

Predicting the hand-written text features through big five personality traits

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- **Abstract:**

Handwriting is one of the unique characteristic to represent what is in our minds, to communicate with others. Handwriting shows the true personality including behaviour, emotional outlay, self-esteem, anger, imagination, honesty, fears, defences and many other personality traits. It is commonly known as Graphology. Graphology is the scientific method for recognizing, assessing and to understand writer's personality through the shapes and word patterns in the handwriting. The graphologist has an essential role in disclosing the hidden personality characteristics of handwriting. They also work on signature and tell about writer's financial condition. Apart from general reading of handwriting, there are many things to be examined like- pressure of pen, upward-downward strokes, degree of writing, slant writing, which shows the mental and physical state, loyalty, jealousy, altruistic nature, resentment, and so many things. Personality can be identified through more than 2000 handwriting features such as alphabet, penmanship, movement, speed, form and continuity, shapes and loops, etc. Handwriting analysis has wide application in the various fields such as psychology, medical diagnosis, recruitment of staff, mate selection, career counselling, writer identification, forensics studies etc. For this study we have used only five features of handwriting as zone, baseline, slant, size, 't' bar and margin for analysis. Big 5 Inventory (BFI) is a psychological test to measure five main dimensions of personality like extraversion, agreeableness, conscientiousness, neuroticism and openness. Further the test measures around thirty characteristics of the personality like ideas (curious), fantasy (imaginative), aesthetics (artistic), action (wide interests), feelings (excitable), values (unconventional), competence (efficient), etc. This paper provides an outline of handwriting analysis and Big 5 Inventory; it's all related to personality traits, a psychological study of the existing paper on handwriting analysis. For this research, the sample of students from standard 9 and standard 10 (N=60 in which 30 boys and 30 girls) is taken from C D Gandhi English medium school, Kapadwanj. Result shows that there is no significant difference between big 5 test analysis and handwriting traits for measures the personality characteristics. Results of Big5 inventory and Graphological personality evaluation are very nearer in co-relation method, $r= 0.93$ which is high co-relation between two methods. So, we can use the Graphology instead of psychological test to measure personality traits.

Keywords: handwriting analysis, big five inventory

• Introduction:

Handwriting is one of the unique characteristic to represent what is in our minds, to communicate with others. Handwriting shows the true personality including behaviour, emotional outlay, self-esteem, anger, imagination, honesty, fears, defences and many other personality traits. It is commonly known as Graphology. Graphology is the scientific method for recognizing, assessing and to understand writer's personality through the shapes and word patterns in the handwriting. Personality can be identified through various handwriting features such as zone, baseline, slant, size, spacing, margin, pressure etc. Handwriting analysis has wide application in the various fields such psychology, medical diagnosis, recruitment of staff, mate selection, career counselling, writer identification, forensics studies etc. Handwriting is a well-known way of communication and expression for humans. It's been recently found that handwriting has a strong correlation with working of the brain and the psychological side of humans. (Groot, et al., 2009) shows the study of human personality by writing. Graphology is a projective test of personality that gives knowledge of temperament, genetic factors contributing to a person's behaviour, biological foundation, and character. (James, et al., 2012) show the relationship between handwriting in neuromuscular and the effects of various factors like aging and health problems, on handwriting variability. Handwriting is a motor ability that we tend to lose when it comes to neurological disorders. Parkinson disease, depression among many other psychological disorders, is quickly detected through handwriting analysis. Therefore, it is an effective and good predictor of behaviour and personality and a useful method for many organizational processes, such as recruiting, interviewing and selection, team foundation, counselling, and career based planning. At least 300 different handwriting features are used in the science of graphology in its investigative approach. The National Pen Company in U.S., in a research, stated that, a person's handwriting can give away clues about 5,000 different personality traits based on the way the person spaces letters, how the person signs his or her name, and even how the letters are connected.

