Results of Interlab Proficiency Test No. 003 in Handwriting Analysis:

Comparison of methods for graphological measurement of personality traits I

Content

Methodology and objectives of ring trial 003

For the purpose of a method comparison for graphological personality trait measurement, the different manifestations of nine personality trait parameters derived from four different methods are compared in the present interlab proficiency test 003. The data are collected by means of questionnaire technique and graphologically from the manuscripts of 53 test persons. Questionnaires in Method 1 (M1) establish a self-image (S) with four personality trait parameters (internal security or S1, self-initiative or S2, conflict optimism or S3, flexibility or S4) of 53 test persons. Method 2 (M2) captures a external image (F) with five personality trait parameters (sensitivity or F1, conflict ability or F2, creativity or F3, balance or F4, integrity or F5) of an average of three foreign-assessors per self-assessor (a total of 152 colleagues and friends or relatives), also by means of questionnaires. A total of nine personality trait parameters are determined per test person. Written psychological personality trait measurement is carried out on the one hand by the classical-manual graphological determination (method 3 or M3) with a pool of eight graphologists and on the other hand by a software-based (method 4 or M4) with a graphologist, whereby the graphological methods must adhere to the definitions of the personality trait parameters from the two questionnaires (M1 and M2).

With the software-based method called GraphoPro® a graphologist assessed 235 standardised handwriting signs for each handwriting. Prior to this, another graphologist has formed handwriting sign groups that speak for the nine trait parameters to be investigated. Based on these, GraphoPro® calculates the value of each trait parameter. With GraphoPro®, detailed handwriting analyses are available at any time and can be used for further in-depth statistical investigations if required.

In the classical-graphological method, each of the eight graphologists received the definition of the nine trait parameters, including the questions that were asked of the self- and foreign-assessors, and estimated the parameters for each of the 53 test persons according to their knowledge and experience.

The difference between the two graphological personality trait measurements is that, depending on their training and experience, the eight graphologists analysed the personality trait parameters to be evaluated independently of each other, without specifying the corresponding handwriting signs, whereas the graphologist working with the GraphoPro® software, used a pre-defined system to evaluate the handwriting signs to the same extent at all times per handwriting and not the personality trait parameters.

The interlab proficiency test 003 thus not only demonstrates the relationship between questionnaire results and personality trait parameters collected by two different graphological methods, but also the relationship between classical-manual and software-based graphological personality trait measurement.

Furthermore, the differences between questionnaire-based assessments by friends and colleagues and the two graphological methods are investigated. Since these are groups with different degrees of homogeneity, different results are possible. Homogeneous are the group of self-assessors, foreign-assessors, the eight graphologists and the software. However, the group of foreign-assessors can also be considered as a heterogeneous group: These are people who know the self-assessors from different contexts of life (work or private life) and therefore do not have a homogeneous level of knowledge about the people they had to assess. In this respect, a distinction can be made between M2a (external assessments by friends) and M2b (external assessments by colleagues).

The method comparison in ring trial 003 therefore includes:

- Comparison of self-image (M1) with classical-manual graphological method (M3) or with software-based method (M4)
- Comparison of external image (M2) with classical-manual graphological method (M3) or with software-based method (M4)
- Comparison of external assessments by friends (M2a) with classical manual graphological method (M3) or with software-based method (M4)

- Comparison of external assessments by colleagues (M2b) with classical manual graphological method (M3) or with software-based method (M4)
- Comparison of classical-manual graphological method (M3) with software-based method (M4) regarding M1, M2, M2a and M2b.

Definition of the personality trait parameters used for method comparisons

Definition of the four self assessment parameters (S)

1. Parameter ”Inner security“ (S1): Interpersonal dependency, degree of self-confidence, own sovereignty.
2. Parameter ”Own initiative“ (S2): Strength of activity and drive from within, measure of joy and proactivity in the event of challenges.
3. Parameter ”Conflict optimism“ (S3): How positive and optimistic is one's own perception of conflicts?
4. Parameter ”Flexibility“ (S4): How important are variety and surprises? How important is the knowledge of what will happen to someone next?

