

Triplet and Sibling Handwriting Study to Determine Degree of Individuality and Natural Variation

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There have been no reports in the literature of handwriting studies that involved the comparisons of writings of triplets or comparisons of writings of multiple-birth siblings with their nonmultiple-birth siblings. The purpose of this small study, therefore, was to determine if the writing of one set of triplets and their nontriplet sibling could be distinguished and, if so, the degree of individuality in each subject's writing. Unlike previous twin/sibling studies, normal or natural variation (intrawriter variation) is examined and contrasted with differences or dissimilarities (interwriter variation). The findings support the concept of natural variation in handwriting and two of the axioms of handwriting identification: (1) no two individuals write exactly alike, and (2) no one individual writes the same text exactly the same way twice.

Introduction

Robertson and Vignaux (1977) suggest that all forensic science methods stem from two principles: Locard's Principle of Exchange and Leibniz's Principle of Identity of Indiscernibles. The former principle, developed by Dr. Edmond Locard's (1877-1966), supposes that objects or surfaces which come into contact always exchange trace evidence (Almirall and Furton, 1995), whereas the latter, Gottfried W. Leibniz's (1646-1716) famous principle (*The Stanford Encyclopedia of Philosophy*, 2000 and *The Metaphysics Research Lab*, 2002), holds that no two individuals (or objects) can be absolutely indistinguishable, or indiscernible, in the sense of possessing exactly the same set of properties (i.e., no two things in nature are exactly alike). This second principle is the focus of the current study.

In an effort to determine if individuality exists in handwriting and the degree of similarities or dissimilarities in each person's handwriting, several studies have been conducted on the handwriting of siblings and twins. One of the earliest published studies was that of Edward L.

Thorndike (1915). Thorndike, a teacher at Columbia University, obtained a limited amount of writing from 72 twin pairs, aged 7 to 15 years. Based on his findings, he concluded that, "Twins are probably distinguishable by their handwriting oftener than by their physical appearance."

Kramer and Lauterbach (1928) collected data from 306 pairs of twins enrolled in public schools in Wisconsin and Montana in an effort to determine the degree of resemblance in the handwritings of twins. Findings were expressed as coefficients of correlation between the scores of three judges that evaluated the quality of the handwriting. Based on the data, these authors concluded that twins display a greater degree of resemblance in their writings than nonsiblings; like-sex twins display a greater degree of resemblance in their writings than unlike-sex twins; and the resemblance in the writings of older twins is no greater than that seen in younger twins.

Mary Beacom (1960) examined the handwritings of 50 twin pairs (19 monozygotic and 31 dizygotic), ranging in age from 7 to 58 years. Her observations support prior research that the handwriting of twin sets is more similar

to each other than is the writing of nonsibling pairs. However, she also observed that each twin's writing was easily distinguishable from the other.

In addition, Beacom (1979) reported that she had previously examined photographic copies of letters written in English by the Dionne quintuplets when they were sixteen years of age. The Canadian quintuplets, who were born in 1932, were found by Beacom to have in their handwriting "distinct difference in the styles, skills, and characteristics" although all five sisters attended the same private school concurrently and were taught by the same teachers.

In the published research by D. J. Gamble (1980) on the writing of 50 pairs of identical twins ranging in age from 9 to 60 years, he considered 7 primary characteristics: general appearance, size of writing, writing slope, writing speed, writing quality, letter proportions, and individual letter forms. As in the Beacom's 1960 study, Gamble found that although some general similarities appeared in the writing between some pairs of twins, an experienced examiner could distinguish each twin's writing.

More recently, David Boot (1998) of New Zealand reported his results of an examination of 95 pairs of twins (58 monozygotic, 28 dizygotic, and 9 unknown if identical or fraternal) ranging in age from 11 to 82 years. Boot considered some of the same characteristics chosen by Gamble: general appearance, overall size, writing slope, individual letterforms, baseline characteristics, and formatting and placement habits. Boot's study included both handwriting and hand printing. He found that 18 percent of the study participants' handwriting displayed a noticeable degree of pictorial similarity between pairs. In every case where similarity was found between the handwriting of a set of twins, it was possible to find at least five different letterforms that made the writings distinguishable.

None of these handwriting studies, however, examined the writings of triplets or nontwin siblings of twins. The purpose of this limited study is to determine if the writing of one set of triplets and their older sibling could be distinguished from each other and, if so, the degree of individuality in each one's writing. Unlike previous twin/sibling studies, intrawriter variation (the variance of characteristics within a particular person's handwriting) is contrasted

with the interwriter variation (the variance of characteristics between the handwriting of different writers). For this research, handwriting specimens were obtained from four sisters that included one set of triplets. Two of the triplets are identical (monozygotic), and the third is fraternal (dizygotic).

