

Criteria, Parameters, And Technical And Software Support For Graphological Analysis

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Abstract: This article examines the criteria for graphological analysis, identifies its parameters, and analyzes each criterion and parameter using handwriting samples, providing conclusions. Special attention is given to the technical equipment and software necessary for graphological expertise, emphasizing their importance. The roles of high-precision microscopes, graphometric devices, digital scanners, and high-precision cameras, which are considered technical support for graphological expertise, are elucidated in the analysis. The functions of artificial intelligence and machine learning models are explained, including automatic handwriting recognition and classification, analysis of biometric characteristics, detection of anomalies and fraud, and data archiving and comparison.

Keywords: Graphological parameters, pressure, letter size, spacing, shape, volume, graphometric devices, microscopes, cameras, artificial intelligence.

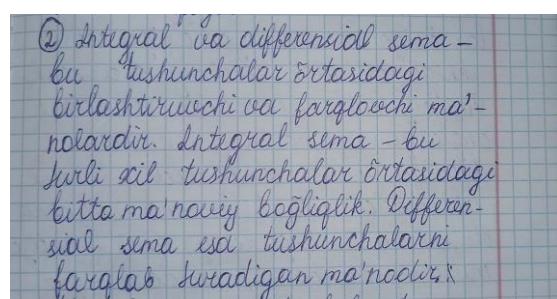
Introduction: Like all analytical methods, graphology encompasses the main criteria and parameters of graphological analysis. Graphology is a method of determining an individual's psychological, emotional, and temperamental characteristics through handwriting and its features. The primary objective of graphological analysis is to examine various signs and parameters in writing to draw conclusions about personality. In graphology, there are several key criteria for evaluating the external and internal characteristics of handwriting. These are:

- a) external appearance of the writing: size, pressure, rhythm, angularity, and curvature;
- b) internal characteristics of writing: spacing between letters, spacing between words, direction of the lines, overall shape of the writing;

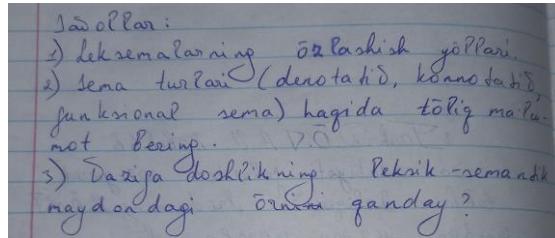
c) special features in writing: pen stroke style, signature, and orthographic errors.

Graphological parameters. In graphology, the following parameters are mainly considered when studying handwriting:

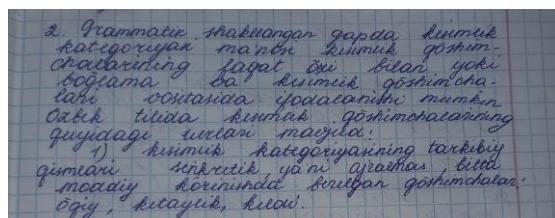
The size of the handwriting. It represents a person's self-confidence and social indicators. Large handwriting belongs to a person who is intelligent, self-confident, able to attract people, is a leader of the company and a true leader, builds strong relationships with those around them, has an open personality, and is absolutely incapable of isolation. Such people often become bosses. Negative character traits include excessive trust in strangers and lack of order in daily affairs:



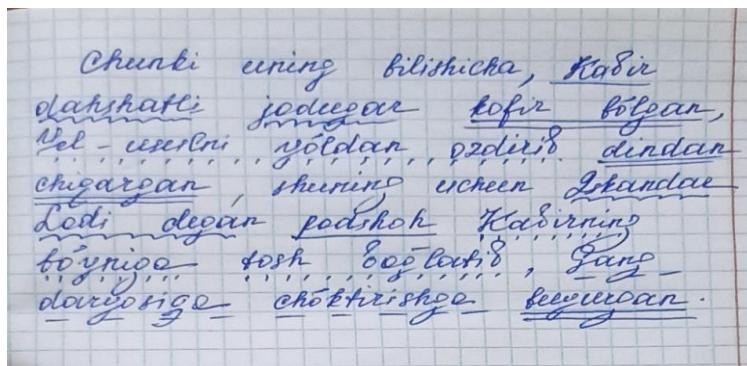
Small and unreadable handwriting. It belongs to shy people who are unable to overcome serious difficulties. Such individuals possess certain hidden talents and the ability to think logically. They often feel uncomfortable



