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Analyzing The Relationship Between Signature And Personal Traits: A Research On Managers

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Özet:

İlgili literatür incelendiğinde, imza ile kişilik yapısı arasında doğrudan ilişki olduğunu ortaya koyan araştırmalara rastlama olasılığının çok yüksek olmadığı görülmektedir. Yapılan araştırmaların ortak amacı, imza ile kişilik yapısı arasındaki ilişkiyi güçlendirecek bulgulara ulaşmak ve sözkonusu ilişkiyi net biçimde ifade edebilmek olasa da, mevcut literatür henüz imzanın kişilik özelliklerini yansıttığı tezini doğrulayacak kanıtlar sunamamaktadır. Bu nedenle, konu ile ilgili çalışmalar halen sürdürülmektedir. Bu makale, mevcut literature bilimsel değer katmaya ve imzanın fraktal boyutu (fractal dimension) ile kişilik test sonuçları arasında bir korelasyon olup olmadığını saptamaya çalışmaktadır. Araştırma, günlük iş temposunda imzayı sıklıkla kullanan yöneticiler üzerinde yürütülmüştür. Bulgular, "hiçbir ilişki bulunmamaktadır" ifadesini doğrulamaktadır.

Anahtar Kelimeler: *İmza analizi, fractal boyut, kişilik özelliği, grafoloji, el yazısı*

Abstract:

In related literature, it is not a high possibility to encounter the researchs directly questioning the relation between signature and personality traits. The overall aim of the existing researchs is to strenghten the findings proving the relationship between signature and personality traits and to display this relation clearly. However, the existing literature has not yet been able to present the clear proofs verifying the thesis that the signature reflects personality traits. Because of this, the researchs on this subject has still been continuing. The present article is trying to add a scientific value to the existing literature and determine whether there is a correlation between fractal dimensions of the signatures and the results of personality tests. The study was conducted on the directors who use the signature very often in their daily business operations. The findings supported the statement "there is no relationship"

Keywords: *Signature analysis, fractal dimension, personal traits, graphology, handwriting.*

1. Introduction

The signature is our most personal handwritten mark. We know that signatures have assumed great importance and everybody, regardless of their social level, must sign their name daily or even many times a day. Most of us invested quite some effort in creating a signature with which we are satisfied. Children, and especially adolescents, experiment with various ways of signing their names, as they seek out and develop their identities. So, a signature can be a sign of who we are. (Devlin-Gascard, 1997: 43) Also the line which is the basic element of drawing which we use in our signatures expresses something about our inner world, personality and is a way to show our domain characteristics in our signature.

The signature is not only a mark, but a very personal mark. It is an individual combination of strokes in which it is possible to recognize the writer. In the other words, it may be said that it is not only a desire for simplification which leads to modifying the inscription of one's name to what we call a "signature". In many cases, we see young men, and even adults who perform tests to obtain a signature which suits them and in which they can project the graphic elements of the personality they want to be. (Mathyer, 1961: 123)

Handwriting is still very important and widely used in society. Identification by handwriting (signatures, letters, notes) has a wide application field, for example confirming document authenticity in the financial sphere, or solving expert problems in criminology, etc. (He et al. 2006: 210)

Layman asks and gives the answer, "Is handwriting a good way of analysing a person's personality? Best Answer - Chosen by Asker: They say it can be done, but I myself can change my handwriting to match just about anyone else's. So if you think about it, being able to 'copy' another person's script... does that mean I have multiple personalities, or take on the personality of the person whose script I am copying?"[1]

Existence of individual differences makes psychology differ from the natural sciences. The same chemicals in two test tubes that are treated identically respond identically, but two human beings may react quite differently to the same stimulus. (Hampson and Colman, 1995: 54) Using handwriting to analyze the psychological structure of the human subject is not new. In ancient times Confucius said, "Beware of a man whose writing sways like a reed in the wind". (King and Koehler, 2000: 336)