Big 5 Inventory (BFI) is a psychological test to measure five main dimensions of personality like extraversion, agreeableness, conscientiousness, neuroticism and openness. Further the test measure around thirty characteristics of the personality like ideas (curious), fantasy (imaginative), aesthetics (artistic), action (wide interests), feelings (excitable), and values (unconventional). Typically, on this scale, people are rated based on the dichotomy: consistent vs. curious, competence (efficient), order (organized), dutifulness (not careless), achievement striving (through), self discipline (not lazy), and deliberation (not impulsive). On this scale, people are rated based on the dichotomy: organized vs. careless, Gregariousness (Sociable), assertiveness (forceful), activity (energetic), excitement-seeking (adventurous), positive emotions (enthusiastic) and warmth (out going). On this scale, people are rated on the dichotomy: outgoing vs. solitary, trust (forgiving), straightforwardness (not demanding), altruism (warm), compliance (not stubborn), modesty (not show-off), tender mindedness (sympathetic). On this scale, people are rated based on the dichotomy: compassionate vs. detached, anger and anxiety, as well as a vulnerability to depression. It measures: anxiety (tense), angry hostility (irritable), depression (not connected), self-consciousness (shy), impulsiveness (moody), vulnerability (not self confident). On this scale, people are rated based on the dichotomy: nervous vs. confident.

- **Purpose of present study:**

The purpose of the present study is to find out the co-relationship between handwriting analysis and big five inventory.

- **Hypothesis:**

1. There is no significant difference between big five inventory and handwriting analysis to measure personality characteristics.
2. There is no significant difference between big five inventory and handwriting analysis to measure personality characteristics of boys and girls of standard 9 and standard 10.

- **Tools:**

1. Big Five Inventory John, O. P., & Srivastava, S. (1999). The Big-Five trait taxonomy: History, measurement, and theoretical perspectives.
2. Hand writing analysis (Analysis by Dr. Javnikha Sheth, Graphologist)

- **Data collection:**

-Data (N=60) is taken from C D Gandhi English medium school, Kapadwanj is categories as under:

	boys	girls
standard 9	15	15
standard 10	15	15
total	30	30
	N=	60

Further the data is divided into several parameters are required to be considered. We take into account these parameters such as:

1	Age	Age group between 13 to 16 years		
2	Gender	30 boys and 30 girls		
3	Education	standard:9 and standard:10		
4	Handedness	Right handed	26 boys	28 girls
		Left handed	04 boys	02 girls
5	Big 5 test	44 statements with 5 point scale		

- **Procedure:**

The researcher has taken the permission from the principal to go in the class for data collection. This study prepared a novel dataset that contains a clean writing text and personality score of each writer. A controlled experiment is conducted in collecting the writing samples and personality traits of participants. Participants are first asked to write the given notes in English language alphabets, then they requested to fill the Big 5 scale. It will all take around one hour of the students.

Please write in your handwriting; you can use backside of paper also:

1. Knowledge is something that will serve you your whole life. The most powerful thing in the world is knowledge because it can create and destroy life on earth. Moreover, knowledge helps us distinguish between human and animals. Knowledge is the ability to use your knowledge to help other.
2. The quick brown fox jumps over the lazy dog.

- **Test Measures:**

1. Big 5 inventory (BFI):

Big Five (Five-Factor Model) is a well-known model for describing the personality of an individual. 44 items inventory that measures an individual on the Big Five Factors of personality (Goldberg, 1993). Each of the factors is then further divided into personality facets. It is based on five basic personality traits which are grouped in sub-factors, as follows:

Openness to Experience: refers to people who can easily express their emotions and have a desire for adventure, appreciation for art, and out-of-the-box ideas. It measures: ideas (curious), fantasy (imaginative), aesthetics (artistic), action (wide interests), feelings (excitable), and values (unconventional). Typically, on this scale, people are rated based on the dichotomy: consistent vs. curious

Conscientiousness: refers to people who are dependable, have a predilection towards behaviours which are carefully planned, and are oriented towards results and achievements. It measures: competence (efficient), order (organized), dutifulness (not careless), achievement striving (through), self discipline (not lazy), and deliberation (not impulsive). On this scale, people are rated based on the dichotomy: organized vs. careless

Extraversion: refers to people who easily express positive emotions, like other's people company, are assertive, and talkative. It measures: Gregariousness (Sociable), assertiveness (forceful), activity (energetic), excitement-seeking (adventurous), positive emotions (enthusiastic) and warmth (out going). On this scale, people are rated on the dichotomy: outgoing vs. solitary

Agreeableness: refers to people who have a tendency to be compassionate instead of suspicious, as well as helpful, and tempered. It measures: trust (forgiving), straightforwardness (not demanding), altruism (warm), compliance (not stubborn), modesty (not show-off), tender mindedness (sympathetic). On this scale, people are rated based on the dichotomy: compassionate vs. detached

Neuroticism: refers to people who lack emotional stability and control and tend to experience negative emotions easily, such as anger and anxiety, as well as a vulnerability to depression. It measures: anxiety (tense), angry hostility (irritable), depression (not connected), self-consciousness (shy), impulsiveness (moody), vulnerability (not self confident). On this scale, people are rated based on the dichotomy: nervous vs. confident.

