competition; he can then hit the bull's-eye 7 times out of 10. The effects of alcohol make it possible for John to perform a task which, as a rule, he feels that he cannot perform, but nevertheless it does not let him perform it to the best of his real ability. It is thus not a simple matter to say what has happened to John's efficiency. It is obvious, however, that John would do better by training the strength of his self-confidence than by giving it a crutch with alcohol. This is particularly true since men whose production is facilitated by alcohol are especially liable to rely more and more on the crutch and thus finally become dependent upon it.

There are many other features which complicate the question of alcohol and efficiency. Thus, when the subject of automobile accidents and "driving under the influence" is discussed, nearly always someone maintains that either he or somebody he knows drives more efficiently after one or two highballs. If one pursues the discussion long enough, it develops that the driver in question "drives more carefully" because he knows that the drinks may have interfered with his driving ability. Thus alcohol does not make these persons better drivers, but fear of the possible consequences puts them on their mettle and makes them especially cautious and careful. Unfortunately, in most drivers the alcohol destroys fear of consequences and, with it, even their usual caution. Thus the argument of "driving more efficiently after one or two cocktails" has no weight in the question of alcohol and traffic accidents.

In 1943 an article appeared in newspapers announcing that one

of the "findings" reported at that year's summer session of the School of Alcohol Studies at Yale University was the fact that alcohol is not a stimulant but a depressant. This was "news" in spite of the fact that it has been known by students of the question for some 50 years. That it was still "news" in 1943 is not surprising, however, since people find it hard to accept the fact that alcohol is a depressant and not a stimulant. They say, "But when I take a drink, I don't feel depressed, quite the contrary." Their mistake lies in the interpretation of the word "depressant." In common usage, depression means being gloomy and sad, but in scientific language it means lessening of the activity of the brain center and, thus, reduction of attention, critical attitude and judgment. A feeling of ease and relaxation results. The reduction of attention, judgment and critical attitude, however, in turn means that acts requiring these attributes cannot be performed with the same efficiency as before.

This, then, is the complicated problem which psychologists have undertaken to investigate. Their experiments are summarized in the following pages.

ALCOHOL AND THE FLOW OF THOUGHT

As has been indicated, the results of psychological experiments with alcohol may often be interpreted in two ways; consequently it is always a question which interpretation is the more relevant or more to the purpose. As an example, there are those experiments in which a psychologist uttered certain stimulus words and asked the men who served as subjects, and who had been given medium amounts of alcohol but were not intoxicated, to respond with all the words they could think of immediately on hearing the stimulus word. This is called an association test. As a control procedure, an equivalent test was given to the same subjects without alcohol. The experimenters found that with alcohol the response was more abundant—the subjects produced a greater number of words in response to the stimulus. On closer examination it became apparent, however, that there was an important difference between the kind of words produced with and without alcohol. The number of responses elicited without alcohol was

smaller, but the responses were of a distinctly superior quality, they were more relevant, more logically associated with the stimulus. The larger number of words produced with alcohol were of a poorer quality, they were not as often relevant to the stimulus word. For example: to the stimulus word *butter,* normally such response words are produced as *cheese, bread, yellow,* that is, words designating objects or qualities which in their origin, their use or their characteristics, are connected with the object designated by the stimulus word. On the other hand, after taking a glass or two of whisky, the stimulus word *butter* may evoke such responses as *bitter, flutter, butterfly,* that is, words related to the sound and form of the stimulus word rather than to its meaning. These findings can be interpreted in the following two ways: (*1*) That alcohol diminishes the efficiency of the subjects in responding relevantly to a test of association; this is apparent in the production of responses of an inferior quality. (*2*) That alcohol produced relaxation in the subjects; this is apparent in the ease of production of a larger number of "nonsense" responses. And, finally, some inhibited subjects respond freely and with relevance only with alcohol because of release from self-consciousness; this is apparent in the occasional individual who shows improved production.

THE EFFECT ON JUDGMENT

THE example given above leads one to surmise that judgment may be affected somewhat by medium and even small amounts of alcohol. Psychologists have been interested in this question and have investigated it from many angles. The term "judgment" is rather vague and may cover a large variety of mental functions, some of which may be rather simple and some highly complicated.

