HANDWRITING VARIATIONS IN INDIVIDUALS WITH MPD

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ABSTRACT

Differences in handwriting characteristics of persons experiencing multiple personality disorder (MPD) have been noted by psychotherapists and forensic handwriting experts. In the present study, eleven adult women diagnosed with MPD provided samples written by alternate identities or personality states (alters). Four inconspicuous handwriting characteristics were measured with electronic calipers under magnification. Analysis of the handwriting measures with one-way ANOVAs determined that most MPD subjects showed significantly more variability in handwriting samples produced by different alters than would be expected from different samples produced by the same person. These differences between handwriting measures of different alter personalities were neither as frequent nor as large as those between separate individuals in most cases. Clinical information on MPD subjects was analyzed for factors which contributed to the occurrence of handwriting variations, but no consistent pattern was found.

The possible existence of striking differences in the handwriting of persons with multiple personality disorder (MPD) while experiencing alternate identities or personality states (alters) has attracted considerable notice by clinicians familiar with MPD patients (Braun, 1985; Kluft, 1987; Putnam, 1989). These observations had not yet been tested by handwriting experts, however, and search of the literature indicated that no systematic study of handwriting variations in MPD patients has yet been published.

In addition to variations in stylistic handwriting features, in clinical settings the writings of MPD patients often contain information specific to a particular alter (alternate identity or personality state) who may express emotions repressed by other alters or provide information for which other alters are amnestic. Where handwriting samples from the general population convey a broad range of emotions and information, handwriting samples from an alter of an MPD patient often reflect specific memories and emotions to which the alter may have exclusive access (Putnam, 1989). The variations in written material produced by alters of MPD patients, therefore, often reflect differences in content and tone as well as handwriting form and style. The present study was designed to examine specific handwriting formations without regard to content, using the tools and methods of the forensic handwriting expert, in order to explore the occurrence of handwriting variations in a group of MPD patients and identify possible reasons for their development.

FORENSIC HANDWRITING EXAMINATIONS

The study of handwriting features as practiced by experts in the identification and comparison of handwriting specimens and documents is a complex scientific approach that may uncover similarities in handwriting specimens that are not evident to the untrained eye (Bradley, 1986). The practice of forensic handwriting analysis (also known as questioned document examination) is performed almost exclusively by law enforcement trained personnel in police departments, forensic laboratories, government agencies and private practice. Handwriting experts known as questioned document examiners are skilled in identifying the authorship of documents including anonymous letters, forgeries, and disguised handwriting. Questioned document examination has had a long and successful history, and is well-accepted in courts of law. It should be noted that graphology, another type of handwriting analysis, is a very different approach that attributes personality traits to writers on the basis of handwriting features. Since the present research was designed to observe the nature of specific handwriting variations, graphological methods, which have more in common with projective techniques than with questioned document examination, were not used in this study.

Handwriting has long been considered by questioned document examiners to be a unique and distinctive individual behavior (Smith, 1984). The patterns of handwriting which distinguish the script of one person from that of another have been attributed to a variety of influences including the writer's perceptual abilities, physiology, musculoskeletal system, nervous system, intellectual development, emotions, and motivations (Bradley, 1986), as well as education and occupation (Saudek, 1933). This combination of features is reflected in an individual handwriting pattern which may be impossible to duplicate in its entirety. Smith (1984) has computed the likelihood that two writings by different authors would be identical in only twelve characteristics of the 500 or more found in a typical page of handwriting (Osborn, 1946) as 1 in 241 million.

This is not to suggest that individuals do not normally

vary their writing. Baxter (1966) observes that an individual may deliberately change a handwriting style to create a different appearance for a variety of reasons. It is commonly accepted by questioned document examiners that level and form of education, mood states, physical well-being, and many transient conditions affect the written product, including qualities of the writing instrument and writing surface. In addition, characteristics of the writing situation exert a powerful influence on the appearance of the written specimen—a signature written at a busy check-out when the author was rushed, tired, or distracted, may vary considerably from a signature written on a piece of personal correspondence when the author was relaxed or attempting to create an impression (Naftali, 1965; Saudek, 1928). Despite a variety of influences, however, handwriting remains a relatively enduring and automatic behavior which has been found to be reliable and consistent once the author achieves maturity, unless influenced by chemicals, injury, or poor health (Bradley, 1986).