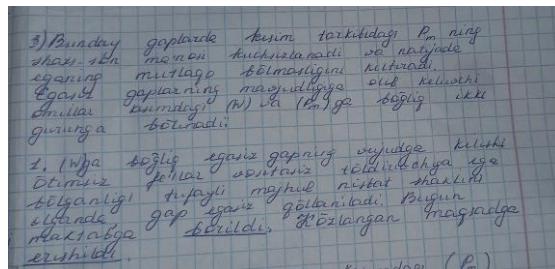
All the letters are written together. This type of handwriting is characterized by the ability to think correctly and rationally, as well as possessing exceptional sensitivity. Underlining letters, words, and phrases indicates diligence and a serious attitude towards assigned tasks. People with such handwriting



The shape of letters. Angular handwriting indicates a love for competition in any attempt to demonstrate independence, critical thinking, and self-worth, whether in sports or other pursuits. Broken and rounded letters in writing represent an independent



Curls. Small and lowercase letters with curls are characteristic of people with simple personalities, whose lives are meaningful and who adapt quickly to ordinary life. These individuals act on their own



A curl on a single symbol reflects spiritual development and love for family, and is characteristic of people who are distant from relatives and good friends. Wide lower

in public places and avoid engaging in communication:

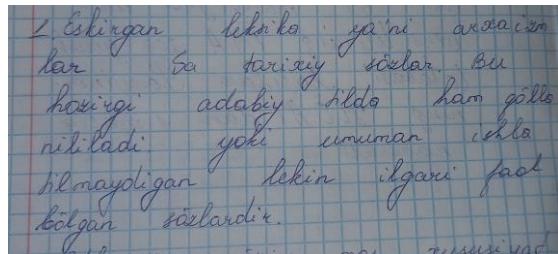
do not live with doubts in their family life, but instead enjoy a happy and prosperous life. Continuous and concise handwriting is evidence of a proud and independent character; such individuals dislike unnecessary acquaintances and try to avoid them:

person who is hospitable, knows how to attract others, has excellent taste, and always finds their way. However, such a person tends to be very selfish and dislikes being told how and what to do:

independent decisions and dislike dishonesty in relationships:

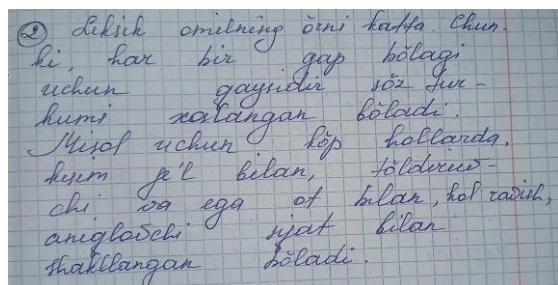
"curls" indicate a focus on purposefulness, material wealth, and communication. If the lower curl is not proportional to the letter, it signifies laziness and a lack

of favorite activities or hobbies.