2. Handwriting Analysis:

a) Letter Slant:

The slant of the letter is used to understand whether an individual's handwriting is inclined towards the right or towards the left or is it vertical. It has been observed that, around 77 percent of individuals write with a right slant, 15 percent with left slant and remaining 8 percent write vertically. The slant of handwriting is in relation to an individual's emotional direction and degree of sentimental control. The writer's connection between the inner and outer world is indicated by means of the slant of the letters.

Table 1: Slant Characteristics

No	Slant	Corresponding trait
1	Extreme left	Fear of the future, defensive , early rejection
2	Extreme right	Lack of self-control, impulsive, unrestrained, intense, very expressive, low frustration tolerance.
3	Left	Reflective, independent, not sympathetic, difficulty in adapting and expressing emotions
4	Right	Expressive, confidence in convictions, freedom of thought, extrovert, future orientation.
5	Vertical	Head controls over heart, independent emotional nature, and works independently

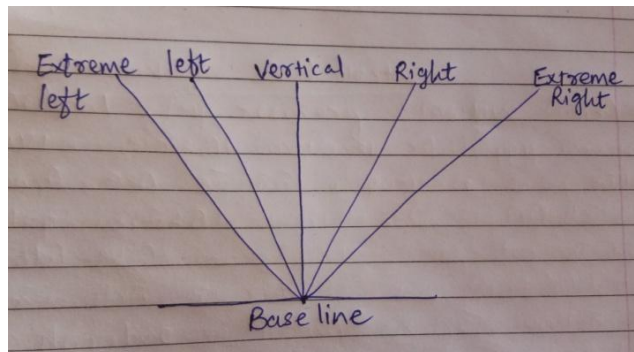


Fig. 1: Position of slant

b) Position of 't' bar :

Another important feature that reveals lot of accurate information about the writer is the lower-case letter 't'. There are different ways in which a lowercase 't' can be written. This paper would be specifically focusing on the height of the t-bar. The t-bar can cut the stem of the letter 't' at different positions like the lower-portion, mid-portion, upper-portion of the stem or not cut the stem at all. Different characteristics traits of a writer can be identified depending on where the writer crosses the t-bar. These personality traits are mentioned in the table below.

Table 2: 't' Bar Characteristics

No	Position of 't' bar	Corresponding trait
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1	Crossed very high(but not above the stem)	High self-esteem: This reveals confidence, ambition, and the ability to plan ahead, high goals, high personal expectations and an overall good self-image
2	Crossed just above the middle zone	Moderate self-esteem: It indicates a practical and successful person.
3	Crossed very low on the stem	Low self-esteem: This person fears failure and resists change. He is rarely successful enough in his own eyes despite his accomplishments and resists change.
4	Crossed above the stem	Dreamer: This person's goals and dreams lose touch with reality.

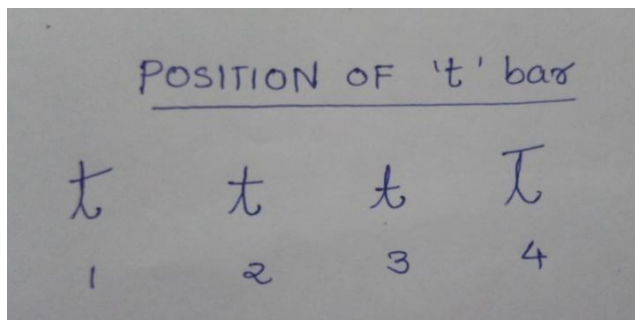


Fig. 2: Position of 't' Bar

c) Margin:

The margin is generally considered to define the layout of the page. Any individual assumes a particular margin while writing on a blank paper. The blank spaces on the left, right, top and bottom on a page comprises the margin. In this paper, different types of left and right margins namely- wide right, wide left, no margin at all and evenly spaced margin will be considered. Following are the characteristic personality traits of individuals associated with the above mentioned types of margin.