The pattern of handwriting produced by a mature individual is sufficiently unique to be distinguished from the handwriting patterns of another by the highly trained observer (Sonnemann, 1950). The single exception to this rule is the existence of similarities in the writing of some very closely related persons (e.g., monozygotic twins and same-sex parent-offspring pairs) (Peeples & Morris, 1986). Even in the uncommon case in which an individual exhibits markedly different styles of writing, the questioned document examiner may conclude that the writing styles share critical identifying features after applying forensic methods for comparing handwriting characteristics (Osborn, 1929). Forensic methods may include the use of specialized microscopes, optical equipment, calipers, measuring grids, and devices for measuring the pressure applied to the writing surface. Unfortunately, academia and law enforcement agencies have rarely cooperated in systematic handwriting research in the United States and Great Britain (Baxter, 1973). As a result, there are no universally accepted methods of handwriting measurement for identification purposes, although several systems are used successfully by different agencies.

CHARACTERISTICS OF ALTERS OF MPD PATIENTS

Behavioral and Physiological Characteristics

The alters of an individual with MPD present consistent patterns of behaviors, social relationships, emotional reactions, levels of education, memories of personal experiences, and other features which suggest the existence of a set of separate identities within the personality of the MPD patient. Features of a particular alter may contrast sharply with parallel features of other alters within the same personality system (Schafer, 1986). Extreme dissociation has been correlated with a range of differences in physiological conditions exhibited by alters of individuals with MPD. Examples of these variations include differential effects of medications on different alters (Putnam, Guroff, Silberman, Barban, & Post, 1986), differences in evoked potentials in electroencephalographic studies (Braun, 1983b; Putnam, 1984a), allergic and dermatological reactions by specific alters (Braun, 1983a; Brende, 1984), changes in dominant handedness (Kluft, 1986; Putnam, 1984a, 1984b; Putnam et al., 1986), and optical differences (Miller, 1990). These variations could not be simulated or purposely generated by normal controls (Miller, 1990; Putnam, 1984a). Alterations in physiology may produce alterations in handwriting patterns as well, and, therefore, are of interest to questioned document examiners and handwriting researchers.

Handwriting Characteristics of MPD Patients

The handwriting patterns of alter personalities of persons with MPD often appear to exceed the range of differences attributable to natural variation. In contrast to the relative consistency in handwriting patterns in the general population, the existence of striking differences between the handwriting patterns of different alters within a single individual with MPD has been noted (Braun, 1985; Kluft, 1986; Kluft, 1987; Putnam, 1989). As early as 1920, Melcher, an attorney and handwriting expert, described his experience with several cases involving persons with MPD and their varying handwriting styles:

> In each of the [MPD patient's] personalities, his thoughts, words, and deeds are perfectly natural to him for the time being, and are in no sense a voluntary disguise; but there is still a more or less absolute inconsistency between the [alter personality states]... [...] the handwriting variation [exhibited by the MPD patient] is such that one who is ... well acquainted with a person's style of writing [in one alter state] would utterly fail to recognize the same person's writing... [in a different alter state]. (pp. 211-212)

More recently, clinicians have observed that the handwriting patterns of some MPD patients are so distinct that it is possible to identify the alter responsible for a specimen of handwriting by the writing patterns alone (K. M. Hilgers, personal communication, December 13, 1989). Since a number of government questioned document examiners reported amazement at the array of handwriting variations produced by some MPD patients, forensic interest in the handwriting produced by MPD patients has also increased (F. W. Putnam, personal communication, May 23, 1989).

Based on these observations, the purposes of the current study were three-fold. First, we attempted to determine whether the handwriting patterns produced by the different alters experienced by persons with MPD showed significant differences in inconspicuous handwriting characteristics, i.e., those features that are less susceptible to deliberate alteration than the broader features of style and letter formation. Second, we attempted to discover whether the differences in inconspicuous handwriting characteristics, if any, were as large as differences between the same handwriting measures in separate individuals. Further, we hoped to learn whether the extent of handwriting variations across alters was related to the severity of the MPD or to other factors.

The present research expected to confirm the hypothesis that the variant handwriting patterns created by alters of individual MPD patients would not be significantly different in the four inconspicuous measures selected for this study, and would certainly be less variable than the differences found between separate individuals. Finally, we expected that MPD patients whose alters displayed the most extreme discrepancies in behaviors, appearance, and memories would show the greatest variation in handwriting patterns as well.