Methods and Materials

The *Gale Encyclopedia of Psychology* (2001) reports that the scientific study of twins was pioneered by Sir Francis Galton in 1876, and that the "most widely used method of comparison is comparing monozygotic and dizygotic twins for concordance and discordance of traits." Concordant traits are those either possessed (or missing) by each twin of a pair. Discordant traits are those possessed by only one of the pair. Following this scientific method, the researchers attempted to identify and describe concordant traits (similarities) in the siblings' handwriting and any discordant traits (dissimilarities or differences).

Based on information obtained in an interview for the current study, the oldest participant, Linda, was born in Baghdad, Iraq on August 14, 1972. Her triplet sisters, Wardina, Christina, and Catrina, were born in Lebanon on April 7, 1974. The family immigrated to the United States when the triplets were infants. Two of the triplets, Wardina and Christina, are identical (monozygotic) having both come from one ovum (making them genetically identical and physically similar). Their fraternal (dizygotic) sibling Catrina was produced from a second fertilized egg, thus making her no more genetically like her monozygotic siblings than is her sister Linda. All four sisters, who are right-handed, were raised in the same environment and attended the same Chicago-area schools from kindergarten through high school. The triplets learned to write cursive from the same teacher concurrently and in the same classroom. It is interesting to note that all are bilingual, speaking Assyrian and English, although they never learned to write in Assyrian.

Each study participant was issued the same type of pen, three sheets of lined yellow paper, with an accompanying letter requesting that they write in cursive the text shown below three times (once on each sheet of paper) using the pen and paper supplied:

For the longer term, I think the biggest challenge is the one that has developed over the last 10 years. Industries have perceived that successful operation on a global basis has meant operating to a single set of standards developed by a single process and a very small number of bodies. The captains of United States industry have bought into that, espousing the idea that there should be one standard and only the one test in the global market.

Borrowing from previous studies by Gamble (1980) and Boot (1998), each sibling's handwriting was initially examined and compared for characteristics related to:

1. Pictorial similarity
2. Size of writing
3. Writing slant
4. Formatting and placement habits
5. Individual letterforms and their relationship to adjoining letters.

If this initial examination showed that the triplets and their sibling did not write alike, supporting the findings of previous studies on twins and siblings, the writings would be then be examined for intrawriter or natural variation. Natural variation has been defined as the "normal deviations found between repeated specimens of any individual's handwriting (McClary, 1998)."

Results

Interwriter Variation

In document examination, pictorial similarity is defined as the "overall appearance of handwriting upon superficial examination; the sum of a small number of factors, which slope (slant) and rhythm are the most important (McClary, 1998)." As demonstrated in Figure 1, it was easily discerned that the handwriting of Christina and Catrina were pictorially similar. This was an interesting observation because Christina and Catrina are not the identical pair in the triplet set.

Dissimilarities in size of writing were found in the samples from the four siblings. From the largest to the smallest handwriting, the writers were Catrina, Christina, Linda, and Wardina.

Compared with her siblings' writings, Wardina's writing was termed the smallest due to the height of the letters.

Slant of writing (McClary, 1998) is defined as "the angle of inclination of the axis of letters relative to the baseline." Catrina has a tendency to have a slight left slant in her handwriting particularly noted in some of the s's and t's. The handwritings of Christina and Wardina tend to slant to the right, although their styles are quite dissimilar. Linda's writing slants obviously more to the right than that of her siblings.

No directions were given as to placement of the writing, thus it was interesting to note that Linda (the nontriplet sibling) was the only one who used double spacing. Although Linda indented further on the first line of the paragraph, her writing and Catrina's writing aligned with the left margin guidelines. Whereas identical twins Wardina and Christina utilized at least an 1/8-inch spacing from the left guideline margin throughout the paragraph.

All of the writings were examined to determine if discriminating characteristics or differences existed in the letterforms and formatting that would differentiate one writer from the other. Differences have been defined as "characteristics in one body of writing having no counterparts in another body of writing. The nature and extent of these differences may be indicative of another writer, and termed significant differences (McClary, 1998)." Figure 2 shows the sisters' handwriting of two words, "United States," that demonstrates at least five differences or interwriter variation found between the siblings. Boot (1988) also reported finding at least five differences between the writings of twin pairs.

Intrawriter Variation

After this initial examination, which supported the findings of previous studies in twins and siblings, the sample writings were examined to determine intrawriter or the natural variation within each study participant's writing.