Table 3: Margin Characteristics

No	Margin Orientation	Corresponding trait
1	Wide left	Courageous.
2	Wide right	Avoids future and a reserved person.
3	No margin	Insecure and devotes oneself completely.
4	Even margin	Self disciplined and balanced.



Figure 3. Different types of margin

d) Zones:

The handwriting is partitioned into three parts called upper part, middle part, and lower part as shown in Fig.1. The Personality can be identified by analysing these three zones. The sections of the three zones are used to define the balance between the three major areas of ego development of the writer: the intellectual and spiritual sphere of the individual, everyday activities and the unconscious intuitive drives.

Table 4: Zone Characteristics

No	Zone	Corresponding trait
1	Upper Zone	Future, upper body, conscious spiritual, intellectual and cultural aspirations, mental perceptions, concepts, fantasy.
2	Middle Zone	Present, middle body, realistic, practical and social expression of the ego, emotional expression.
3	Lower Zone	Past, Lower body, memory, unconscious drives, sensual perception, basic drives, unconscious drives and biological needs.

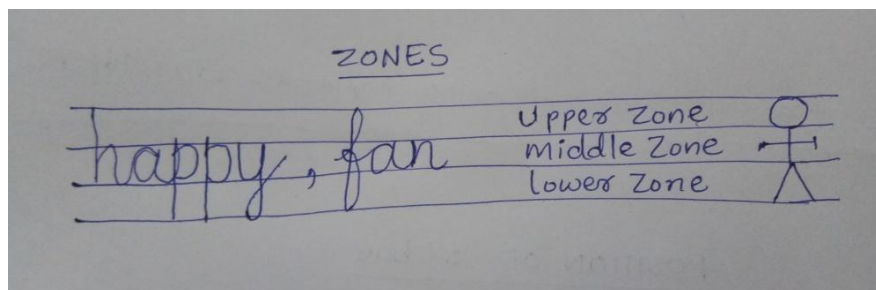


Figure 4. Different types of zones

e) Baseline

The baseline can be ascending, descending, straight, as shown in Fig.2. Baseline is used to find the emotional outlay and nature of the writer. Ascending baseline represents the person is Optimistic, Hopefulness & cheerfulness, Stay Busy and Active, Excitability, choleric behaviour. Descending baseline shows that the person is pessimistic, mental tiredness of a temporary nature and has digestive trouble. Straight baseline shows that the person has stable outward behaviour, straightness, realism, and disciplined.

Table 5: Baseline Characteristics

No	Baseline	Corresponding trait
1	Ascending Baseline	cheerfulness, positivity, confidence, optimism, enthusiasm
2	Descending Baseline	pessimistic,
3	Straight Baseline	discipline, satisfaction, lack of ambitious imagination

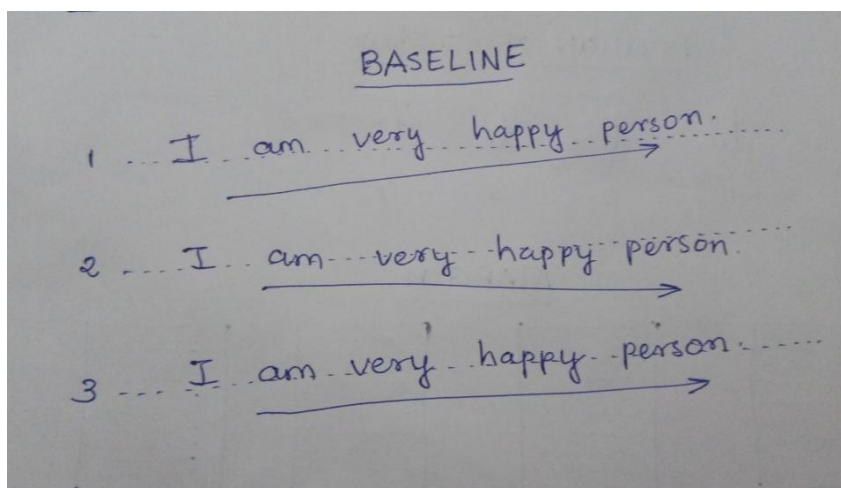


Figure 5. Different types of baseline

- **Results:**

- Most common results with handwriting analysis and Big five test:

Table: 6 Correlation between the handwriting features and the Big Five personality types

no	Big Five personality type	Most present three handwriting features, signature style and traits
1	Openness to Experience	Lowercase letter “t”: balanced Word Slant: Medium Right Slant Upper zone writing wide left margin
2	Conscientiousness	Word Slant: Extreme Left Slant Baseline: descending, Lowercase letter “t”: cross-like Mix zone writing
3	Extraversion	Baseline: Ascending Word Slant: Extreme Right Slant Middle zone writing Wide right margin
4	Agreeableness	Word Slant: Extreme Left Slant Lowercase letter “t”: very low Lower zone writing Even margin
5	Neuroticism	Baseline: levelled Lowercase letter “t”: angular point Lower zone writing No margin or very less margin

Table: 7 Distribution of raw data of big five inventory (BFI)

Big five measure	Standard:9		Standard:10		Total
	Boys	Girls	Boys	Girls	

Openness to Experience	3	3	3	2	11
Conscientiousness	3	2	4	1	10
Extrovert	5	7	4	9	25
Agreeableness	2	3	3	2	10
Neuroticism	2	0	1	1	04
Total					60

Table:8 Distribution of raw data of Handwriting analysis traits

Handwriting analysis	Standard:9		Standard:10		Total
	Boys	Girls	Boys	Girls	
1. Lowercase letter “t”: balanced Connecting Strokes: Medium Connectivity Word Slant: Medium Right Slant	3	2	3	3	11
2. Word Slant: Extreme Left Slant Baseline: descending, Lowercase letter “t”: cross-like	3	3	3	2	11
3. Connecting Strokes: weak connectivity Baseline: Ascending Word Slant: Extreme Right Slant	7	5	4	8	24
4. Connecting Strokes: strongly connected Word Slant: Extreme Left Slant Lowercase letter “t”: very low	2	3	2	2	09
5. Baseline: levelled Word Slant: Moderate Right Slant, Lowercase letter “t”: angular point	2	1	1	1	05
Total					60

Table:9 Correlation between two methods:

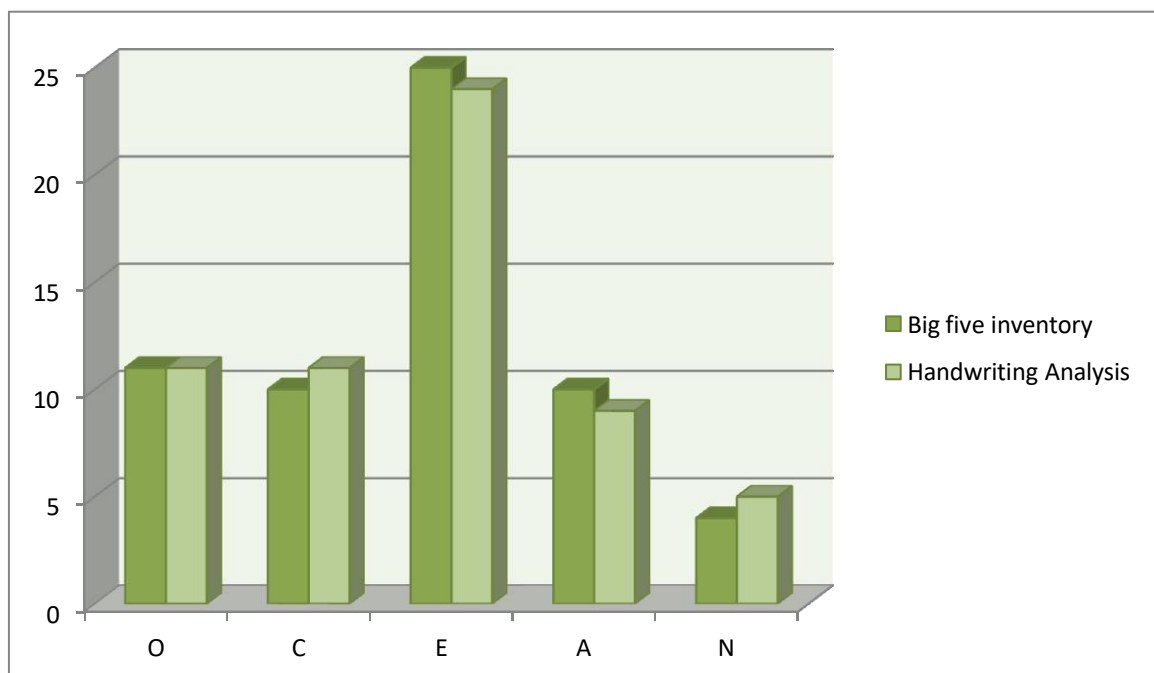
Big five test	Hand writing analysis	x	y	D	D ²
11	11	2	2.5	0.5	0.25
10	11	3.5	2.5	1.0	1.00
25	24	1	1	0.0	0.00
10	09	3.5	4	0.5	0.25
04	05	5	5	0.0	0.00
				Σ D ² =	1.50