METHOD

MPD Participants

Eleven adult women receiving outpatient treatment for MPD volunteered for this study at the request of their respective psychotherapists. Ten subjects were recruited through therapist members of a local professional study group. Additional requests to professionals outside Minnesota yielded one more subject. Each MPD participant was aware of her diagnosis and actively involved in therapy at the time the writings were produced, but none was in the final integration phase of therapy. It was only by coincidence that all participants were female; however, adult females constitute the majority of MPD patients in outpatient therapy (Schafer, 1986). No further demographic information was obtained on any MPD participant due to the apprehensions of the patients and ethical concerns for confidentiality.

Each MPD participant was asked to complete the Dissociative Experiences Survey (Bernstein & Putnam, 1986) to provide an independent measure of the severity of dissociation experienced by each patient. Most MPD participants found this request too threatening and refused the survey; several others answered all questions with an identical response at one end of the scale, producing invalid forms. As a result, a questionnaire was developed which obtained the impressions of the therapist regarding the differences observed among the patient's alters in appearance, behaviors, capabilities, and physiological reactions. This measure explored the possibility of confounding variables such as the presence of schizophrenia and other psychoses or the influence of chemicals on the participant. Patient information was obtained from the therapists only after the handwriting samples had been collected and measured.

HANDWRITING SAMPLES

MPD Participants

Since handwriting patterns are not consistent in individuals before the onset of maturity (Bradley, 1986), the specimens requested were limited to those produced by adult alters. We elected against addressing concerns related to the child-likeness of child alters, an area in which considerable differences of opinion exist. Specimens most often consisted of letters written by the MPD participant to another person, frequently the therapist, or were extended journal entries. All but two samples were written prior to the study. This condition was designed to limit the amount of unnaturalness and tension that would be found in samples written with the knowledge that researchers would examine them. Each sample was described by the therapist as a good representation of the handwriting of a particular alter. MPD participants were asked to cover any sensitive or identifying information on the specimens with copy-tape, and then to photocopy the specimens and provide the photocopies to the researchers. Most MPD participants provided at least two samples covering a sheet of 8 1/2" x 11" paper from each adult alter, yielding sixty-eight pages of samples from thirty-six alters of eleven MPD participants. Each sample was numerically coded according to therapist, client, and alter to facilitate the appropriate comparisons. All contacts between researcher and MPD participants were made through the therapists to control bias and preserve confidentiality.

Non-MPD Participants

Three volunteers known to the researcher submitted three letters each, written at intervals of two years or more, producing nine samples spanning a seven-year period. Handwriting characteristics were measured and compared to determine whether these features varied significantly over time. Comparisons were also performed on the samples from non-MPD participants, as with specimens from MPD participants, to help determine whether the selected handwriting measures distinguished between individual subjects of either group.

MEASUREMENT SYSTEM

A wide variety of measurement systems are used by questioned document examiners in the United States and Great Britain, and none has achieved universal acceptance (Baxter, 1973). Measurements in this study were obtained according to guidelines presented to the author during training in questioned document examination with Andrew Bradley, QDE, using a method developed by Erika Karohs (1988). Karohs' system for measuring handwriting characteristics was selected for this study because it demonstrates a simple and reliable method for obtaining the measures of the handwriting features chosen for examination.

Equipment

Each measurement was obtained with Mitutoyu electronic calipers (Model 500-351) purchased from the Satterlee Company in Minneapolis, Minnesota. Measurements were made under ten-power magnification through a Vigor Vision Visor, a headpiece with an attached optical lens used by jewelers and opticians. Although the use of the visor is experimental, reliability of the electronic calipers with a three-power magnification lamp has been reported at greater than 95% (Peeples, 1989).

Procedure for Obtaining Handwriting Measurements

Questioned document examiners may examine more than 500 handwriting characteristics when studying a sample (Osborn, 1929), which generally fall into twenty to thirty categories, depending on the system used. These cate-

gories include slant, pressure, quality of the writing line (smoothness or tremor), spacing, layout on the page, and characteristics of the letter forms (Gay, 1971), among others. The handwriting measures selected for this study were *letter ratios* (i.e., the height of lowercase letters such as *b, d,* and *h,* and the length of lowercase letters such as g, p, and y, in relation to middle zone letters such as *a, c, e,* etc.); *word space ratios* (i.e., the space between words in relation to the height of the middle zone letters contained in those words); and *i-dot displacements* (i.e., placement in millimeters right or left of a line bisecting the body of the letter).