Judgments relating to the pleasant or unpleasant nature of things, such as taste and smell, were not changed in a number of men who were tested before and after they had taken the equivalent of about 1½ glasses of whisky. Somewhat more complicated judgments did show impairment, however, after this amount. Thus, the American psychologist Hollingworth showed

that the ability to name opposites of given words decreased by 29 per cent after drinking an amount of alcohol equal to 1 glass of whisky. Taking two or three times this amount was followed by 52 per cent impairment on this test.

The loss of sharpness in judgment resulting from alcohol is further shown in a test of estimating lapse of time. Dr. Vernon, who performed many experiments with alcohol on behalf of the British Medical Council, found that automobile drivers given alcohol in an amount corresponding to that in about 1½ glasses of whisky drove a given course in a shorter time than before the alcohol, but felt that they had taken longer. In other attempts to determine more exactly the effect of alcohol on the time sense, a number of men were trained in the course of several days to sound a bell at what they felt to be a 5-minute interval. They became able to do this with an accuracy that was within 30 seconds. The error was generally in excess of the 5 minutes. When these men were given a stimulating drug, such as thyroid extract, they sounded the 5-minute signal after about 4 minutes had elapsed. When, however, they were given ½ pint of strong wine (equivalent to about 3¼ ounces of whisky) they sounded the signal after some 8 minutes had elapsed.

A person's judgment in certain matters may depend on whether or not he is able to perceive fine differences in the loudness of sounds, or the intensity of light. The degree of discrimination of loudness of sound and intensity of light was measured in a number of men before and after drinking 2 or 3 glasses of whisky. For an hour or so after the drink, when the alcohol in the blood was at its highest concentration, they were able to hear noises of a softness which they were not able to hear before the alcohol was taken. Their sensitivity to sound was not depressed by the alcohol; it was actually increased. On the other hand, their ability to distinguish between the loudness of two sounds, an accomplishment involving judgment as well as hearing, was diminished. The influence of moderate amounts of alcohol on vision was found to be much the same as that on hearing. The sensitivity to light was increased; a smaller intensity of light could be perceived after the alcohol than before. But as with

hearing, discrimination was impaired; there was loss in ability to distinguish between two lights of different intensities.

THE EFFECT ON REACTION TIME

THE reaction time, that is, the time it takes a person to give the proper response to any signal such as a word, a sound, a light, or a touch, has been the subject of many experiments. This is a simple behavior, yet not only in the psychological laboratory but in everyday life we are accustomed to observe and make judgments from the speed of response to a stimulus.

Under ordinary conditions a normal person takes on the average 1/5 second to respond to the flashing of a light by, let us say, pressing a button. Under differing conditions the differences in reaction time are so small that they must be measured in thousandths of seconds, called milliseconds. Yet, since the normal average time is 1/5 second, that is, 200 milliseconds, a change of only 10 milliseconds represents a change of 5 per cent. Scientists have devised apparatus suitable for the measurement of such brief time intervals.

Pressing a button in response to the flashing of a light has been used by many psychologists for observing changes in reaction time after drinking varying amounts of alcohol. Some of the results are shown in the accompanying table.

The Effect of Alcohol on Visual Reaction Time

Alcohol Equivalent to Glasses of Whisky	*Per cent Slowing of Reaction Time 1 Hour After Drinking**
1½	6
2½	12
3½	34

*The per cent change is based on the reaction time measured before alcohol was given; this averaged approximately 200 milliseconds.

A change of 34 per cent is considerable. In this particular instance it means that the subjects in the experiment took 68 milliseconds longer to respond to a light signal after drinking 3½

glasses of whisky than before drinking. What does this mean in practical terms? It means, for instance, that, traveling at 50 miles per hour, it would take about 17 feet more road space to bring the car to a full stop. This is a powerful reason against mixing alcohol and gas. From the preceding table it is also seen that even such small amounts as 1½ glasses of whisky have some effect on the nervous system. When no mechanical task is involved, the meaning of the results is that the nervous tempo has been slowed, and this indicates loss of tension or, in other words, that alcohol has produced sedation or relaxation. Whether men who are habituated to alcohol are more or less affected in their reaction time by alcoholic beverages cannot be decided from the evidence of reported experiments.