$$r = 1 - \frac{\sum D^2}{N(N-1)}$$

$$\begin{aligned}
 r &= 1 - \frac{6 \sum D^2}{N(N^2-1)} \\
 &= \frac{\sum D^2}{N} = 1.5 \\
 &= N = 5 \\
 &= 1 - \frac{6 \times 1.50}{5(5^2-1)} \\
 &= 1 - \frac{9.0}{5(25-1)} \\
 &= 1 - \frac{9.0}{5(24)}
 \end{aligned}
 \quad
 \begin{aligned}
 &= 1 - \frac{9}{120} \\
 &= 1 - 0.075 \\
 &= 0.925 \\
 &= 0.93
 \end{aligned}$$

$r = 0.93$
 High Correlation

- Graphical analysis of both the tests:



- **Discussions:**

This work focuses on the mapping of features to the two famous personality theories, Big five inventory and handwriting analysis to give a detailed report without the manual flaws that could occur in the multiple choice based personality analysis systems. In big five inventory, there are multiple choice 44 questions with five point scale.

Table:6 shows that the co-relation between big five tests and handwriting analysis. The first parameter of big five inventory is openness to experience which relates as Lowercase letter “t”: balanced Word Slant-Medium Right Slant, upper zone writing, wide left margin in handwriting analysis. The second parameter of big five inventory is Conscientiousness which relates as word slant-extreme left slant baseline: descending, lowercase letter “t”: cross-like mix zone writing in handwriting analysis. The third parameter of big five inventory is extraversion which relates as baseline-ascending, word slant-extreme right slant, middle zone writing, wide right margin in handwriting analysis. The fourth parameter of big five inventory is agreeableness which relates as word slant- extreme left slant lowercase letter “t”- very low, lower zone, writing even margin in handwriting analysis. The fifth parameter of big five inventory is neuroticism which relates as baseline-levelled, lowercase letter “t”: angular point, lower zone writing, no margin or very less margin in handwriting analysis. This work includes limited physical features of handwriting are slant, ‘t’ bar, zone, margin and baseline. Table: 7 Distribution of raw data of big five inventory (BFI) shows raw data of boys and girls. Here, 11 students are openness to experience, 10 students are conscientiousness, 25 students are extrovert, 10 students are agreeableness and 4 students are neuroticism. Table: 8 Distribution of raw data of Handwriting analysis traits shows raw data of boys and girls. Here, 11 students are in first parameter, 11 students are in second parameter, 24 students are in third parameter, 09 students are in fourth parameter and 07 students are in fifth parameter. Table:9 Correlation between two methods shows the high co-relationship (0.93) between big five inventory and handwriting analysis. We can see the graphical information also that both methods have high co-relation values.

- **Conclusion:**

This study developed a novel model that utilized handwriting features for identifying an individual’s Big Five personality traits. This work focuses on the mapping of features to the two famous personality theories, big five inventory and handwriting analysis to give a detailed report without the manual flaws that could occur in the multiple choice based personality analysis systems. In multiple choice questions in big five inventory, the user might not be able to decide which the exact trait-resembling option is. This work includes limited physical features of handwriting. Extension of this work may include more features like different types of strokes, thickness of characters and pen pressure variation etc. Natural Language Processing may also be augmented to the present work, wherein the semantics of words used by the writer, would provide the analyzer with additional perspective.

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