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## Alcohol: Its Effect on Handwriting

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**REFERENCE:** Galbraith, N. G., "Alcohol: Its Effect on Handwriting," *Journal of Forensic Sciences*, JFSCA, Vol. 31, No. 2, April 1986, pp. 580-588.

**ABSTRACT:** A series of research studies was conducted to determine if there would be changes in the handwriting of 35 men and women after they had been drinking. Handwriting samples were taken before the participants had consumed any alcohol and again after the drinking period had ended. Deterioration in the handwriting was charted. Based on this study, the handwriting could not be used in any way to measure accurately the blood alcohol concentration of a writer. The results of the handwriting comparisons are discussed.

**KEYWORDS:** questioned documents, handwriting, alcohol

Numerous discussions, research studies, and articles have concentrated on the subject of alcohol consumption and its effect on handwriting. Frequently, document examiners are faced with signatures that differ from the known handwriting samples but do not contain characteristics associated with forgeries.

And so the questions arise, "was the document signed by an individual who was under the influence of alcohol?," "was this document signed by someone attempting to simulate a genuine signature?," or "was this document signed with the intent of simulating the writing of an intoxicated individual?" "Is it genuine, but signed by a fatigued writer?" The possibilities are endless.

Hilton [1] observed, "the opportunity to examine writing and signatures prepared during a controlled drinking situation could be of assistance in learning more about the influence of consumed alcohol on handwriting."

Studies have been conducted under controlled laboratory conditions and they have provided some insight into the effects, or lack thereof, of varying amounts of alcohol consumption on the body [1,2]. However, there are certain problems with laboratory testing. According to McCarthy [3],

Measurements of performance in laboratory tests may underestimate the detrimental effects of intoxication because the subjects being tested are able and often feel motivated to 'pull themselves together' counteracting the depressant effects of alcohol on central nervous system functions which regulate sensory and motor performance, motivations and emotions.

A carefully controlled laboratory study that would deemphasize the laboratory atmosphere could produce results that were measurable.

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## The Sample

Thirty-five men and women participated in a series of research studies designed to measure the effects of alcohol consumption on handwriting and coordination. Two additional non-drinking writers were used as a control in Study 2 and are included in the statistics only when noted.

Seven studies were conducted over an eight-year period with a total of thirteen women, aged twenty-one to forty, and twenty-two men, aged twenty-one to fifty-three, as the subjects. Each participant volunteered for one study. The participants were attorneys, clerks, police officers, criminalistics students, and interested parties to the study. The studies were held in the recreation room of a police station or a college whenever possible. A party atmosphere was encouraged with plenty of conversation, card playing, and music.

## Alcohol

Since the coordination of the subjects would be measured against blood alcohol concentrations, a clinical laboratory technician<sup>2</sup> was asked to give a simplified explanation of the process within the body. Alcohol is described as

... a chemical term for a large group of compounds that have a particular group of atoms in common. Ethyl alcohol is what is commonly called alcohol and is contained in alcoholic beverages. Alcohol is absorbed into the body through the lining of the stomach and small intestine. Since ethyl alcohol is small and passes easily through cell membranes, it enters the blood from the gut in 20 to 40 minutes when no other food is present. Once in the blood it is carried to all other tissues of the body. How high the actual alcohol content of each tissue gets is dependent on the water content of that tissue.

In respect to the breath test,

When the blood is in the lungs, alcohol passes into the air in the lungs. The amount of alcohol going into the lung air is directly related to the blood alcohol concentration. This occurs at a ratio of 2,100cc to 1. That means there will be the same amount of alcohol in 2,100cc of deep lung air as there is in 1cc of blood.

The results of breath, blood and urine tests are stated in g/dL blood alcohol concentration. For the purpose of this article, blood alcohol concentrations will be truncated and thus referred to as a 0.05 or 0.10 rather than a 0.052 or 0.107 g/dL blood alcohol concentration.

## Method

All of the subjects took a breath test upon arrival to establish that their blood alcohol concentration was a 0.00 and they had not been drinking. Information was taken regarding when they had eaten their last meal, how long they had been awake, their weight, age, height, and drinking history. This information was used to compute how much alcohol would be required to bring each subject up to a 0.10, the legal limit for driving in California.

The participants gave samples of their handwriting before they consumed a measured amount of alcohol and again after they had reached their peak blood alcohol concentration. In Study 5 a sample was also taken at the midway point.

An assortment of materials was used in an effort to produce an instrument that might better identify the influence of alcohol consumption.