When dealing with words written in the Roman alphabet, and more specifically English words, writing must look somewhat alike or no one could read what was written. It is, therefore, the forensic document examiner's task to determine what characteristics (or combination of characteristics) comprise the natural variation in a person's writing that sets their writing apart from all other writers. As stated earlier, natural

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LINDA

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WARDINA

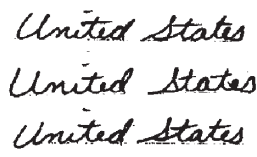
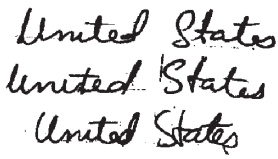
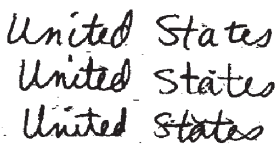
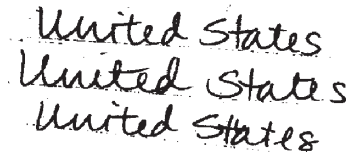
For the longer term, I think the biggest challenge is the one that has developed over the last 10 years. Industries have perceived that successful operation on a global basis has meant operating to a single set of standards

CHRISTINA

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CATRINA

Figure 1. The writing of Linda followed by the writing of her triplet sisters Wardina, Christina, and Catrina.

	LINDA	1. "t" staff retraced 2. "d" and "a" capped 3. "S" cursive 4. "S" long initial stroke 5. All letters joined
	WARDINA	1. "U" initial stroke (V) 2. "i" no dots 3. "S" curled top 4. "t" ampersand-like/conventional (V) 5. "s" ending stroke (V)
	CHRISTINA	1. "U" narrow 2. "i" dot left of staff 3. "t" no initial stroke 4. "a" pen drags 5. "te" connecting stroke below baseline (V)
	CATRINA	1. rounded style 2. "n" tops tented 3. "it" and "St" hiatus 4. "d" terminal flat/long (V) 5. "s" printed style terminal "s"

(V) = Variable

Figure 2. At least five differences (*interwriter variation*) were noted in each sister's writings that differentiated one writer from the other.

variation in writing is defined as the "normal deviations found between repeated specimens of any individual's handwriting (McClary, 1998)." Hilton (1982) writes that, "Variation naturally occurs in a series of lettered specimens by the same writer, just as with any form of writing." Additionally, Hilton states:

Final identification rest in large measure on the individual habits of design, including the size of letters compared to one another; curvature or angularity of strokes; the relationship between the parts of each letter; and artistic, conventional, or unique style.

...a sufficient number of individual habits must be common to the two sets of specimens, questioned and standard, so that the likelihood of both coming from a common origin is so great that it becomes a virtual certainty. By the same token, fundamental differences, especially consistently repeated ones, establish that the two sets of lettering are by different writers.

Using the previously described definitions of natural variation, the personal habits that represent variation were observed within the

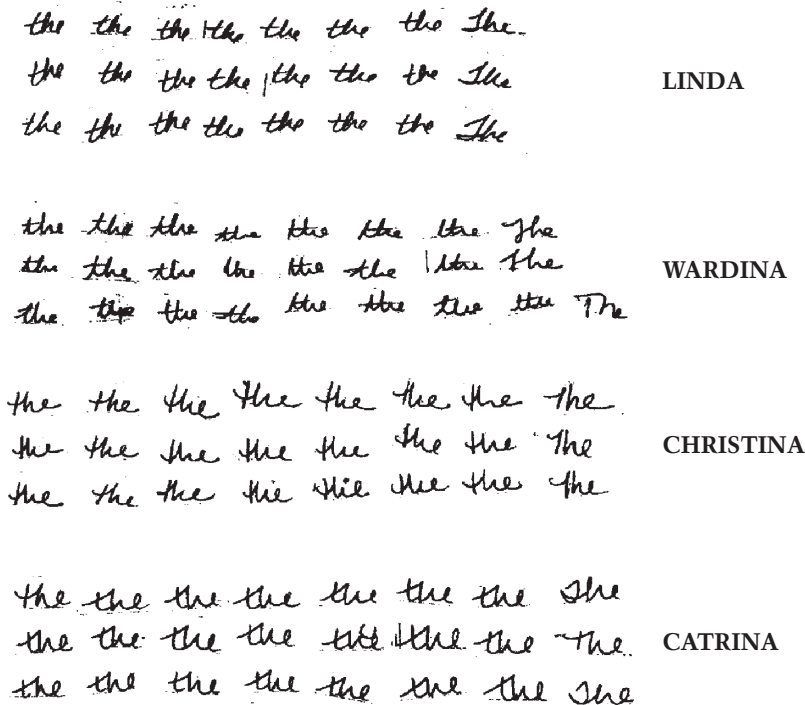


Figure 3. Example of how just one word can be used to demonstrate the natural variation that exists in each study participant's writings.

writing of each study participant. The word "the" in Figure 3 is used to illustrate variation. This word was repeated at least 21 times by each writer, not including the capitalized form of the word. In the repetitions of "the," at least two consistent habits were found within each of the four sets of writings that excluded the class characteristics associated with size and slant (Table 1). Also, each writer's range of variation was examined. Range of variation has been defined as "the parameters of the various ways in which an individual writes a particular character form (McClary, 1998)."