Definition of the five external assessment parameters (F)

1. Parameter ”Empathy“ (F1): Attention and respectful perception of divergent views.
2. Parameter ”Conflict ability“ (F2): Ability to face possible conflicts and withstand resistances.
3. Parameter ”Creativity“ (F3): Finding alternatives for action and problem solving, reacting flexibly to different situations and conditions.
4. Parameter ”Balance“ (F4): Measure of prudent behaviour in stressful and burdening situations, degree of irritability.
5. Parameter ”Integrity“ (F5): Measure of loyalty and ambiguity tolerance.

Parameters F1-F5 were collected by questionnaire-based external assessments, parameters S1-S4 by questionnaire-based self assessments.

Short summary of results of interlab proficiency test 003

Before the results and conclusions are explained in detail in the following chapters of this evaluation, a brief summary of the results of the interlab proficiency test 003 is presented here.

- Graphological trait measurements with methods 3 and 4 achieve a higher agreement with the self assessments (M1) of the test persons (> 60% bzw. Kendalls $\tau_b \approx 0.2$) than with external assessments (M2) from a pool of colleagues and friends (> 50% bzw. Kendalls $\tau_b \approx 0.1$). This is evident throughout all method comparisons in a high degree of agreement in the categories rank deviations of 0, 0.5 and 1.0, which is however higher for the parameters of self assessment than for the external assessment parameters. This is also reflected in the rank correlation coefficient according to Kendall.
- In the case of trait parameter ”conflict ability“ that contains clearly judging aspects as it is socially desirable, the agreement between questionnaire results M2, M2a and M2b (all kinds of foreign assessment) and the graphological methods M3 or M4 is lower. A glance at the raw data reveals that the graphological methods evaluate conflict ability on average less than the foreign assessors.
- If one compares the two graphological methods (M3 and M4) with the two different groups ”external assessments by friends“ (M2a) and “external assessments by colleagues“ (M2b), the results differ

considerably: The software-based trait measurements (M4) achieve a higher agreement with ”external assessment by friends“, the classical-manual graphological method (M3) on the other hand, a higher agreement with the group ”external assessment by colleagues“ (M2a). This is not reflected in the rank correlation coefficients according to Kendall.

- The software-based method (M4) achieves comparable results as the classical-manual graphological method (M3) and the agreement is high for both measuring methods used (Kendall and percental rank comparison agreement).

How these conclusions are derived is outlined below.

Measurement methods used for method comparison

For the method comparison, on the one hand, percental rank comparison agreement and on the other hand, the rank correlation coefficient according to Kendall were used as measuring methods.

Ranking correlation coefficient according to Kendall

For the calculation of the rank correlation coefficient according to Kendall, the ranks of the variable series to be compared are formed (e. g. method 1 with method 3 for scale S1 of all relevant subjects). Subsequently, the data is sorted according to the ranks of one of the two data series (e. g. method 1) from the smallest to the largest rank and then checked to what extent the second data series (e. g. method 3) has "sorted" itself. After sorting, the first rank pair (x_i and x_j) of the first data series is compared with the same rank pair (y_i und y_j) of the second data series. If the two data series show that the ranks move in the same direction, i. e., $x_i < x_j$ und $y_i < y_j$, then this pair is evaluated as "concordant". If, on the other hand, the opposite occurs, $x_i < x_j$ und $y_i > y_j$, this pair is considered to be "discordant". If the first or second data series has the same rank ($x_i = x_j$ bzw. $y_i = y_j$), this is called a binding. In the Interlab proficiency test 003, the below mentioned formula for Kendall's τ_b was used due to the fact that bonds are present in both data series. This means that pairs to which $x_i = x_j$ und $y_i = y_j$ apply simultaneously are not taken into account in the formula. In contrast, the same ranks in one of the two data series ($x_i = x_j$ oder $y_i = y_j$) are taken into account in the formula with "extra**y**" or "extra**x**". This results in the following calculation formula, which was used for all calculated values when using statistics software:

$$\text{Kendalls } \tau_b = \frac{\text{concordant} - \text{discordant}}{\sqrt{\text{concordant} + \text{discordant} + \text{extray}}\sqrt{\text{concordant} + \text{discordant} + \text{extrax}}}$$