Upper and Lower Zone Ratios

In the American alphabet systems, letters are divided into three categories: unizonal or middle zone letters such as *a, c, e, i, m,* and *w;* bizonal letters which include upper zone letters (i.e., letters with upward extensions such as *b, d, l,* and *t*), and lower zone letters (i.e., letters with downward extensions such as *g, j, p,* and *z*); and one trizonal letter, *f,* which has both upward and downward extensions. Upper and lower zone ratios or proportions are derived by comparing the upper extension in upper zone letters or the lower extension in lower zone letters to the middle zone of the letter being compared, as illustrated in Figure 1. In letters which lack a definable middle zone, the extension is compared to the middle zone of letters adjacent to it.

Although absolute letter sizes produced by an individual writer vary according to the writing situation, characteristics of the document, speed of writing, and other factors, letter proportions or ratios have been found to be a consistent feature of an individual's writing pattern despite overall changes in speed or size of writing (Harrison, 1958; Sedeyn, 1988). Pick and Teulings (1983) have found that letter ratios remain consistent despite changes in the angle of the writing upward or downward, even as other features such as letter form and slant begin to decompose. Further, letter ratios are an involuntary, unconscious handwriting characteristic which are difficult to alter voluntarily and consistently over an entire page (Harrison, 1958).

Measurements of letter ratios were obtained according to Karohs' measurement system. Twenty upper zone portions of letters and their associated middle zone heights were measured for each sample. Measurements were taken vertically at a 90° angle from the apex of the middle zone to the highest point of the upward extension, regardless of the slant of the letter. In this manner, the measurement obtained the rise of the letter rather than its length. It was necessary to compute an upper zone ratio for each letter and its associated middle zone since some samples displayed considerable variability in size across the page. The measures for the upper zone height of a particular letter and its associated middle zone height were converted to an upper zone ratio by dividing the upper zone height by the measure for its associated middle zone height.

Using the same method, twenty lower zone portions of letters and their associated middle zone heights were measured for each sample. Lower zone extensions were measured vertically at a 90° angle from the base of the middle zone portion of the letter (i.e., the baseline) to the lowest point of the extension, regardless of the slant of the letter. This method measures the height of the slope of the letter rather than its overall length, as illustrated in Figure 1. To calculate the lower zone ratio of these letters, lower zone letters were compared to the middle zone portion of the letter or to an adjacent middle zone. Lower zone ratios were derived by dividing the measure for lower zone length by the measure for its associated middle zone height.

Using these methods, more than forty letters were measured for height or length on the midsection of each sample wherever possible. Because of the frequent mention of letter ratios as an identifying characteristic in the literature

FIGURE 1
Letter zones

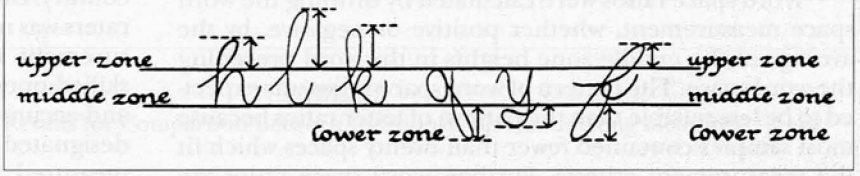


FIGURE 2
Word spacing: positive and negative distances between words

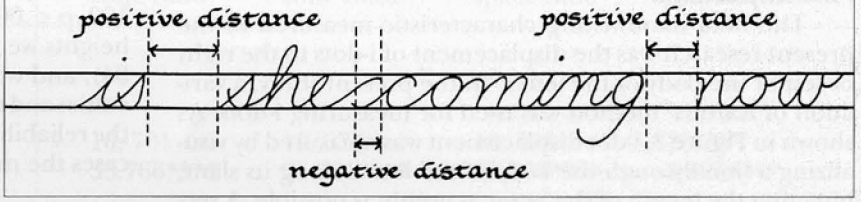
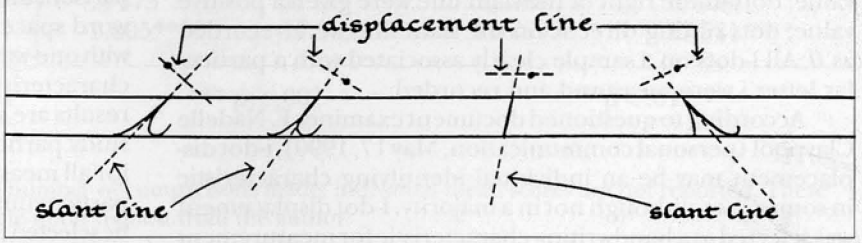


FIGURE 3
I-dot displacements: slant lines and displacement lines



on questioned document examination, letter ratios were expected to be the most reliable handwriting characteristic found in this study.