The central nervous system provides a direct and undistorted link to the deeper self. Every human mind comprises a unique and immensely complex blend of character and accumulated experiences of life. Handwriting reflects this by evolving constantly." but up until now nobody has clearly explained how the central nervous system provides "a direct and undistorted link to the deeper self" or how it works. It is commonly accepted that people's emotions and motivations can be read from their body movements. In handwriting, signals from the brain guide the hand holding the pen, giving rise to the graphologists saying that "handwriting is brainwriting". For example, the degree of pressure on the page indicates the writer's level of energy. (King, 1994: 26)

Is there an actual relationship between signature and personality? Although there are several studies that explore whether there is a relationship between signature and personality, the findings have not been able to indicate such a relationship in an unequivocal way. In spite of continual efforts, signature analysis still maintains its attribution field, which is hard to work on. It is reasonably difficult to make various descriptions or to relate it with various fields by just analyzing individual's signature, which is composed of only a small part. From the point of view of the science of graphology, the identification

1 http://uk.answers.yahoo.com/question/index?qid=20080211032220AAYNLji&show=7, 2009.

of signatures is difficult because autographed signatures do not feature standard characteristics (they may appear in different forms in every signature) (Said et al. 2000: 149).

When handwriting principles are considered, it has been specified that no one can write a letter in exactly the same way a second time. If it is thought that in every signature individuals use more than one letter and these letters cannot be written identically for the second time, it can be said that the formal contents of each signature differ from each other. (Marquis et al. 2005: 23) In particular, if the environmental factors of the individual, materials (such as paper and pen) that are used and the power that was used for autographing are considered, it would not be incorrect to say that every signature has different formal contents. (Webster, 2008: 284) On the other hand, Naftali underlines that a piece of writing should not be considered as representing the person but rather as representative of that person at a particular life period and in a specific situation. (Naftali, 1965: 538)

It is well known that the analysis of visual elements such as signature and handwriting benefits from graphology. In general, graphology has been defined as the study of handwriting to reveal the personality traits of the writer or as a science of inferring personality traits from handwriting. (King, 1994: 26) According to The British Academy of Graphology, "Graphology is the analysis of the psychological structure of the human subject through his or her handwriting". Graphology studies date back to ancient Greek and Roman philosophers. Accordingly, it is believed that there is a relationship between handwriting and character. Camillo Baldi performed the first systematic study in the field of graphology with the publication in 1622 of "The Means of Knowing the Habits and Qualities of a Writer from His Letters". Graphology emerged as a science with two studies entitled "The Mysteries Of Handwriting" and "A System Of Graphology" in 1872 by a French priest named Abbe Jean Michon. He also founded the "Journal La Graphologie" which is still published today. (Brewer, 1999: 6) When we use "ology" at the end of a word we may create a scientific impression and give credibility to a word, but annexing an "ology" at the end of a word and even receiving high regard from the public can not change the reality.

Graphology can be assessed as an instrument used in many scientific fields. The literature suggests it has been used in a number of diverse fields, such as psychology, employment, education, medicine, criminal detection, commerce and recruitment. (Brewer, 1999: 6) At the end of the 20th century and in the first decade of the 21st, many sources indicate that graphology is surprisingly common in personnel selection and is widely used in Europe and in the U.S.A. but findings do not support this behaviour. "The graphologist's recommendations showed no more than a chance relationship with those which would have been made by a psychologist on the basis of intelligence tests" (Super, 1992: 323). "Given its increasing popularity, efforts have been directed toward assessing the validity of graphoanalysis in applied settings. Research findings to date have been mixed" (Tett and Palmer 1997: 11). Additionally, graphologists say that graphology predicts job performance and helps to pick the right person at the right time, but none of these arguments have been supported by sufficient scientific and valid research. On the contrary, it is not hard to find articles that declare these cannot be scientifically proven. According to others, "It is routinely used in Europe and in Israel, and it has been used by over 3,000 American firms. There has been virtually no research supporting the validity of graphology for predicting job performance or occupational success; the few methodologically strong studies that have been done suggest that graphology does not work and that the predictions of graphologists may be no better than predictions made by chance". (Murphy and Davidshofer, 1998: 117) The handwrit-