Facsimiles of a bank card receipt, gasoline credit card receipt, personal size check, and business size check were used. The participants also printed the alphabet and numerals on a 3 by 5 card, filled out a handwriting exemplar card, signed their names in several designated spaces,

<sup>2</sup>Anne Beth Yee, material provided for unpublished research study, "The Effects of Alcohol on Performance," Nanette G. Galbraith, coordinator, 14 April 1978.

typed two short sentences, and copied a familiar nursery rhyme on a sheet of plain or graph paper.

Different combinations of the above materials were chosen for each of the studies, in the interest of time. The graph paper was used so that possible variations could be observed more readily. A familiar nursery rhyme was used to eliminate potential errors that can result from copying an unfamiliar printed page, as observed by Hilton [1].

In the earlier studies, a scenario was prepared so that the bank card receipt, gas receipt, and personal check would be introduced as a part of the party atmosphere. The actual writing, however, was executed at a table set apart from the other subjects.

### The Tests

Field sobriety tests were administered to the participants by a California Highway Patrol Officer or a San Diego Police Officer. When the first handwriting specimens were completed, the drinking portion began.

Measured amounts of vodka, scotch, bourbon, or beer were prepared for the appropriate subject along with the requested mixes. Snacks were also available. Each subject was assigned a monitor who kept a record of the amount consumed and behavior changes. In addition to the breath test, blood and urine tests were given to the participants for correlation purposes.

Five physiological testing apparatus were made available for Study 5 by the psychology department of a local university. The purpose of that study was to determine if handwriting and certain physiological tests would reveal performance deterioration in subjects presumed impaired as defined by California statute in 1978.

The five motor skill tests were given to each subject before they consumed alcohol to establish baseline performance data. The tests were given again midway through the drinking period and again after the drinking time had ended.

The tests used were a steadiness test, peg board test, tapping test, reaction time test, and a tracking test that required the subject to move a hand-held stylus between two strips narrowing at one end in a deep V. Of the five, the tracking test probably most closely resembled the act of holding a writing instrument and moving it across a paper.

### Results

Fourteen of the participants reached a blood alcohol concentration of 0.05 to 0.09, fifteen reached 0.10 to 0.14 and six reached 0.15 or above. The average blood alcohol concentration for the women was 0.12 with an average of 0.10 for the men.

A comparison was made of the handwriting obtained before drinking and the handwriting taken approximately 30 to 45 minutes after the last drink. The drinking time was 1 to 1½ hours.

Particular attention was given to the changes and variation in size, spacing, deterioration, carelessness, legibility, casualness, alignment, and accuracy as described in previous work in this area [1-3].

The more common changes were a tendency towards more casual or relaxed handwriting and writing that was larger and spread out across the writing area.

The handwriting was measured to determine the extent of the horizontal space changes. Much of the writing enlarged, but there were a few writers who used less or the same space for their signatures or nursery rhyme lines when compared to the first specimen. There were other writers who used less space on one writing line and more space on the next.

Many of the writers increased the spread in their writing by leaving larger spaces between the words.

Of the writers who wrote error-free samples in the predrinking period, 51% wrote with errors, corrections, or omissions in one or more of the postdrinking samples.

A comparison was made to determine if there were observable writing differences between

the age groups or sex of the writers. Of the 35 participants in this study, 13 men and 11 women fell in the 21- to 30-year age group. Charts of the writers in this group were prepared showing the drinking history as determined by each individual and the changes in handwriting after the drinking period (Tables 1 and 2).

Based on this study, there is no statistically significant difference in the postdrinking handwriting performance between the sexes or between light, moderate, or heavy drinkers in the 21- to 30-year age group. As can be expected, a noticeable change in some categories of deterioration can be observed between those subjects who were under a 0.10 blood alcohol concentration and those who were 0.10 or above. Even at the lowest blood alcohol concentration of 0.05, there was some change in the amount of space used for the writing.

The remaining eleven participants fell into three age groups. The small sample size in each of these groups prevented statistical comparisons by age. The deterioration in handwriting of the writers aged 31 to 53, however, is consistent with the results in the 21- to 30-year group.

Two nondrinking individuals participated as a control in Study 2 by completing the same handwriting specimens as the drinking subjects and in the same time frame. The purpose was to determine if the environment influenced the research studies in any way. The handwriting of the nondrinkers maintained the same general appearance throughout. However, the two participants did vary in the amount of horizontal space used for their writing samples. This variation was consistent with some of the writing in the drinking group.

The writing of the nursery rhyme was timed. Of the 31 subjects, 22 took more time after the drinking period had ended, 4 used the same amount of time, and 5 used less time. Of the nondrinkers, one took more time and the other the same amount. Four subjects did not write the rhyme.