Word Space Ratios

Word spacing refers to the horizontal distance between the farthest rightward extension of a word and the leftmost extension of the word following, regardless of the zone in which these strokes appear, as illustrated in Figure 2. Word space ratios, similar to letter ratios, remain relatively consistent in most cases, despite changes in absolute size of writing, speed, and other handwriting features in the mature, unimpaired writer (Bradley, 1986).

In order to measure word spacing according to Karohs' method, vertical lines are visualized at a 90° angle to the base of the word being measured. These lines are placed at the most rightward stroke of the first measured word and the most leftward stroke of the following word. The distance between them is measured and recorded. Distances lacking any strokes between the final stroke of the first word and the leftmost stroke of the following word (i.e., empty spaces) are given a positive value equal to the measurement; where strokes overlap or extend beyond the other word, the horizontal width of the overlap is given a negative value equal to the measurement of the overlap, as illustrated in Figure 2. Words followed by punctuation or capital letters and words beginning or ending with t were not measured for this study.

Word space ratios were calculated by dividing the word space measurement, whether positive or negative, by the average of the middle zone heights in the word preceding the word space. The pattern of word space ratios was expected to be less reliable than the pattern of letter ratios because most samples contained fewer than twenty spaces which fit the measurement criteria. Further, word space ratios are mentioned as consistent identifying characteristics less often than are letter ratios.

I-Dot Displacement

The final handwriting characteristic measured in the present research was the displacement of i-dots to the right or left of the body of the letter. In the present study, a variation of Karohs' method was used for measuring i-dots. As shown in Figure 3, i-dot displacement was measured by visualizing a line through the body of the letter along its slant, bisecting the length of the letter as evenly as possible. A second line, the displacement line, was drawn at a 90° angle to the slant line toward the center of the i-dot. The displacement of the i-dot was measured in millimeters from the slant line. Dots to the left of the slant line were given a negative value; dots to the right of the slant line were given a positive value; dots resting directly on the slant line were recorded as *0*. All i-dots on a sample clearly associated with a particular letter i were measured and recorded.

According to questioned document examiner F. Nadelle Claypool (personal communication, May 17, 1990), i-dot displacement may be an individual identifying characteristic in some cases, although not in a majority. I-dot displacement was selected as a handwriting characteristic for measurement in this study due to curiosity and ease of measurement. It was expected, however, that this measure would yield the fewest consistent findings and the least significant differences, if any, of the handwriting characteristics examined in this research.

STATISTICAL PROCEDURE

All measures were compared with one-way ANOVAs using an alpha level of .01. The use of the Bonferroni correction is recommended when several ANOVAs or t-tests are used to analyze a single body of data (Myers, 1979). Since four different measures of handwriting were analyzed for each MPD case, the Bonferroni procedure would set alpha at .0125 to avoid excessive Type 1 error. In addition, the measures of handwriting in this study are very sensitive to small differences, creating F ratios greatly in excess of critical values, suggesting a susceptibility to Type 1 error at an alpha level of .05. Differences in handwriting characteristics between separate individuals in this study, for example, were always highly significant ($p \leq .0001$ or less). Consequently, a .01 level of significance was adopted throughout the present research.

Interrater reliability was obtained by removing selected letters and word spaces from the specimens of handwriting provided by both MPD and non-MPD participants, mixing them randomly, and sending them with written instructions to two questioned document examiners in other parts of the country. Direct supervision of the measurements by the interraters was not offered in order to discover whether the measurement methods were sufficiently straightforward for skilled questioned document examiners to apply with ease and accuracy. The interraters listed their measurements in designated spaces adjacent to the letters and spaces being measured, and returned them to the researcher. Since i-dot displacement was not expected to be a meaningful measure, only upper zone heights, lower zone lengths, and word spaces were obtained from the interraters. The mean interrater reliability correlation across all three measures was .95 ($n = 109$, $p < .001$). Mean reliability coefficients for upper zone heights were .93 ($n = 34$), lower zone lengths were .96 ($n = 34$), and word spaces were .52 ($n = 7$). Photocopying difficulties and the small number of usable word spaces decreased the reliability of word space measurements, although in most cases the measurement methods proved reliable.

