

## TECHNICAL NOTE

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### A System for Handwriting Classification

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**REFERENCE:** Taylor, L. R. and Chandler, H., "A System for Handwriting Classification," *Journal of Forensic Sciences*, JFSCA, Vol. 32, No. 6, Nov. 1987, pp. 1775-1781.

**ABSTRACT:** In dealing with questioned document cases, examiners may encounter a questioned writing with no known suspect or a potential suspect with no writing available. The benefit and purpose of a classification system is to put at the fingertips of the examiner a means of filing and retrieving handwriting information on classified individuals who in many instances are repeat offenders and could be potential suspects. For clarification purposes, it should be stated that the classification of handwriting is not synonymous nor should be confused with the identification of handwriting. Classification simply allows the development of a mathematical formula based upon types of handwriting patterns for the purpose of retrieving information. Identification, on the other hand, is concerned not only with patterns that occur in handwriting, but individual characteristics as well as a host of other features. This paper discusses the development and implementation of a handwriting classification system used primarily to expedite the search for potential suspects where no suspects have been developed by the investigating agency, and as a source to project trends in certain handwriting characteristics as they relate to each other and to the sex and the race of known offenders.

**KEYWORDS:** questioned documents, handwriting, classifications, identification systems

The classification system developed in Arkansas was based on eight handwritten letters. The selection criteria involved letters that were commonly used; letters that were not capitalized; and letters whose formations included loops, retraces, buckles, t crossings, and i dots. The classifications of letters were assigned numbers. The lower numbers denoted a more common copybook form of writing, while the higher numbers denoted a more unusual formation deviating from a copybook form. The letters selected were the small letters a, d, f, g, i, k, r, and t. These were classified into the following categories:

- Letter a-1—No loop on top with retrace on final stroke.
- a-2—No loop on top with loop on final stroke.
- a-3—Loop on top with retrace on final stroke.
- a-4—Loop on top with loop on final stroke.
- Letter d-1—No loop on top with loop on staff.
- d-2—No loop on top with retrace on staff.
- d-3—Loop on top with retrace on staff.
- d-4—Loop on top with loop on staff.

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- d-5—Loop on staff with reverse retrace.  
 d-6—No loop on staff with reverse retrace.
- Letter f-1—Loop on upper staff with loop on lower staff.  
 f-2—Retrace on upper staff with loop on lower staff.  
 f-3—Loop on upper staff with retrace on lower staff.  
 f-4—Retrace on upper staff with retrace on lower staff.  
 f-5—Loop on upper staff with reverse loop on lower staff.
- Letter g-1—No loop on top with retrace on final stroke and loop on lower staff.  
 g-2—Loop on top with loop on final stroke and loop on lower staff.  
 g-3—No loop on top with loop on final stroke and loop on lower staff.  
 g-4—Loop on top with retrace on final stroke and loop on lower staff.  
 g-5—No loop on lower staff.
- Letter i-1—Retrace with dot.  
 i-2—Loop on staff with dot.  
 i-3—Retrace on staff with horizontal slash.  
 i-4—Loop on staff with horizontal slash.  
 i-5—Retrace on staff with circle.  
 i-6—Loop on staff with circle.  
 i-7—Retrace on staff with half moon.  
 i-8—Loop on staff with vertical slash.  
 i-9—Retrace on staff with vertical slash.  
 i-10—Loop on staff with vertical slash.  
 i-11—Retrace on staff with no dot.  
 i-12—Loop on staff with no dot.
- Letter k-1—Loop on upper staff with round buckle.  
 k-2—Retrace on upper staff with round buckle.  
 k-3—Loop on upper staff with half moon.  
 k-4—Retrace on upper staff with open buckle.  
 k-5—Loop on upper staff with open buckle.  
 k-6—Retrace on upper staff with open buckle.
- Letter r-1—Two retraces forming a cup on top with high point on left.  
 r-2—Left retrace high point with right point curved.  
 r-3—Two retraces on top with high point on right.  
 r-4—No retraces on flat top.  
 r-5—Round curve on top.  
 r-6—One point on top.  
 r-7—Speed r.
- Letter t-1—Retrace on upper staff and crossing intersects staff.  
 t-2—Loop on upper staff and crossing intersects staff.  
 t-3—Retrace on upper staff and crossing above staff.  
 t-4—Loop on upper staff and crossing above staff.  
 t-5—Loop on upper staff with speed crossing.  
 t-7—Retrace on upper staff with speed crossing.