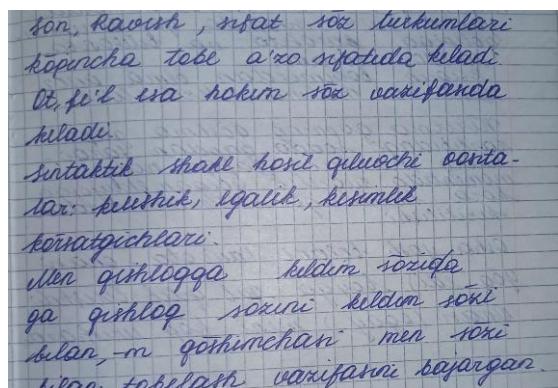
Curls that are the same at the top and bottom are a sign of a freedom-loving person who is very rarely able to

be controlled:



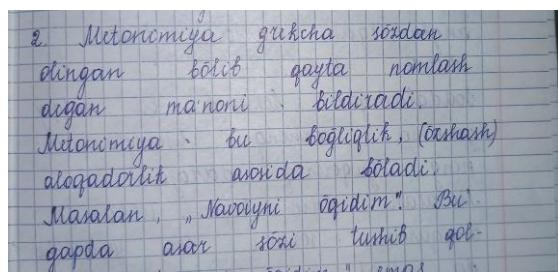
Calligraphic. A person with such handwriting is very sensitive and a wonderful family person. They are emotionally peaceful individuals who face no major difficulties in life or problems at work. Everyone loves to be friends with them. The shortcoming of someone

with such handwriting is a lack of self-confidence, which compels them to seek help from people who are capable of listening attentively and offering support:



Sharp handwriting. This type of writing is characteristic of people who possess intelligence, observational skills, aggressiveness, and cunning. Individuals with such handwriting tend to have a distrustful and indifferent

attitude towards people, their lifestyles, and their ways of thinking.



On a large scale. This type of handwriting always characterizes a proud person who desires to be in leading roles in any business, striving for self-affirmation. People with such handwriting are romantic and view their surroundings through rose-colored

glasses. These individuals quickly forget and forgive insults; they are kind-hearted, have a sensitive nature, and are therefore often considered "eccentric":

hitobga chizmang - gapdag'i hitobga
 birligi sör hisoblahadi.
 Lihsemalar fagat atash ma'nosiga
 ega boladi, yani dash ma'nosiga ega
 bolgan barcha birliliklar lihsemalardir.
 Lekin so'rlarning hammasi ham atash
 ma'nosiga ega bolmaydi. Masalan, biz
 va, ammo, lekin kabi yordamchi
 so'zlarni ham lehsema emas, sör deb
 hisoblaymiz.

Pressure (pen pressure). Pen pressure describes the writer's emotions. Smooth writing is a type of handwriting characteristic of people who are intelligent, romantic, but weak-willed, emotionally

sensitive, easily influenced by others, and lacking deep experience:

sör qoyta boladi
 2. Graduonimya malum bur
 darajalash qator graduon.
 miyaga misol qilib [orta] so'ni
 oshimiz m-n. Graduonimya darajala
 katta -> orta - kichik
 Y-sh -> orta -> qari
 usaq -> orta -> yagoni

Writing with strong pressure indicates a person's emotional intensity and strong willpower.:

3. Jurnal untalni's surʼata kura-
 hunda seulgan nutqiy untal-
 tilik hodisasi 'organatli' el
 achiqalik hadisasi, vogeliq oq-
 bat ujabidagi nutqiy hadis-
 asi, badi 6-6 umu-
 miylik, mohiyat, imlosiyat,
 sebab, ujabidagi, litoniy,
 bilikni, 'organatni' subs koz-
 nali

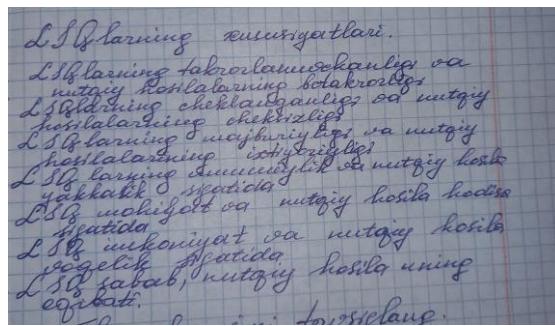
The spacing between letters. Indicates social distance: while smaller spacing implies closeness. larger spacing suggests a more distant relationship,