RESULTS

Three types of comparisons were made with the data obtained from the handwriting samples. In the first comparison, the means of the upper zone ratios, lower zone ratios, word space ratios, and i-dot displacements were compared with one-way ANOVAs to determine whether these handwriting characteristics distinguished between individuals. These results are summarized in Table 1. The differences between study participants were significant, producing high F ratios for all measures ($p < .0001$) in both MPD and non-MPD study participants, suggesting that each handwriting characteristic selected for this study is highly specific to the writer. Although letter proportions were expected to produce high F ratios,

word space ratios were not expected to produce equally high F ratios, and i-dot displacements were not expected to produce significant F ratios. The present study supported the hypothesis that letter proportions and word space ratios were identifying characteristics, and suggested that i-dot displacements may be an identifying feature as well. These findings corroborate the observations of questioned document examiners who maintain that inconspicuous handwriting characteristics are distinct in different individuals even when the handwriting samples they produce appear to resemble one another to the untrained eye, except in the cases of some highly sophisticated forgers or closely related persons.

In the second comparison, one-way ANOVAs were used to compare the same handwriting measures produced by different alters within the personality of each MPD participant. This comparison was made to determine whether the differences on the four handwriting measures between alters of an MPD participant would be as reliable or as large as those between separate individuals. Overall, the results were mixed. Only one of the eleven MPD participants showed significant differences in all four handwriting measures. Ten of the eleven MPD participants, however, exhibited a significant difference in at least one handwriting characteristic. Although one MPD participant exhibited no significant differences between alters on the four handwriting characteristics, six (55%) exhibited a significant difference in one of the four characteristics, and three (27%) showed a significant difference in two of the handwriting measures.

Clinician ratings of MPD participants according to the behavioral and physiological discrepancies between alters were not successful at predicting the extent of handwriting variations exhibited by the MPD participants. The MPD participants whose alters were most distinct from one another in other behavioral manifestations (dress, voice qualities, mannerisms, and activities) did not exhibit the largest differences in the handwriting measures. No single factor or combination of factors was identified which might explain the frequency or extent of the handwriting variations exhibited by the MPD participants.

In the third comparison, measures from the non-MPD participants were compared with one-way ANOVAs to determine the reliability of the four handwriting measures over time. A between-subjects comparison across the four handwriting measures revealed significant differences in each category, as shown in Table 1. A within-subjects comparison of handwriting samples written at intervals of two years or more over a seven-year period showed no significant differences between samples written by the same individuals, suggesting that the four handwriting characteristics selected for the present study are consistent over time.

The overall median F ratio for the differences found among all individuals studied—both MPD and non-MPD participants — was 19.7512. A smaller overall median F ratio equal to 3.7300 was found for the differences in handwriting measures among the various alters of MPD participants in the present study. The smallest overall median F ratio, 0.7603, was found for the differences among the handwriting samples written over a seven-year interval by non-MPD participants.

Finally, the expectations for the performance of the selected handwriting measures were not supported by the results. Letter zone ratios (upper zone ratios and lower zone ratios) were expected to show the least amount of variation between alters of individual MPD participants because of the strength of their performance as an identifying characteristic in questioned document examination. Word space ratios were expected to show more variation than letter zone ratios, with i-dot displacement showing the greatest amount of variation between alters. In this study, however, upper zone ratios and

TABLE 1
ANOVA Results for Comparison Between Individuals on Handwriting Measures[1]

Individuals	Handwriting Measure			
	upper zone ratio	lower zone ratio	word space ratio	i-dot displacement
MPD Participants (N = 11)				
df	10, 701	10, 675	10, 598	10, 597
F	33.766****	21.721****	28.561****	8.492****
Non-MPD Participants (N = 3)				
df	2, 173	2, 174	2, 182	2, 108
F	9.805****	17.322****	180.693****	17.781****

**** $p < .0001$ *** $p < .001$ ** $p < .01$

[1]Given the large number of comparisons made, individual mean scores are not reported. These data are available upon request from the author.