ten signature is very widely used biometrically today. Biometric Technologies are based on identifying a person by analyzing his psychological or behavioral characteristics. Biometrics, such as voice, eye print, fingerprints, signature, handwriting and many other ways have proved to be individual and cannot be easily stolen, lost or imitated. (Joulia, 2006: 484)

Overall, the principle behind graphology is that people who share certain personality traits also exhibit similar forms in their handwriting. However, it is not certain whether the people who share certain character and personality traits also exhibit similar forms in their handwriting. Although many human resource practitioners give positive testimony to the inferences of graphology and use the services of graphologists, "diagnosing personality from handwriting may bear some intuitive appeal, evidence for its validity is weak. The results of recent research testing the validity of using handwriting for predicting personality traits have been consistently negative" (King and Koehler, 2000: 340)

Sometimes scientific results seem to shed light on the individuality of handwriting. Tests in a study showed that the handwriting of twins is less able to be discriminated than that of non-twins: an overall error rate of 12.91% for twins and 3.7% for non-twins. Error rates with identical twins were higher than with fraternal twins (Srihari et al. 2008: 446)

Another survey disclosed that females more commonly wrote text-based signatures than mixed or stylized types, whereas males more commonly wrote in a mixed or stylized form than in a text-based form (Linton et al. 2002: 870)

Some other researchers hypothesize that good forgeries are less smooth than authentic handwriting and they report, "We found that the wrinkliness of the good forgeries was significantly greater than that of the authentic writings, showing that it is possible to identify candidate forgeries from scanned documents"[2] .

Regarding handwriting and signatures, no two samples are the same and may be this uniqueness helps ordinary people to form ties between personality traits and the shape of their signatures. Graphology is so widespread and this makes me ask why so many of us believe that our handwriting can reveal our personality. This question may be answered by these explanations:

- Graphology has face validity: If the validity of a test is estimated or judged intuitively, without any objective evidence it has face validity.
- "The law of small numbers" may be another explanation: In 1971 Tversky and Kahneman published their first joint article, "Belief in the Law of Small Numbers" (Tversky and Kahneman, 1971: 108) They showed that people tend to believe that the law of large numbers applies to small numbers. People expect even small samples to be representative of the populations from which they are drawn. Jacques noted that in signatures, only a few letters of the alphabet are present, and most of them appear only once in each signature, so that the law of large numbers cannot be applied. (Mathyer, 1961: 131)
- "Cognitive bias" also leads individuals to perceive less risk than a "Bandwagon effect", where the tendency is to do or believe things because many other people do or believe the same.

1.1. What is fractal dimension?

The concept of "fractal dimension" (FD) is attributed to a 20th century mathematician, Benoit Mandelbrot. It is an index for measuring the complexity of an object. Clarke and Schweizer note that 'Fractal geometry has

2 Chen, Hung-Chun, Cha, Sung-Hyuk, Chee, Yi-Min, Tappert, C. Charles, "The Detection of Forged Handwriting Using a Fractal Number Estimate of Wrinkliness". Unpublished Manuscript.

been called one of the four most significant scientific concepts of the 20th century, on a par with quantum mechanics, the general theory of relativity, and the double-helix model of the structure of DNA" (Sun and Gong, 2006: 3965) Fractal dimension is also defined as "a number which measures the degree of irregularity or of fragmentation of a set", or "the measure of the complexity of the studied set". (Boulétreau et al., 1998)