Linda consistently connected the bottom of the "t" with the "h" at or slightly below the baseline, thus forming a trough. In addition, she repeatedly looped the extenders of the "h," centered the crossbar on the "t," and fashioned the ending stroke of the "e" in a downward motion. An examination of the "h" revealed a wider range of variation in the formation of the hump of the "h." The spacing between the downstroke of the back of the "h" with the hump would range from none

to substantial. The top of the hump itself varied from rounded to tented.

Wardina always used an approach stroke in the formation of her "t." She showed a wide range of variation in the placement of the "t" crossbar, and this seemingly erratic placement, along with the tapered crossbar ends, indicates a fair amount of speed used in crossing the staff of the "t." The use of two different forms of the uppercase "T" is an element of her range of variation.

Christina consistently made the staff of the "t" as a straight down stroke. The crossbars on her "t" curve upwards and connect to the top of the "h." Her ending strokes on the "e" are almost always extended.

Catrina always curved the staff of the "t" to the right at the baseline in a nonconnecting stroke, with one exception. In addition, she always fashioned the "t" crossbar in an upward diagonal movement, attaching to the top of the "h," with one exception. The noted exception is the first "the" on the first line. Considered alone this particular "the" would be difficult to

Intrawriter Variation (Natural Variation)		
Linda	"th"	connecting stroke below baseline (NOTE: Baseline not seen in the reproductions of the original items.)
	"h"	upper loop open
	"h"	wide hump (V)
	"t"	crossing centered
Wardina	"t"	approach stroke
	"t"	crossbar (wide variation)
	"t"	bar tapers, indicating fast pen speed
	"T"	two forms (HW/HP)
Christina	"t"	staff straight downward stroke
	"t"	crossbar curves up
	"e"	ending stroke long/right
Catrina	"t"	staff bottom curves up/right
	"t"	crossbar upper/right diagonal
	"T"	two forms (HW/HP)
V = Variation HW = Handwritten HP = Hand Printed		

Table 1

distinguish between those made by Christina. This exemplifies why a limited amount of writing may result in an inconclusive finding by the forensic document examiner.

Although not one "the" is written identical within each sister's set of writings, consistencies in certain habits, including alternate letterforms, is evident within each set. Wardina's writing displays a relatively wide range of variation in writing "the." For example, Wardina's placement of the crossbar on the "t" shows greater variation than the crossbar placement noted in her sisters' writing. Wardina's crossbars can be found in the middle of the staff of the "t," to the left of the staff, or to the far right. Additionally, the "e" in Wardina's writing can be opened or closed. Also a loop can be found sometimes in the extender of the "h," and she uses two versions of the uppercase "T." Much less variation can be found in "the" written by sibling Linda and Wardina's

identical sibling Christina. Although Catrina's writing of "the" does not contain as much variation as her fraternal sibling Wardina, a certain range of variation can be observed in the formation of the capital "T."

Discussion

As in previous handwriting studies involving multiple-birth siblings, the findings of this study support one of the main axioms of handwriting identification — no two individuals write exactly alike (be they identical twins, triplets, or quintuplets). In addition, by demonstrating the variation within one person's writing, an additional axiom of handwriting identification is supported — no one individual writes the same text exactly the same way twice. Clearly, the handwriting of each individual is unique.

In a release by the National Center for Health Statistics (2001), triplet and other higher order multiple births in the United States declined in 1999 for the first time in a decade after more than doubling between the years 1990 and 1998. There were 7,321 triplet births in 1999, compared to 3,028 in 1990. An estimated two-thirds of the triplet/+ births are the result of fertility-enhancing therapies. Twin births have continued to rise, from 110,670 in 1998 to 114,307 in 1999. The twin birth rate has risen 25 percent since 1990. These statistics disclose an increasing likelihood the forensic document examiner will be asked to discern between the writings of siblings, twins, or triplets. If so, the examiner can be confident that given adequate writing exemplars for comparison, identity of a single writer is likely.

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