TABLE 2
ANOVA Results for Within-Subjects Comparison of Alters of MPD Participants on Handwriting Measures[1]

Individuals	Handwriting Measure			
	upper zone ratio	lower zone ratio	word space ratio	i-dot displacement
Participant #1 (2 alters)				
df	1, 38	1, 25	1, 33	1, 15
F	5.629	0.083	3.730	1.006
Participant #2 (2 alters)				
df	1, 31	1, 33	1, 33	1, 34
F	23.776****	1.623	0.158	5.282
Participant #3 (3 alters)				
df	2, 53	2, 43	2, 57	1, 36
F	1.002	10.348***	18.331****	3.918
Participant #4 (4 alters)				
df	3, 78	3, 75	3, 70	3, 82
F	1.722	3.114	11.283****	2.101
Participant #5 (3 alters)				
df	2, 32	2, 31	2, 23	2, 31
F	1.184	6.144**	1.406	5.597**
Participant #6 (4 alters)				
df	3, 95	3, 95	3, 78	3, 98
F	3.670	1.860	7.770	1.386
Participant #7 (5 alters)				
df	4, 92	4, 92	4, 78	2, 57
F	3.038	1.827	4.256**	2.952
Participant #8 (3 alters)				
df	2, 55	2, 54	2, 43	2, 55
F	12.725****	4.428	9.191***	2.231
Participant #9 (4 alters)				
df	3, 85	3, 85	3, 65	3, 73
F	9.431****	16.574****	24.737****	6.274***
Participant #10 (2 alters)				
df	1, 61	1, 61	1, 51	no data
F	15.471***	3.997	0.969	—
Participant #11 (4 alters)				
df	3, 56	3, 56	3, 42	3, 54
F	10.218****	3.010	1.035	5.694**
**** $p < .0001$	*** $p < .001$		** $p < .01$	

[1] Given the large number of comparisons made, individual mean scores are not reported. These data are available upon request from the author.

lower zone ratios performed independently of each other. Upper zone ratios showed significant differences among alters of five MPD participants; lower zone ratios varied significantly among the alters of three MPD participants, two of whom showed no differences in upper zone ratios at the .01 alpha level.

These findings are listed in Table 4 and can be described as follows. Word space ratios exhibited the most frequent significant differences among alters of MPD participants and were produced by the alters of six of the eleven (55%) MPD participants. Significant differences among alters of MPD participants were also found in upper zone ratios (five of eleven MPD participants, or 45%), lower zone ratios (three of eleven MPD participants, or 27%), and least, i-dot displacement (two of eleven MPD participants, or 18%). In the present study, lower zone ratios and i-dots displayed the least amount of variation between handwriting samples produced by different alters of individual MPD participants, proving to be the most reliable handwriting characteristics in the MPD group.

DISCUSSION

The present study was designed to address two issues regarding multiple personality disorder and handwriting: first, the use of handwriting as a contributing factor to a more precise diagnosis of multiple personality disorder, and, second, the forensic identification of authorship with handwriting variations of MPD and patient alters. As predicted from the questioned document examination literature, the four handwriting characteristics selected for this study were found to distinguish between MPD participants to the same degree as non-MPD participants. Although significant differences in at least one handwriting characteristic were produced by ten of the eleven MPD participants, a within-subjects analysis comparing measures between alters of individual MPD participants showed a much smaller degree of variation. It is clear that the handwriting differences of MPD alters fell at an intermediate level behind the differences occurring among separate individuals and greater than the differences found in handwriting samples produced by non-MPD participants over time.

As a group, the MPD participants showed greater variability between handwriting samples than the non-MPD group. The degree of variability for individual cases was not successfully predicted. A wide range of differences in handwriting variations was found among MPD participants who were similar in background, severity of MPD, and extent of progress in therapy.

This observation has forensic and clinical implications. The present study suggests that the forensic examiner would be able to resolve a majority of handwriting identification problems presented by persons with MPD through skillful questioned document examination. The existence of significant variations in four inconspicuous handwriting characteristics by one MPD participant raises the possibility that some alters of persons with MPD may produce handwriting styles which are not traceable to a specific individual in a limited number of cases.

The clinical implications of the lack of correlation of handwriting variations with patient history, degree of disorder, or progress in therapy suggests that the existence and extent of handwriting variations do not assist the process of differential diagnosis. Handwriting variations are not indicative of the extent of the disorder, the degree of trauma experienced by the MPD client, or the level of integration achieved. Although the present study found that handwrit-

TABLE 3
ANOVA Results of Within-Subjects Comparison of Changes in Handwriting Measures Over Time in Non-MPD Participants[1]

Individuals	Handwriting Measure: upper zone ratio	lower zone ratio	word space ratio	i-dot displacement
Non-MPD Participant #1 (3 samples)				
df	2, 56	2, 56	2, 67	2, 39
F	2.079	0.283	1.300	0.252
Non-MPD Participant #2 (3 samples)				
df	2, 56	2, 56	2, 54	2, 35
F	1.113	1.415	2.633	0.141
Non-MPD Participant #3 (3 samples)				
df	2, 55	2, 54	2, 55	no data
F	1.093	0.151	0.760	—

**** $p < .0001$ *** $p < .001$ ** $p < .01$

[1] Given the large number of comparisons made, individual mean scores are not reported. These data are available upon request from the author.

ing variations are more common and more excessive in the MPD participants as a group, the handwriting variations selected for his study offered nothing that would clarify or deepen our understanding of the individual MPD participants.