2. Grammatik shakuniga gapda kumin
 kategoriyasi manbi kumin qoshim-
 chalarining fagat öw' belan yoki
 bozilma bo'la kumin qoshimcha-
 lari ostasida ifodalonchi munken
 oshki tuda kumin qoshimchalarining
 quyidagi surʼon maydida:
 1) kumin kategoriyasining tarkibiy
 qimari seneviq yani qarshas bitta
 meʼadiy kerinminda bozilgan qoshimchalar,
 öqiy, kicayik, kicau.

3. Shki mustaqil so'ning biri ilkinchi-
 siga tobelanib bo'lganishidan esa bi-
 vilanau honl boladi. Soz bichmasi boli-
 shi uchun:
 1) har shki qism ham mustaqil so'rlardan
 berat bolishi;
 2) so'rlar ma'no jihatdan bi-biriga
 mos bolishi;
 3) so'rlar grammatik jihatdan toqri
 shallontirishni kerak.
 Masalan, ilmib qiz, gulning ifori...

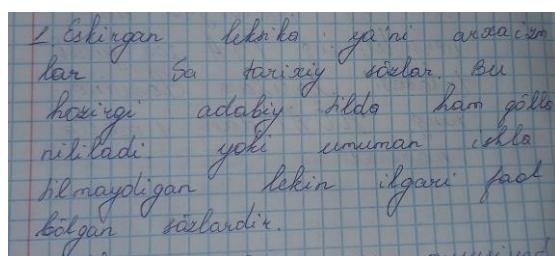
Spacing between words. The small distance between letters indicates openness and friendly communication, as well as an expression of deep and powerful intellect

and discipline:



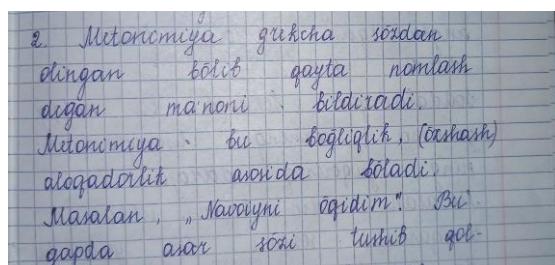
The presence of many empty spaces indicates a person with visual-metaphorical thinking who is imaginative. Their actions tend to be unclear, and they like to draw attention to themselves. Additionally, large empty

spaces can represent a fear of interacting with strangers.



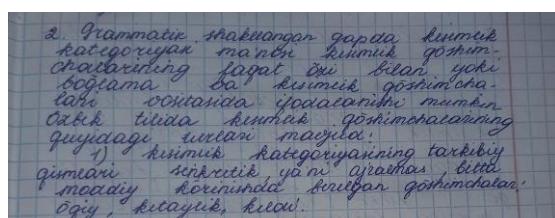
Line direction. The height, flatness, or downward inclination of handwriting is an indicator of one's mental state. This characteristic reveals emotionality and attitude towards others. The vertical alignment of

letters signifies self-respect, composure, and a calm character, as well as expressing restraint towards others:



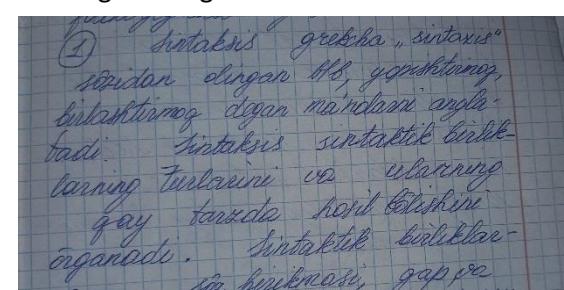
A slight right-leaning handwriting is a characteristic of gentle and kind-hearted individuals. The owner of such handwriting tends to be sensitive and prone to

emotions:



A strong rightward slant of handwriting is a sign of

constant mental strain:



General form of writing. The space occupied, direction, and order of the writing indicate whether the person is

organized or disorganized.