There were few errors in the writing of the rhyme by the participants, possibly because the subjects were familiar with the text. Alignment of the writing on the graph paper was better than the writing on the unlined sheets of paper. This was true in the predrinking as well as the postdrinking period.

The handwriting of five subjects deteriorated greatly as illustrated by a writer with a 0.11 blood alcohol concentration (Fig. 1). Another writer with a 0.12 illustrated that for some there were few or no significant changes (Fig. 2).

Tremor in the handwriting of the 35 participants was not apparent in the samples collected in this study. However, tremor has been observed in studies of individuals who are alcoholics [4,5].

With the exception of writers who produced deteriorated and illegible handwriting, the specimens produced by the participants could be identified. The signatures would probably be considered within the normal variation of the predrinking signatures.

The results of the motor skills tests were interesting when compared to the blood alcohol concentrations. The subjects' steadiness on that particular test was significantly reduced at a blood alcohol concentration of  $\geq 0.10$  as was their performance at the peg board test.

Results of the tapping test showed deterioration in performance when the blood alcohol concentration reached  $\geq 0.15$ .

The reaction time test best illustrated the change in behavior of the participants as the blood alcohol concentrations became more elevated and they attempted to perform their tasks. During the predrinking period, all performed according to directions. After drinking, they found it difficult to follow the proper sequence. Two individuals insisted on hitting all four control buttons at the same time.

However, in the tracking test, using a stylus, there was no significant deterioration at 0.10. In general, at 0.15 there was significant deterioration, but one subject actually showed improvement. The participants took longer on the tracking test as most would stop and restart the stylus as they neared the narrow end of the apparatus. The most noticeable delay occurred when two different subjects stopped in the middle of the test to discuss philosophical points of view with the observers.

TABLE 1—Changes in handwriting after alcohol consumption for male participants, ages 21 to 30 years.

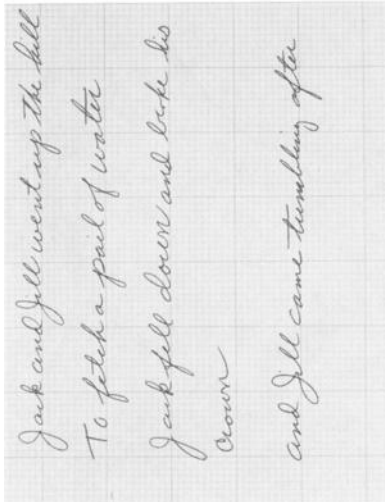
Participant	BAC <sup>a</sup>	Age	Drinking History <sup>a</sup>	Less Legible	Alignment Dipping	Errors, Corrections, Omissions	Less Accurately Formed Letters	Relaxed Careless Line Quality	Enlarged, Spread Out	Spread Varied
2	0.05	28	NA	...	...	...	...	...	X	...
12	0.06	28	NA	...	...	X	...	...	X	...
14	0.06	28	NA	...	...	...	...	...	X	...
11	0.07	28	NA	X	...	X	X	X	...	X
15	0.07	29	H	...	...	...	...	...	...	X
6	0.08	21	M	...	...	X	...	X	...	X
34	0.09	27	M	...	...	...	...	X	X	...
30	0.09	29	M	...	X	X	...	X	X	...
33	0.10	29	H	...	...	...	...	...	X	...
7	0.11	28	H	...	...	...	...	...	X	...
26	0.11	28	L	...	X	X	X	X	X	...
28	0.12	28	M	...	X	X	...	...	...	X
32	0.13	28	L	X	X	...	X	X	...	...

<sup>a</sup>BAC = blood alcohol concentration, H = heavy, M = moderate, L = light, and NA = not available.

TABLE 2—Changes in handwriting after alcohol consumption for female participants, ages 21 to 30 years.

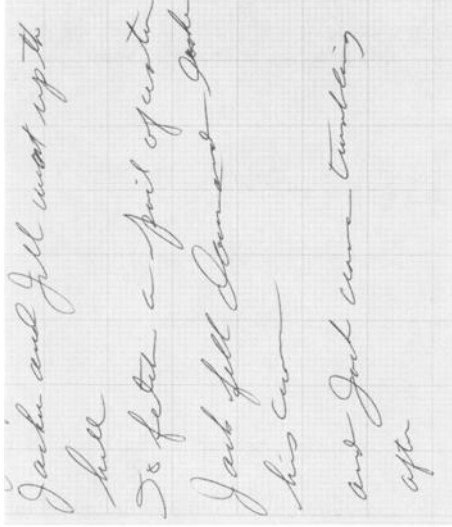
Participant	BAC <sup>a</sup>	Age	Drinking History <sup>a</sup>	Less Legible	Alignment Dipping	Errors, Corrections, Omissions	Less Accurately Formed Letters	Relaxed Careless Line Quality	Enlarged, Spread Out	Spread Varied
17	0.07	22	H	...	...	...	...	...	X	...
27	0.07	29	L	...	...	X	...	X	X	...
35	0.08	27	M	...	...	X	...	X	X	...
9	0.09	25	M	...	...	...	...	X	...	X
8	0.10	25	L	...	...	X	...	X	X	...
22	0.10	30	L	...	X	X	X	X	X	...
24	0.12	26	L	...	X	X	X	X	X	...
29	0.14	21	M	...	...	...	...	...	X	...
3	0.15	21	L	...	X	X	...	...	...	X
4	0.15	25	M	...	...	...	...	X	X	...
18	0.16	25	M	...	X	X	...	X	X	...