The boundary of the Lévy C curve was estimated as 1.9340 . An analysis of data for bacteriohodopsin reconstituted in phospholipid vesicles gives a fractal dimension of 1.6 (Dewey & Datta, 1989: 417) It was found that all kaolins show a fractal regime in the same nitrogen relative pressure range, with fractal dimension values ranging between 2.38 and 2.57. (Aparicio et al. 2004) The obtained fractal dimension values are 1:632±0:0036 for Monarch butterflies, 1.628 ± 0.0059 for the Tropical Viceroy, and 1.634±0.0051 for the Northern Viceroy. (Castrej Pita et al., 2004: 11)

2. Method

Signatures are still the most common way of authentication when dealing with papers. The handwritten signature is very widely used biometrically today (Chapran, 2006: 485) and it has been shown that the fractal parameters are stable and discriminant enough to establish a handwriting classification according to styles and it is also possible to apply these parameters to the study of signatures. (Boulétreau et al., 1998: 1760) Our study is mainly a case study that tries to find relations between variables. In this study we will try to find a relationship between the fractal dimension of signatures and personal traits. In our method, handwriting is measured as a fractal dimension of signatures.

2.1. Participants

Participants at two groups of firms in the textile and cleaning (utility) sectors were 39 volunteers selected from high level of managers, including coordinators, directors, vice directors and chiefs. This sample consist 18 male and 21 female participants who use the signature in high frequency in a work day were especillay chosen.

2.2. Procedure

Our overall research was conducted in four phases. The first phase determined which firms and which high level managers would be included in our research. After determining two groups of firms in the textile and cleaning sectors, a total of 39 high level managers, including coordinators, directors, vice directors and chiefs were selected as our sample.

In the second phase, a joint study was started with The Behavioral Sciences Institute for personal trait tests. After interviewing the experts of The Institute, it was decided to conduct a test which provided 12 different personal traits. This type of test is called "16 PF Select Type".

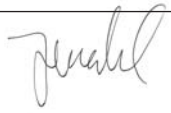
An e-mail list of managers was prepared and sent to The Institute and in the third phase of our research the personal trait test forms were sent to the managers. To ensure that the forms were completed in a proper way, the human resources department managers were involved as supporters. The completed test forms were sent to The Institute by e-mail and the personal traits of our sample were measured on a 10-point scale.

In the last phase, the managers in our sample were told that their signatures would only be used for scientific purposes and their signatures were collected. Afterwards all the signatures were scanned with an Hp psc 1315 scanner and turned into bmp format. Benoit software was used to find the fractal dimension of the signatures and our data set that consisted of matched personal traits and the fractal dimensions of the signatures was analyzed by SPSS 13.0.

The fractal dimensions of the collected signatures were calculated. The personality test results were correlated with the obtained results from the calculations. In this context, the calculated fractal dimensions of the signatures in our study s shown in Table 1, range between 1.91672 – 1.95819.

Table 1

The Signatures and Calculated Fractal Dimensions

				
1,93956	**1,93190**	**1,92610**	**1,93653**	**1,93923**
				
1,95636	**1,93064**	**1,93753**	**1,92102**	**1,92240**
				
1,94072	**1,92738**	**1,93167**	**1,93091**	**1,93543**
				
1,9333	**1,95819**	**1,93581**	**1,93384**	**1,93164**
				
1,93304	**1,93359**	**1,93886**	**1,94472**	**1,93570**
				
1,92945	**1,93281**	**1,91672**	**1,94910**	**1,93779**
				
1,94332	**1,95121**	**1,93432**	**1,93875**	**1,92431**
				
1,93429	**1,95642**	**1,92654**	**1,93197**	

3. Results

The research point to two interesting findings. The first and the main finding of this study is that no relationship exists between signature and personality characteristics. Table 2 presents the correlations between personal traits and fractal dimensions of signatures.

When Table 2 analyzed, it is observed that there is no relationship between the fractal dimensions of the signatures and the personality test results at the 0.05 significance level. Consequently, the hypothesis, which was spelled out in various scientific and non-scientific studies that signature reflects personality characteristics was not supported by this study.