Handwriting technique. How the pen is held while

writing provides information about a person's inner balance and emotional state.

Spelling errors. Mistakes reveal a person's thinking style and level of attention.

Signature characteristics. The method of self-

representation expresses one's social position.

Using the above parameters, we will analyze the following writing sample:

1. Hozirgi özbek tili lug'at boyligi-dagi öz qatlonda qanday ma'mol leksemalar mayyed, özlashgan qatlonda chi?

2. Usual man/no nima?

3. Kontrar qarama-qarshilik hagi-da ma'lumot bering. Javoblar:

3. Kontrar qarama-qarshilik - da-rajalanuchi leksema qatoridagi tapayutning fargalariga, farqning ziddiyat, ya'ni qarama-qarshilikka ötil boishi natijasida birinchi azo bilan oxirgi aizonning antonimlashi. Masalar: kichik - orta - katta yosh - ösmir - ölla yosh - gari. Leksema loarning & kontrar qarama-qarshiligi darajalarish yozni gra-

| Parameters | Upper writing parameter | Description |
|-----------------------------------|----------------------------------|--|
| Writing size | Average, all letters are uniform | A sensitive person with the ability to think correctly and rationally. |
| Pressure (pencil pressure) | Light | An intelligent, romantic person, but with a weaker will, easily influenced by others, and lacking deep experience. |
| Spacing between letters | Average | Quickly and easily builds relationships with people, doesn't maintain distance. |
| Spacing between words | Average | A person with an orderly mindset, clear and firm intellect. |

| | | |
|---------------------------------|------------------|--|
| Pencil movement (rhythm) | Fast | Not particularly cautious. |
| Line direction | Vertical | Expresses self-respect, calm character, and composure towards others |
| Shape of letters | Calligraphic | A person with such handwriting is very sensitive and a wonderful family person. In life, they have no major difficulties or problems at work; everything continues without troubling adventures. Everyone loves to be friends with them. The shortcoming of the owner of such handwriting is insecurity, which compels them to seek help from someone who is capable of listening attentively and providing support. |
| Overall form of writing | Orderly and even | A person with the ability to think correctly and rationally, capable of anticipation. |
| Spelling errors | No errors | A broad-minded, well-educated, attentive person. |

General Summary: The owner of this handwriting is a knowledgeable, educated, intelligent person with a broad worldview, capable of correct and rational thinking, highly sensitive and attentive. They are a good friend in life, family-oriented, and romantic. Although they are considered a positive and calm individual who respects themselves and interacts calmly and gently with others, they sometimes exhibit negative traits such as carelessness, weak willpower, gullibility, easily falling into others' traps, having low self-confidence, and feeling a need for support.

Technical and software support for the examination process. Graphological examination is the process of identifying a person or examining documents based on

handwriting, the effectiveness of which depends on technical and software tools. Hardware and software play an important role in making the expertise accurate, fast, and reliable.

Technical support. The technical means used in conducting graphological examination include:

1. High-resolution microscopes: Used to observe lines in handwriting, pressure changes, and other small details. In graphological expertise, microscopes are a crucial tool for detecting small details and errors on the writing surface. The results of Gusev's research show that the high accuracy of technical means reduces errors in graphological examination by 30-40%.

2. Graphometric devices. Graphometric devices are

designed to measure the writing process and, according to Russian scientists, "are used to measure the geometric properties of handwriting, such as the direction of movement, the level of pressure, the speed and rhythm of movement." Pressure force: Measures changes in hand pressure during writing, which is important in analyzing a person's psychological state or writing style. Writing speed: measures the speed and rhythm of movement. Movement trajectory: records the exact trajectory of hand movement, which helps to identify errors in writing and cases of imitation. We can list the following as graphometric devices:

3. Digital scanners and high-resolution cameras. In 3D scanning, there are methods that record changes in writing pressure in three dimensions. This clearly shows the pressure level and thickness of the writing. High-resolution photographs of the writing are taken using micro or macro cameras, which are subsequently used in graphical analysis programs. According to Smith's conclusions, digital scanners and cameras allow for high-precision digitization of documents, facilitating their more detailed analysis and archiving.