In classifying a particular letter, for example the letter "a," the pictorial shape of two "a's" may differ while maintaining the same classification (Figs. 1 and 2). These illustrations reinforce the distinction between the classification and the identification processes which have only a casual connection with one another.

#### **Classification Procedure**

As document cases were received into the laboratory, handwriting samples were compared, classified, coded, and stored in a computer (Figs. 3 and 4). Once the information was

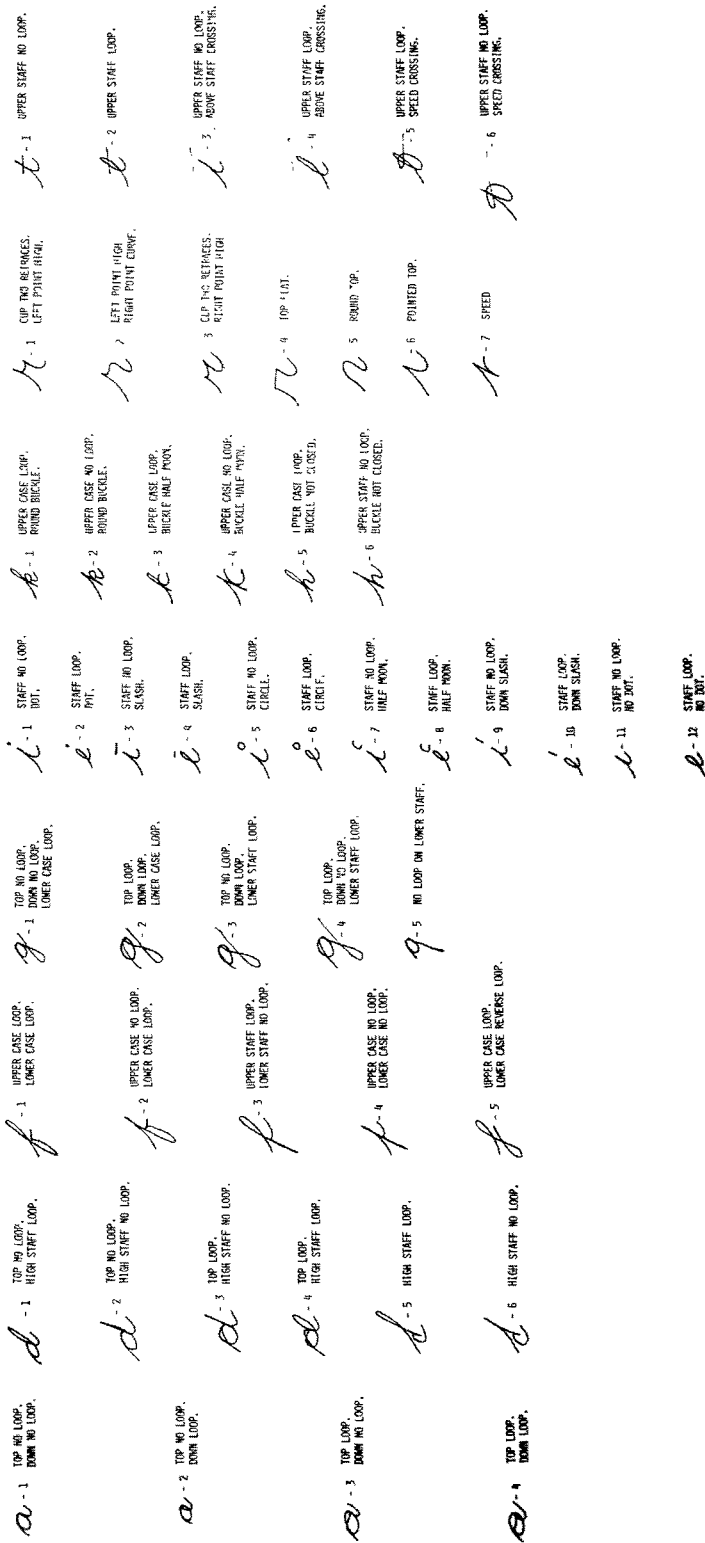


FIG. 1—The classification system.