If Kendall’s τ is positive, there are more concordant couples than discordant, while Kendall's τ is negative, there are more discordant couples than concordant. A value of +1 would therefore mean that there is a maximum rank correlation in both data series, whereas a value of -1 would mean that there is no rank correlation at all in both data series.

Kendall's rank correlation coefficient τ_b was used because this way all value pairs can be compared to each other, not only the two values of a pair.

Percental rank comparison agreement

In addition to Kendall's rank correlation coefficients, the rank distributions of the nine trait parameters per test person were sorted separately according to methods 1 and 2 (self-image and external image) according to the following scheme in order to calculate the percental rank comparison agreement: From the trait parameter with the highest value per method (maximum of 4 for self assessment parameters and 5 for external assessment parameters) to the trait parameter with the lowest value (1). Afterwards,

it was calculated how closely the ranks per test person and parameter match or deviate from each other when comparing two methods.

The following is an example with real values to illustrate the procedure. The following table shows the rankings of test person 1 differentiated according to external image (F1-F5 in lines 2-6) and self-image (S1-S4 in lines 7-10) in three methods (M1, M4 and M3 in columns 3-5). If you compare, for example, the rank M1 with M4 in the trait parameter F1, you get a difference of 0.0 in column 6/line 2. Both methods thus assign the same rank. In the example, the columns (6 to 8) with a light grey background show the differences in ranking between the different methods.

Test person	Parameter	Rank M1 & M2 (questionnaire)	Rank M4 (GraphoPro®)	Rank M3 (Graphologists)	Absolute difference M1/M2 to M4	Absolute difference M4 to M3	Absolute difference M1/M2 to M3
1	**F1**	3,5	3,5	3,0	0,0	0,5	0,5
1	**F2**	3,5	1,0	1,0	2,5	0,0	2,5
1	**F3**	5,0	5,0	2,0	0,0	3,0	3,0
1	**F4**	2,0	2,0	4,0	0,0	2,0	2,0
1	**F5**	1,0	3,5	5,0	2,5	1,5	4,0
1	**S1**	3,0	2,0	4,0	1,0	2,0	1,0
1	**S2**	4,0	3,0	3,0	1,0	0,0	1,0
1	**S3**	1,5	1,0	1,0	0,5	0,0	0,5
1	**S4**	1,5	4,0	2,0	2,5	2,0	0,5

A ranking difference of 0 has to be evaluated differently than a ranking difference of e. g. 2. In the present ring trial test, the following ranking agreements or deviations are possible and were calculated by means of the percental rank comparison agreement. For the self assessment parameters per method:

1. Rank difference 0 or ranking match
2. Deviation from 0.5 and 1.0 ranks (low)
3. Deviation from 1.5 and 2.0 ranks (average)
4. Deviation from 2.5 and 3.0 ranks (high)

For the external assessment parameters per method:

1. Rank difference 0 or ranking match
2. Deviation from 0.5 and 1.0 ranks (low)
3. Deviation from 1.5, 2.0 and 2.5 ranks (average)
4. Deviation from 3.0, 3.5 and 4.0 ranks (high)

Half ranks occur when two trait parameters have the same value. The ranking intervals are not continuous, but have a clear classification in intervals of 0.5.

In addition, for the nine trait parameters and the respective measurement method (self-image and external image, GraphoPro® and graphologists) it was determined how many values are available per category mentioned above (four categories for self assessment or external assessment parameters

from ranking match to max. deviation) and this value was in each case proportionate to the total sample in order to obtain a percentage ranking comparison agreement.