Another interesting finding of this study is the differences in male and female signatures. In literature, it is known that some studies have explored the connection of handwriting with gender. For instance, Beech and Mackintosh examined the relationship between handwriting, gender and hormones and concluded that the prenatal hormone influences the feminity of handwriting for females. (Beech and Mackintosch, 2005: 465) Moreover, Goodenough (1945), Hamid & Loewental (1996) and Hartley (1991) found findings about the relationship between handwriting and gender showing differences between male and female. From this point of view, we wondered whether the sample of this study had significant differences between male and female, constructed on the relationship between the fractal dimensions of the signatures and gender.

Figure 1 below shows us that the fractal dimensions of the signatures of female managers have higher variability then those of the males.

Table 2

Pearson Correlation Analysis Results

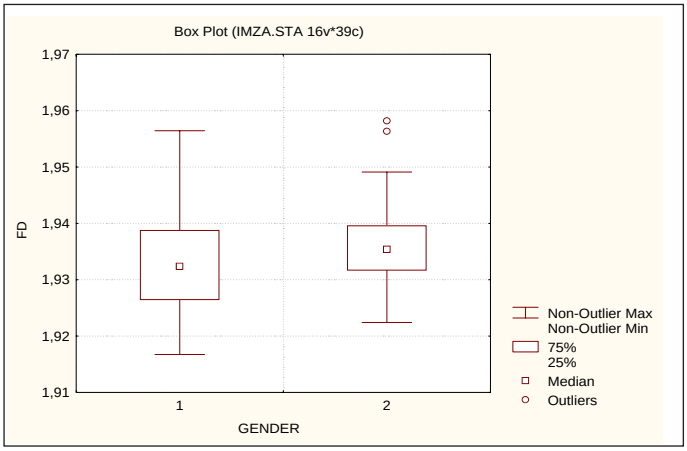
Correlations
Marked correlations are significant at p < 0.05000
N=38 (Casewise deletion of missing data)

Variables	FD	A	C	E	F	G	H	L	M	O	Q1	Q2	Q3
FD	1.00												
A	-0.05	1.00											
C	0.01	0.04	1.00										
E	0.12	0.02	0.32	1.00									
F	-0.14	0.43	-0.06	0.19	1.00								
G	-0.08	-0.22	0.03	0.12	-0.03	1.00							
H	-0.22	0.38	-0.03	0.20	0.61	-0.21	1.00						
L	0.01	0.26	0.39	0.34	0.30	0.31	0.17	1.00					
M	0.00	0.07	-0.22	-0.33	0.04	-0.21	0.14	-0.41	1.00				
O	-0.01	0.07	0.64	0.28	0.24	0.17	0.16	0.40	-0.37	1.00			
Q1	-0.05	0.26	0.19	0.21	0.30	-0.12	0.47	0.29	-0.28	0.36	1.00		
Q2	0.10	-0.36	-0.02	-0.18	-0.16	0.17	-0.37	-0.17	0.14	-0.04	-0.24	1.00	
Q3	0.17	-0.07	-0.05	0.12	0.16	0.22	0.03	0.33	-0.29	0.06	0.13	0.01	1.00

FD: Fractal Dimension

Figure 1

Signature range on the basis of gender



If details and versatility are the main concentration points for females then this result can be taken as natural. This result also indicates that the signatures of male managers resemble each other more than female managers' signatures. Figure 2 below (Scatterplot) enabled us to analyze the signature sample in another way.

The scatterplot above shows that each of the 39 managers has different ordered pairs of fractal dimensions and standard deviations. These ordered pairs can be used as a two dimensional measurement for each of the managers. The dendogram of these ordered pairs depicts two classes and which case numbers most resemble each other in a two-variate manner. For example, 12 and 4, 29 and 4 are the cases which are most similiar. Figure 3 below (Tree Diagram) also enabled us to look at a different point of view.