EFFECT ON SKILLED PERFORMANCE

MANY years ago it was common in industrial plants for the employees to drink alcoholic beverages during recesses in the work; the question eventually arose whether or not this custom interfered with the efficiency of the workmen. In order to answer this question, psychologists measured the effect of alcohol on many tasks involving the coordination of muscles, as in the learned skills. In some of these experiments it was the object to bring a task down to its simplest form so as to find out what part of a skilled performance is affected most or least. Thus such a task as copying on a typewriter requires, among many other factors, accurate perception of the manuscript, attention, the translation of the words into finger movements, and precision in striking the keys on the keyboard. If a strong effect of alcohol on typewriting were found, it would be hard to decide whether this was due to difficulty in reading accurately, or to the straying of attention, or to an impairment of coordination between eye and hand or of any other part of the performance. It is because of this that some psychologists have devised tests which presumably involve only one or two elementary forms of behavior.

A large number of such elementary behaviors as affected by alcohol have been observed by psychologists, and it would be a matter of great interest to compare all these experiments. Un-

fortunately this cannot be done, for some behaviors have been observed under the influence of 1 ounce, and other behaviors under the influence of 2, 3 or 4 ounces of alcohol; and furthermore, some observers noted the effects 20 minutes, others 1 hour, and still others 2 hours, after alcohol was taken. Thus, in many instances, it is not possible to say which behavior is more and which is less affected by alcohol. Such a comparison can be made, however, on a limited number of different elementary behaviors as well as on some complicated tasks which have been observed 1 hour after drinking alcohol equal to the alcohol content of 1½ glasses of whisky.* The following discussion is limited to these comparable experiments in which these amounts were taken.

The speed of the eye in following an object, moved rapidly back and forth, was slowed by 3 per cent after taking the alcohol. The somewhat less-simple finger movements required in tapping were slowed by 9 per cent. This finger tapping requires little skill. Far greater dexterity of the fingers is required when a board with rows of small holes must be filled rapidly with pins placed into the holes; after alcohol, the performance on the pin-board was decreased by 19 per cent. Much more complicated is the act of tracing with a pencil an involved pathway, and the tracing showed 60 per cent more errors after alcohol than before.

The performances discussed thus far were what may be called laboratory tasks. They are not the kind of tasks one carries out in everyday life, although they resemble some of them. Such a task as sewing is more complex, that is, many more elements enter into it than into these laboratory tasks. One would expect, therefore, that the ability to sew would be impaired to a greater degree than tracing pathways. Yet when women well versed in sewing were given alcohol, their production decreased by only 10 per cent. The explanation of this unexpected result may be that alcohol affects familiar tasks much less than unfamiliar ones. Although the laboratory tasks are simpler, they are, nevertheless, unfamiliar. Tracing of pathways, for instance, is a task people

*It goes without saying that the performances of the people participating in these experiments were first observed in the absence of any alcohol intake.

do not perform in their ordinary occupations; they learn how to do it while the experiment is carried on. Students who were accustomed to type but were not professional typists increased their typing errors by 40 per cent on taking alcohol, but lost only 3 per cent of their speed. While the impairment was greater here than on sewing, it was again smaller than on the simpler but unfamiliar task of tracing pathways. The students on whom these experiments were performed were not accustomed to drinking, and that may have increased the effect of alcohol on their work. This assumption seems to be borne out by an experiment in which typesetters, accustomed to alcoholic beverages, took part. Typesetting requires even more skill than typewriting, but the typesetters did not increase their errors at all after alcohol. On the other hand, their speed was reduced by 15 per cent. Thus, even the men greatly trained in the performed task, and accustomed to drinking, were affected in the output although not in the quality of their work.

It would seem that on the whole the effect of small amounts of alcohol on skilled performances increases as the tasks become more complex, but that the effect on a complex but familiar task may be less than on a simpler but unfamiliar one, and that the effect may be less on persons accustomed than on persons not accustomed to drinking. Furthermore, the so-called simple laboratory tasks do not seem quite appropriate for drawing conclusions concerning the effect of alcohol on skill. There remains, however, no doubt that the properties of alcohol which are conducive to sedation or relaxation are by no means conducive to task efficiency, save for such exceptions and with such limitations as have been discussed and exemplified in the instance of the anxious and self-conscious John and his target shooting.