The procedure described above is illustrated below using an example with real values for the parameter "flexibility" using the method comparison of M4 (GraphoPro®) and M1 (self-image) in a total sample of 53 test persons:

Parameters and degree of rank agreement	GraphoPro & questionnaire test (M1 and M4) in absolute values	GraphoPro & questionnaire test (M1 and M4) in %
S4: Flexibility Deviation: 0.0 Ranks	19	35,85 %
S4: Flexibility Deviation: 0.5 and 1.0 Ranks	15	28,30 %
S4: Flexibility Deviation: 1.5 and 2.0 Ranks	11	20,75 %
S4: Flexibility Deviation: 2.5 and 3.0 Ranks	8	15,09 %
Total absolute and in percent	53	100,00 %

Detailed presentation of the results of the interlab proficiency test 003

The results of the three method comparisons (M1/M2 with M4, M1/M2 with M3, M3 with M4) per measured trait parameter are shown in the following table as follows: First of all the results of percental rank comparison agreement per parameter is presented for each of the four categories in the white lines. Then the result of the ranking correlation coefficients according to Kendall is presented in the gray line (per parameter).

Parameters and method comparison	Comparison questionnaire test (M1/M2) & GraphoPro (M4)	Comparison questionnaire test (M1/M2) & graphologists (M3)	Comparison Graphologists (M3) & GraphoPro (M4)
S1 to S4 (all four self assessment parameters) Percental rank agreement: Deviation 0 ranks	23,11 %	26,89 %	49,06 %
S1 to S4 (all four self assessment parameters) Percental rank agreement: Deviation 0.5 and 1.0 ranks	44,34 %	42,92 %	40,09 %
S1 to S4 (all four self assessment parameters) Percental rank agreement: Deviation 1.5 and 2.0 ranks	21,70 %	22,64 %	10,85 %
S1 to S4 (all four self assessment parameters) Percental rank agreement: Deviation 2.5 and 3.0 Ranks	10,85 %	7,55 %	0,00 %
Ranking correlation coefficient according to Kendall for S1 to S4	0,17	0,21	0,55
F1 to F5 (all five external assessment parameters for Friends/ Colleagues) Percental rank agreement: Deviation 0 Ranks	14,34 %	14,34 %	32,83 %

Parameters and method comparison	Comparison questionnaire test (M1/M2) & GraphoPro (M4)	Comparison questionnaire test (M1/M2) & graphologists (M3)	Comparison Graphologists (M3) & GraphoPro (M4)
F1 to F5 (all five external assessment parameters for Friends/ Colleagues) Percental rank agreement: Deviation 0.5 and 1.0 Ranks	40,75 %	41,51 %	40,00 %
F1 to F5 (all five external assessment parameters for Friends/ Colleagues) Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	25,28 %	26,79 %	21,51 %
F1 to F5 (all five external assessment parameters for Friends/ Colleagues) Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	19,62 %	17,36 %	5,66 %
Ranking correlation coefficient according to Kendall for F1 to F5	0,06	0,12	0,53
F1 to F5 Friends (all five external assessment parameters) Percental rank agreement: Deviation 0 Ranks	13,00 %	14,00 %	34,00 %
F1 to F5 Friends (all five external assessment parameters) Percental rank agreement: Deviation 0.5 and 1.0 Ranks	52,00 %	40,00 %	41,00 %
F1 to F5 Friends (all five external assessment parameters) Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	18,00 %	28,00 %	17,00 %
F1 to F5 Friends (all five external assessment parameters) Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	17,00 %	18,00 %	8,00 %
Ranking correlation coefficient according to Kendall for F1 to F5 Friends	0,00	0,00	0,49
F1 to F5 Colleagues (all five external assessment parameters) Percental rank agreement: Deviation 0 Ranks	15,15 %	15,15 %	32,12 %
F1 to F5 Colleagues (all five external assessment parameters) Percental rank agreement: Deviation 0.5 and 1.0 Ranks	33,94 %	41,82 %	39,39 %
F1 to F5 Colleagues (all five external assessment parameters) Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	29,09 %	26,06 %	24,24 %
F1 to F5 Colleagues (all five external assessment parameters) Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	21,82 %	16,97 %	4,24 %
Ranking correlation coefficient according to Kendall for F1 to F5 Colleagues	0,10	0,16	0,55
S1: Inner security Percental rank agreement: Deviation 0 Ranks	15,09 %	20,75 %	43,40 %
S1: Inner security Percental rank agreement: Deviation 0.5 and 1.0 Ranks	45,28 %	41,51 %	45,28 %
S1: Inner security Percental rank agreement: Deviation 1.5 and 2.0 Ranks	26,42 %	28,30 %	11,32 %
S1: Inner security Percental rank agreement: Deviation 2.5 and 3.0 Ranks	13,21 %	9,43 %	0,00 %
Ranking correlation coefficient according to Kendall for S1 Inner security	-0,01	0,11	0,43
S2: Own initiative Percental rank agreement: Deviation 0 Ranks	22,64 %	30,19 %	39,62 %
S2: Own initiative Percental rank agreement: Deviation 0.5 and 1.0 Ranks	49,06 %	45,28 %	47,17 %
S2: Own initiative Percental rank agreement: Deviation 1.5 and 2.0 Ranks	24,53 %	22,64 %	13,21 %