Figure 2

Scatterplot for signature sample

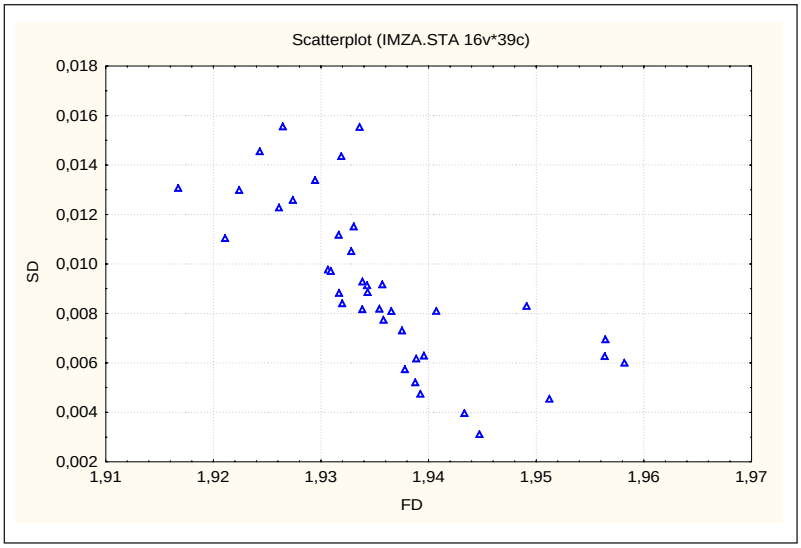
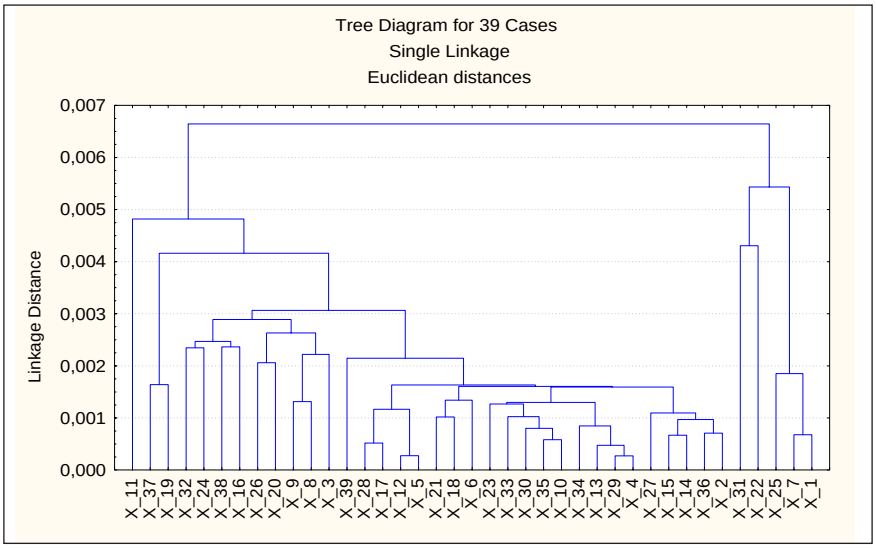


Figure 3

Tree Diagram for signature sample



4. Discussion

Because of the nonexistence of the relationship between signature and personality characteristics, the usage of signature naturally loses its validity and casts doubts on the hypothesis "signature reflects personality characteristics". For instance, in the employee choice it becomes impossible to forecast likely individual characteristics of candidates using the signatures on the application form. Additionally, in criminal analysis, making assumptions about a criminal's personal characteristics would be inaccurate on the basis of signature. This means that all sorts of personality analyses, which depend on signature, would be inaccurate in the frame of this study's findings.