FIG. 2—Examples of the a-1 letter classification.

SUSPECT: ORIGINATING SOURCE: RACE:		SEX:									
LETTERS:	A	D	F	G	I	K	R	T			
1		1	1	1	1	1	1	1			
2		2	2	2	2	2	2	2			
3		3	3	3	3	3	3	3			
4		4	4	4	4	4	4	4			
		5	5	5	5	5	5	5			
		6			6	6	6	6			
					7		7				
					8						
					9						
					10						
					11						
					12						

FIG. 3—The coding sheet.

SUSPECT	SUSPECT CLASSIFICATION BY CHARACTERISTICS													1		
	ORIGINATING SOURCE					RACE					SEX					
CLASSIFICATION	-----															
KUHN, K	8607230					W					F					
A1 A2 A3 A4	D1 D2 D3 D4	D5 D6	F1 F2 F3 F4	F5 G1 G2	G3 G4 G5	I1 I2 I3	I4 I5 I6									
1 1		1		1												
I7 I8 I9 I10	I11 I12	K1 K2 K3	K4 K5 K6	R1 R2 R3	R4 R5 R6	R7 T1 T2	T3 T4 T5	T6								
			1	1			1									
TOTALS-----																
A1 A2 A3 A4	D1 D2 D3 D4	D5 D6	F1 F2 F3 F4	F5 G1 G2	G3 G4 G5	I1 I2 I3	I4 I5 I6	K1 K2 K3	K4 K5 K6							
1 1		1		1												
I1 I2 I3 I4	I5 I6	I7 I8	I9 I10	I11 I12	K1 K2 K3	K4 K5 K6										
			1													
R1 R2 R3 R4	R5 R6 R7	T1 T2 T3	T4 T5 T6													
1			1													
LETTERS A	D	F	G	I	K	R	T									
	2	1		1	1	1	2									

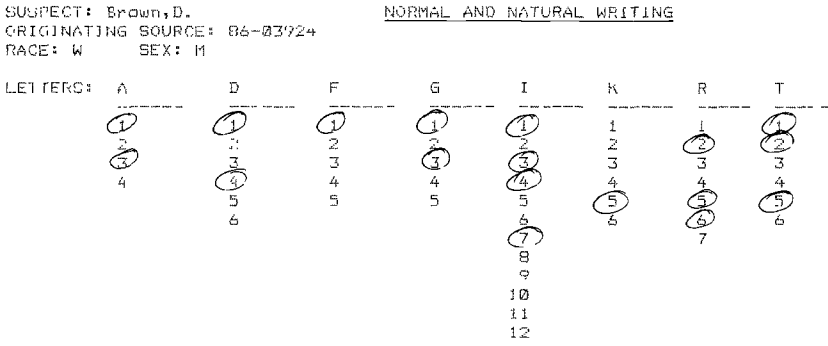
FIG. 4—Information retrieved on an individual classification.

entered, the data base could be accessed by different methods. One method was to select a particular letter classification or combination of letters and classifications to retrieve a field of potential suspects. The user could view only the names and case numbers of individuals selected, or view the complete classification of each person. The data base could also be accessed by suspect name, case number, sex, and race. These access methods were particularly useful when dealing with questioned writing where only one or two letters were classifiable. In this instance, if the investigating agency could provide a description of sex and race, then these variables could reduce the data field significantly when selecting potential suspects.

**Results and Conclusions**

From the beginning, the filing and retrieving of handwriting information on classified individuals was limited by two factors. The number of entries received during the calendar year of 1986 was approximately 500 people, and the amount of storage capability of the home computer used for this project could only manipulate 500 files and subfiles. However, despite these operational limitations, this classification system produced interesting results.

For example, a questioned writing could be pulled and classified from any case where the suspect's known handwriting had already been classified and stored in the computer. By searching the classified questioned material through the existing data base, the system could correctly select the suspect identified in the case file. Therefore, one could expect the system to select individuals if a new questioned writing were received by the lab that had a similar classification with a previous entry.