4. Additional technical tools. These include ultraviolet and infrared lamps and xerographic analyzers. Ultraviolet and infrared lamps are used to detect special erasures or rewrites in a document. Xerographic analyzers examine the layers in the writing and determine when and how the text was altered.

Microscopes and technical devices used in graphological expertise allow for high-precision visualization of the writing surface and identify the specific characteristics of the writing process. Stereomicroscopes and graphometric devices reveal fine details and pressure variations in the writing, making identification more accurate. Digital scanners and high-resolution cameras serve to transfer the writing to a computer in a precise digital format.

Software for Graphological Expertise. The role of software in the field of graphological expertise is increasingly growing. The following software tools are widely used:

Graphological Analysis Programs: For example, GraphologistPro or FORSYS programs are used to automatically identify features in the writing, compare them, and expedite the expertise process.

Artificial Intelligence and Machine Learning Models: Artificial intelligence algorithms are being applied for automatic handwriting recognition and person identification. These programs enable the identification of individuals with high accuracy based on handwriting characteristics. According to the results of research led by Lee, artificial intelligence-based programs have achieved handwriting recognition

accuracy of over 90%, proving competitive when compared to the results of human experts. Artificial intelligence and machine learning models perform the following tasks in handwriting analysis:

1. Automatic handwriting recognition and classification. AI and ML models allow for the identification and analysis of complex features in handwriting - direction of movement, pressure, rhythm, speed of movement, shapes, and trajectories - in digital format. For example, convolutional neural networks (CNNs) are effective in detecting the visual characteristics of handwriting, classifying writings, and demonstrating high accuracy in person identification.

2. Analysis of biometric characteristics. Digital signature and biometric analysis software are used to analyze the biometric characteristics of handwriting, such as pressure, movement speed, and trajectory, to detect fraud. Zhang and Miller note that biometric parameters such as pressure, speed of movement, and trajectory are determined during the writing process. These parameters enable high accuracy in identifying individuals and detecting cases of fraud. Additionally, in their research, Zhang and Miller presented practical examples demonstrating the effectiveness of biometric analysis in fraud detection. Machine learning algorithms perform deep analysis of these biometric data and make fewer errors compared to traditional expert examination.

3. Detection of anomalies and fraud. Anomalies in handwriting - sharp changes in pressure, distortion of form, interruption of rhythm - are automatically detected using AI. This enables quick identification of fraud and falsification cases. In a study titled "Siamese-based neural network for offline writer identification based on word-level data" (2022), co-authored by V. Kumar and S. Sindaram, the use of deep learning technologies was recommended to detect falsification in writing. An article "Artificial Intelligence-Based Handwriting Recognition Systems: Modern Approaches and Practical Applications," co-authored by H. Lee, S. Kim, and J. Park, published in 2021, reported that AI algorithms achieve handwriting recognition accuracy of over 95%.

4. Data archiving and comparison. Using ML models, numerous handwriting samples can be efficiently stored, searched, and compared in a large database. This significantly accelerates the expertise process.

Modern technical equipment and software are necessary for conducting high-quality graphological examinations. Microscopes, graphometric devices, digital scanners, and advanced software accelerate the examination process, increase accuracy, and reduce errors. In particular, the introduction of artificial

intelligence technologies will lead to revolutionary changes in the field. Artificial intelligence and machine learning ensure that handwriting examinations become more sophisticated, faster, and more reliable. When these technologies are used in conjunction with traditional methods, they can take examinations to a new level.

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