All the experimental results discussed here have been used as arguments against driving an automobile after drinking even small amounts of alcoholic beverages. On the other hand, some people have countered with the argument that, although even small amounts of alcohol can be shown to have some effect, the effect is too small to have any practical consequences. But both sides seem to have missed the point. It is useless to quarrel over

the question whether two highballs slow the reaction time by 10 per cent or by 30 per cent. It is useless to argue whether these two highballs narrow the field of vision to a large or only to a small extent. Even if there were no slowing of reaction time, no narrowing of the field of vision, and no loss of skill at all following the drinking of two highballs, there would remain a fact which everybody can observe without laboratory gadgets and which is the final reason for the warning against driving after drinking. This fact is that alcohol creates a sense of well-being which in the anxious man may restore confidence but in the normal man may lead to over-confidence. Over-confidence means willingness to take chances, and taking chances may bring disaster on the road.

THE EFFECT ON MEMORY AND REASONING

With the exception of judgment, the preceding discussion has centered around sensations and mechanical tasks. But what is the effect of alcohol on what is often, but not too appropriately, called "higher" behavior or "mental" behavior?

Memory is a psychological function which is involved in most human activities. There are daily situations in which even a slight loss in the ability to remember may have serious consequences. On the other hand, there are experiences of which one says "better not remember them" and which one seeks to forget.

Thus the effect of alcohol on memory is of twofold interest. In order to test "pure memory" psychologists frequently use the memorizing of "nonsense syllables" because the special meaning a word may have for a given individual may make it easier to remember or forget. The immediate memory for "nonsense syllables" was, in experiments, found to be reduced by 12 per cent after drinking 1 or 2 glasses of whisky. After 4 glasses of whisky the loss in ability to recall the syllables was 44 per cent.

In an experiment on memorizing lines of poetry, the memorizing of 25 lines took more than twice as long when 1½ glasses of whisky were taken on "an empty stomach" than when no alcohol was taken. When, however, 2 glasses of whisky were

taken with food, the time required for memorizing 25 lines increased by only 16 per cent.*

This temporary interference of alcohol with memory is one of the reasons for its use in large amounts by the habitual inebriate—he wants to forget, and so he "drowns" his sorrows. The lighter effect of small amounts is an indication of sedation.

The effect of small amounts of alcohol on reasoning is not known; only experiments with alcohol equal to ½ pint of whisky have been performed. In these experiments reasoning showed an increase of 67 per cent of errors. The fairly large amount of alcohol was taken in a few minutes, and the experiment hardly showed more than one could have guessed.

CONCLUSIONS FROM EXPERIMENTS

PSYCHOLOGICAL experiments have yielded some valuable knowledge concerning the effects of alcohol but they have left much territory unexplored. The greatest drawback of these experiments is that they tell us little about the effect of alcohol on the total behavior. They refer to parts of the total behavior, and one is at a loss to say whether such parts can be reasonably considered separately from other parts with which they ordinarily act together. It is somewhat in the nature of describing a brick house in terms of bricks only, without considering that in a house the bricks are related to mortar, to windows and doors, to designs and to the whole landscape in which the house is placed. These experiments contribute little to the knowledge of why people drink,† except that the psychological effects themselves are somewhere and to some extent among these reasons.

The most important conclusion that may be drawn from psychological experiments with alcohol—and these include many experiments which have not been described here—is that the various effects studied show that alcohol is a depressant, not a stimulant. It affects first the higher brain centers which control the voluntary behaviors and emotions, while the lower centers

*For the effect of alcohol before and after eating, see Lay Supplement No. 7, page 6.

†The reasons for drinking are discussed in Lay Supplement No. 10.

which control such vital functions as breathing are affected only in severe intoxication. Briefly, alcohol acts in the same way as the well-known anesthetics. Since it is an anesthetic, one can correspondingly predict its effect in small and large quantities on efficiency on the one side, and on sedation and relaxation on the other side.

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