*How is the winter there at home? Have beeniced inside here. The weather was good for about two weeks when I first got here.*

*I really enjoyed my visit when I was home and appreciated the money very much. It came in handy at the time and I put it to good use to try and make it through the winter.*

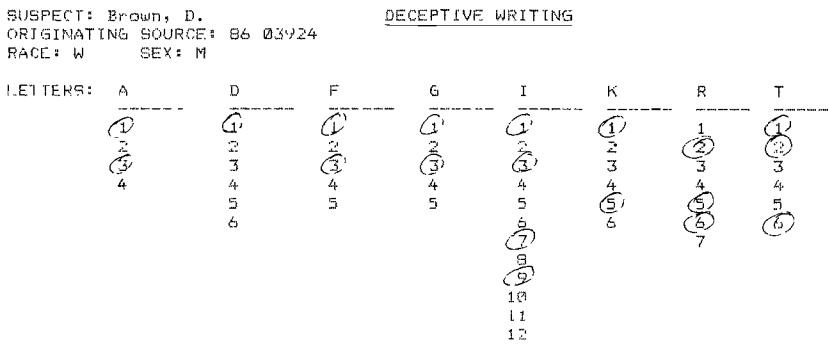
FIG. 5—Classification of individual's normal and natural handwriting.

Upon implementing this classification system for handwriting, a number of significant observations were made. It was noted that a certain classification of one letter had a very high correlation with a classification of another letter. For example, 85% of a-1 users also made a t-1. Of t-1 users 83% made an a-1. Of d-2 users 90% made an a-1, and of d-2 users 93% made a t-1. Therefore, these correlations in the classifications of letters could prove to be useful in projecting trends in the characteristics of letters when the examiner has only a limited amount of letters available in the known sample. For instance, if the examiner has a d-2 in the known sample, but has no "t" nor "a" in the sample, the examiner would be able to project with degrees of reservation that if the letters "t" and "a" were written, then one could expect them to exhibit certain characteristics found in the classification of the a-1 and t-1.

Another observation was that writing prepared in a deceptive manner was as classifiable as normal and natural writing. Although deception creates many problems with regard to the identification process, fundamental writing movements from which letters are constructed appeared to be consistent even when deception was visible in the classified sample (Figs. 5 and 6).

Certain trends in writing have also been noted with regard to sex and race. It appeared that black females tend to deviate less from the copybook form than do black males, white males, or white females.

Figure 7 illustrates that black females have a higher percentage of letter usage according to copybook form, particularly with letters d, g, r, and t. White males appeared to have a



**HANDWRITING SAMPLE FORM — NOT A NEGOTIABLE INSTRUMENT**

Bank 1st Federal of Oklahoma Check No. 947

City Hot Springs, Ark 5-3- 1985

Pay to the order of Jaceline S. Batten \$ 6500.00

Six thousand Five Hundred Dollars

For BJ Oval Signature B.J. Oval

Writer's Initials BJB Date 3-11-86

FIG. 6—Classification of same individual's deceptive writing.

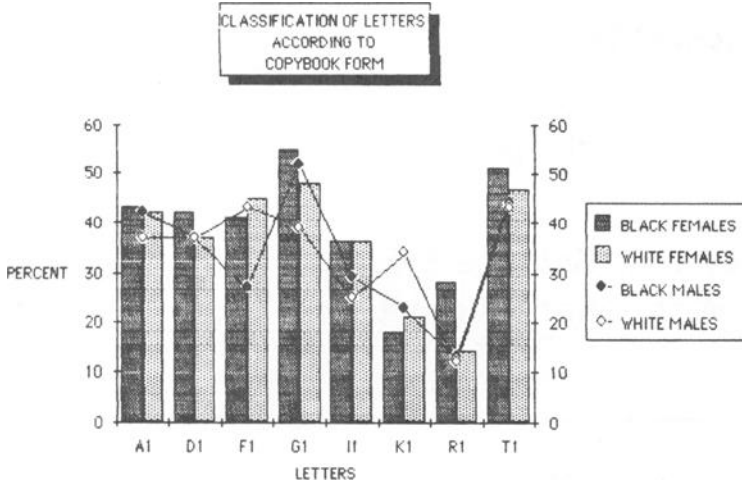


FIG. 7—Percentage of letter usage according to copybook form by race and sex.

lower percentage of letter usage according to copybook form regarding letters a, g, i, and r.

Although the results and observations reported in this paper dealt only with a limited data base, it is felt that this classification system merits further study and consideration in reaching the goals of retrieving handwriting information expeditiously and lending mathematical support to qualified opinions of experts in the field of handwriting identification.

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