This finding also indicates that researchers who work in this area should show an interest in this issue and devote more time to it. As previously mentioned, the studies that explore the relationship between signature and personality have not reached strong findings but only weak and vague conclusions. The findings of this study that are similar to those in the literature support past findings and realize the further projection that there is a need for further studies on this subject.

It is seen that a number of studies examining the relation between signature and the personality traits do not have a scientific value. Especially, the writings published in the internet by non-scientific people attract attention. On the other hand, the investigations concerning the subject and carrying a scientific quality just constitute the minority. Certain and unquestionable statements claiming that the signature reflects the personality traits have been used in these non-scientific writings. On the contrary, in scientific articles, clear and certain proofs displaying the relation between signature and personality traits cannot be presented. These two different points of views display that the researchs structured in accordance with the scientific principles and rules, even if the findings are not satisfiying enough, must be produced to reinforce the literature.

4.1. Limitations of the present study

As in all research, the presence of some restrictions particularly prevents researchers reaching a conclusion. In this research, we were confronted with two main restrictions.

These are:

1. There are structural characteristic differences in every signature of an individual that is autographed at different times. Accordingly, the probability of the calculation of fractal dimensions will be different for every signature. Therefore the reliability of the conclusions is in doubt because the fractal data is used for the correlation analysis.

2. The second restriction is about the sample size. The sample size was restricted because of time. The extent of personality test required much time for the responses by the respondents (managers) so because of the lengthy response time and the pressure of time, the object group was distant from the study. Therefore the sample size could not reach a particular level. These factors beyond our control prevented from obtaining a greater number of signatures. However, the finding that there is no relationship between signature and personality does not "certainly" mean that there is not a relationship. Ongoing projects about this issue show that there is hope and belief about the existence of the stated relationship.

3. There is no satisfactory theorical analysis exists in the literature. Because of less research around this subject, it is difficult to investigate all aspects without having enough sources.

4.2. Directions for future research

It is also probable to analyze by dividing a signature into different parts and calculate fractal dimensions of each part separately. Therefore, by using graphology, it could be more easy to determine the relationship between each part of the signature's fractal datas and personality. In this study, as it is expressed with its reasons in limitations that the volume of the sample coldn't reach above a defined level. In this perspective, it is also necessary to increase the sample volume and reach much more reliable findings in future. It is thought that having more signatures and more fractal datas will help us to strengthen the research findings.

References

Aparicio P., Pérez-Bernal J. L., Galán E., Bello M. A. (2004). "Kaolin fractal dimension. Comparison with other properties", Mineralogical Society of Great Britain and Ireland, Research Paper, http://claymin.geoscienceworld.org/cgi/content/full/39/1/75.

Beech, John R. and Mackintosch, Isla C. (2005), Do Differences In Sex Hormones Affect Handwriting Style? Evidence From Digit Ratio and Sex Role Identity As Determinants Of The Sex Of Handwriting. Personality and Individual Differences, Vol: 39: 459-468.

Brewer, Jane F. (1999), Graphology. Complementary Therapies In Nursing & Midwifery, Vol: 5: 6-14.

Boulétreau V., Vincent N., Sabourin R. and Emptoz H. (1998), Handwriting and Signature: One or Two Personality Identifiers?, Pattern Recognition, Vol: 2: 1758-1760.

Castrej Pita, A. A., Sarmiento Galan, A., Castrejon-Pita, J. R. and Castrejon-Garcia, R. (2004), Fractal Dimension in Butterflies' Wings, Journal of Mathematical Biology, 1-18.

Chapran, Joulia. (2006), Biometric writer identification: Feature analysis and classification, International Journal of Pattern Recognition and Artificial Intelligence, Vol. 20, No. 4: 483-503

Chen, Hung-Chun, Cha, Sung-Hyuk, Chee, Yi-Min and Tappert, C. Charles, The Detection of Forged Handwriting Using a Fractal Number Estimate of Wrinkliness, Unpublished Manuscript.