<sup>a</sup>BAC = blood alcohol concentration, H = heavy, M = moderate, and L = light.



Jack and Jill went up the hill  
To fetch a pail of water  
Jack fell down and broke his  
crown  
and Jill came tumbling after

0.00



Jack and Jill went up the  
hill  
To fetch a pail of water  
Jack fell down and Jack  
his crown  
and Jack came tumbling  
after

0.11

FIG. 1—A writer's handwriting deteriorated greatly with a blood alcohol concentration of 0.11 (right).



Just and fell went up the hill  
to fill a pool of water.  
Just fell down and broke his crown,  
and fell some twenty yds.

0.12



Just and fell went up the hill  
to fill a pool of water.  
Just fell down and broke his crown,  
and fell some twenty yds.

0.00

FIG. 2—The handwriting of another writer with a blood alcohol concentration of 0.12 had few or no significant changes (right).



Once the participants had completed the testing, they conversed for a while, became tired, and were driven to their homes by their monitors. No further samples were collected. Goyne and Kittle [6] observed in their study conducted during the hangover stage the next day that "... any residual influence on the handwriting was negligible."

One of the subjects who reached a 0.11 produced a nursery rhyme and signatures with considerable deterioration. She was described by her monitor as noisy and laughing, with overcontrol of her hand motions, totally uncoordinated, and showing a sleepy appearance. If this individual were to sign a legal document in the presence of witnesses or a notary public, her condition would be remembered. Obvious behavior patterns associated with intoxication were observed in the few subjects who lost control of their writing to the point of extreme illegibility and deterioration.

Any two individuals may vary considerably in the level of impairment at a given blood alcohol concentration. In addition, impairment is observed in different ways among individuals, such as in their manner of walking or talking or writing. A participant in a recent Los Angeles study reached a blood alcohol concentration of 0.21 and produced handwriting with no significant changes,<sup>3</sup> while a subject in this study produced deteriorated specimens at a 0.07 level.

### Summary

Based on this study, handwriting cannot be used in any way to measure accurately the blood alcohol concentration of a writer. However, the extreme behavior associated with intoxication often produces deterioration in the handwriting of that individual.

In determining whether or not handwriting, such as a signature or holographic will, was produced while the writer was under the influence of alcohol, two observations should be taken into consideration. There are some individuals whose impairment does not appear to be reflected in their handwriting, while there are others whose handwriting is affected by a minimal amount of alcohol.

<sup>3</sup>Karen Chiarodit, "Blood/Breath Study," Los Angeles Police Department Alcohol Laboratory, unpublished data, 11 Feb. 1984.

### References

- [1] Hilton, O., "A Study of the Influence of Alcohol on Handwriting," *Journal of Forensic Sciences*, Vol. 14, No. 3, July 1969, pp. 309-316.
- [2] Anderson, G. J., "Varying Effects of Alcohol on Handwriting," presented at the Annual Meeting of the American Academy of Forensic Sciences, Dallas, TX, Feb. 1974.
- [3] McCarthy, J. F., "Handwriting and the Use of Alcohol: An Overview of a Dilemma," presented at the Annual Conference of the American Society of Questioned Document Examiners, Colorado Springs, CO, Aug. 1975.
- [4] Beck, J., "Handwriting of the Alcoholic," *Forensic Science International*, Vol. 28, 1985, pp. 19-26.
- [5] Doud, D., "Some Pitfalls in Testimony Relating to Alcohol Consumption and Handwriting," presented at the Annual Conference of the American Society of Questioned Document Examiners, Colorado Springs, CO, Aug. 1975.
- [6] Goynes, T. E. W. and Kittel, H. R., "Do 'Hangovers' Impair Writing Ability?," presented at the Annual Conference of the American Society of Questioned Document Examiners, Montreal, Quebec, Canada, Sept. 1985.

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