Although this study found no relation between handwriting variations and obvious differences between alters in appearance, behaviors, memories, and capabilities, it is consistent with other research. Studies on physiological changes in MPD patients, for example, often find a surprising number of variations that exceed norms for the general population. In most of these studies, clear patterns and trends which point to underlying factors remain elusive (S. D. Miller, personal communication, July 20, 1990). These findings imply that the underlying basis for variations in handwriting features between alters, as with variations in physiological phenomena in MPD clients, is neither simple nor direct.

Speculation abounds among clinicians regarding the origin and function of handwriting variations among MPD clients (G.W. Stahle, personal communication, March 17, 1989). The development of alters of an MPD client itself is often complex, but is most often associated with a mechanism to deal with the terrorizing effects of overpowering trauma (Spiegel, 1986). Although the development of alters may make it possible for the MPD client to maintain silence about the horrors he or she endured, and to limit their damaging effects through a dissociative process (Steele, 1989), it is not clear whether the same process encourages the development of handwriting variations.

It is possible that creativity contributes indirectly to the production of distinct handwriting patterns. Saudek (1926/1978), a researcher and handwriting identification expert in the early part of this century, refers to a study in *Graphologische Monatschefte* (1903), in which the prevalence of handwriting variations in writers in the general population was explored. The study described a "striking case... of one of those highly gifted individuals... capable of producing no less than 33 essentially different hands [i.e., patterns of handwriting which exceed natural variations]" (pp. 8-9). Saudek, unfortunately, does not provide any further details about these writers other than noting a relationship between giftedness and a high degree of facility in producing handwriting variations. Several clinicians have reported links between giftedness and multiple personality disorder (C. S. Davidson, presentation to the Minnesota Psychological Association, April 6, 1990). Schulz, Braun, and Kluft (1985) report unusual levels of creativity in art, music, or poetry in 82% of their MPD patients. Fuhrman (1988) observes a more frequent use of artistic activities by MPD patients than by the general population, regardless of whether the MPD patient had received any formal training in the expressive arts.

A survey of the therapists of the MPD participants in the present study revealed the existence of above average or strong creative abilities in ten of the eleven MPD participants who exhibited a significant difference in at least one handwriting characteristic. Creativity, however, was prominent in some MPD participants whose handwriting variations were not as significant as those of some MPD participants whose creativity was rated lower. The inconsistent relationship between creativity and handwriting variations reduces the likelihood that creativity explains the development of handwriting variations in MPD clients. It may be worthwhile to note that MPD participants who produced the greatest number of handwriting variations in the present study were reported to be accomplished artists as well as experiencing an extreme level of multiple personality disorder.

In conclusion, the present research determined that significant differences in handwriting patterns that exceed the expected ranges of variation in the general population can exist in MPD clients. These differences were not found to be consistent with any other factor which contributes to the differential diagnosis of multiple personality dis-

TABLE 4

Significant Differences (At ALPHA = .01 or Less)
Among MPD Participants by Handwriting Category

MPD Participant	Handwriting Measures showing significant differences	Median F ratio
#1 (2 alters)	—	2.368
#2 (2 alters)	uzr	3.452
#3 (3 alters)	lzr, wsr	7.133
#4 (4 alters)	wsr	2.607
#5 (3 alters)	lzr, i-dot	3.502
#6 (4 alters)	wsr	2.765
#7 (5 alters)	wsr	2.995
#8 (3 alters)	uzr, wsr	6.809
#9 (4 alters)	uzr, lzr, wsr, i-dot	13.003
#10 (2 alters)	uzr	3.997
#11 (4 alters)	uzr	4.352

uzr = upper zone ratio
lzr = lower zone ratio
wsr = word space ratio
i-dot = i-dot displacement

order. Given our current state of knowledge about MPD and handwriting, an accurate interpretation of the development, occurrence, or function of handwriting variations in MPD clients is not possible. The unusual incidence of handwriting variations in this population poses intriguing questions, however, and compels further study. ■

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