Devlin-Gascard, Lorettann (1997), The Signature As An Access Line To Expressive Drawing, Art Education, Vol: 50, No: 2: 39-44.

Dewey, T. G., and Datta M. M. (1989), Determination of the fractal dimension of membrane protein aggregates using fluorescence energy transfer, Biophysical Journal, Vol: 56: 415-420.

Goodenough, F. (1945), Sex differences in judging the sex of handwriting, Journal of Social Psychology. Vol 22: 61-68.

Hartley, James (1991), Sex Differences in Handwriting: A Comment on Spear, British Educational Research Journal. Vol. 17, No. 2: 141-145.

Hamid, S. and Loewenthal K.M. (1996), Inferring gender from handwriting in Urdu and English, Journal of Social Psychology. Vol: 136, No: 6: 778-782.

Hampson, Sarah E., and Colman, Andrew M. (1995), Individual Differences and Personality, London and New York: Longman Press.

He, Zhenyu, You, Xinge, Tang, Yuan Yan, Fang and Bın, Du, Jianwei (2006), Handwriting Based Personal Identification, International Journal Of Pattern Recognition, Vol: 20, No: 2: 209-225.

Joulia, Chapran (2006), Biometric writer identification: Feature analysis and classification, International Journal of Pattern Recognition and Artificial Intelligence, Vol. 20, No. 4: 483-503.

King, Roy N., and Koehler, Derek J. (2000), Illusory Correlations In Graphological Inference, Journal Of Experimental Psychology, Vol: 6, No: 4: 336-348.

King, Stephen (1994), Graphology: Writing The Wall, Management Development Review, Vol: 7, No: 5: 26-28.

Linton, Mohammed, Bryan, Found, and Doug, Rogers (2002), Frequency of Signature Styles in San Diego County, J Forensic Sci., Vol: 47, No: 4: 856-872.

Marquis, R., Schmittbuhl, M., Mazzella, W.D. and Taroni, F. (2005), Quantification of the shape of handwritten cahracters: a step to objective discrimination between writers based on the study of the capital character O, Forensic Science International, Vol: 150: 23-32.

Mathyer, Jacques (1961), The Expert Examination Of Signatures, The Journal Of Criminal Law, Criminology, and Police Science, Vol: 52, No: 1: 122-133.

Murphy, Kevin, and Davidshofer, Charles (1998), Psychological Testing; Principles and Applications, London: Prentice Hall.

Naftali, A. (1965), Behavior Factors In Handwriting Identification, The Journal Of Criminal Law, Criminology, and Police Science, Vol: 56, No: 4: 528-539.

Said, H.E.S., Tan, T.N., and Baker, K.D. (2000), Personal Identification Based On Handwriting, Pattern Recognition, Vol: 33: 149-160.

Srihari, S., Huang, C., and Srinivasan, H. (2008), On the discriminability of the handwriting of twins, J Forensic Sci., Vol: 53, No: 2: 430-446.

Super, Donald E. (1992), A Comparison of the Diagnosis of a Graphologist with the Results of Psychological Tests, Journal of Consulting and Clinical Psychology, Vol 60, No: 3: 323-326.

Tett Robert P., & Palmer Cynthia A. (1997), The Validity of Handwriting Elements in Relation to Self-report Personality Trait Measures, Personnel Individual Differences, Vol 22, No.1: 11-18.

Tversky, A., and Kahneman, D. (1971), Belief in the Law of Small Numbers, Psychological Bulletin, Vol: 76, No: 2: 105-110.

W. Sun, G. X., P. Gong, and S. Liang (2006), Fractal analysis of remotely sensed images: A review of methods and applications, International Journal of Remote Sensing, Vol. 27, No. 22: 4963–4990.

Webster A., Melcher (1916), Handwriting, From a Psychopathic Viewpoint, Journal Of The American Institute Of Criminal Law And Criminology, Vol: 7, No: 2: 284-287.