Parameters and method comparison	Comparison questionnaire test (M1/M2) & GraphoPro (M4)	Comparison questionnaire test (M1/M2) & graphologists (M3)	Comparison Graphologists (M3) & GraphoPro (M4)
S2: Own initiative Percental rank agreement: Deviation 2.5 and 3.0 Ranks	3,77 %	1,89 %	0,00 %
Ranking correlation coefficient according to Kendall for S2 Own initiative	0,11	0,27	0,51
S3: Conflict optimism Percental rank agreement: Deviation 0 Ranks	18,87 %	20,75 %	54,72 %
S3: Conflict optimism Percental rank agreement: Deviation 0.5 and 1.0 Ranks	54,72 %	50,94 %	30,19 %
S3: Conflict optimism Percental rank agreement: Deviation 1.5 and 2.0 Ranks	15,09 %	18,87 %	15,09 %
S3. Conflict optimism Percental rank agreement: Deviation 2.5 and 3.0 Ranks	11,32 %	9,43 %	0,00 %
Ranking correlation coefficient according to Kendall for S3 Conflict optimism	0,16	0,17	0,36
S4: Flexibility Percental rank agreement: Deviation 0 Ranks	35,85 %	35,85 %	58,49 %
S4: Flexibility Percental rank agreement: Deviation 0.5 and 1.0 Ranks	28,30 %	33,96 %	37,74 %
S4: Flexibility Percental rank agreement: Deviation 1.5 and 2.0 Ranks	20,75 %	20,75 %	3,77 %
S4: Flexibility Percental rank agreement: Deviation 2.5 und 3.0 Ranks	15,09 %	9,43 %	0,00 %
Ranking correlation coefficient according to Kendall for S4 Flexibility	0,17	0,14	0,73
F1 Friends/Colleagues: Empathy Percental rank agreement: Deviation 0 Ranks	16,98 %	5,66 %	33,96 %
F1 Friends/Colleagues: Empathy Percental rank agreement: Deviation 0.5 and 1.0 Ranks	43,40 %	52,83 %	39,62 %
F1 Friends/Colleagues: Empathy Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	20,75 %	24,53 %	22,64 %
F1 Friends/Colleagues: Empathy Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	18,87 %	16,98 %	3,77 %
Ranking correlation coefficient according to Kendall for F1 Empathy Friends/Colleagues	0,18	0,17	0,56
F2 Friends/Colleagues: Conflict skills Percental rank agreement: Deviation 0 Ranks	15,09 %	15,09 %	35,85 %
F2 Friends/Colleagues: Conflict skills Percental rank agreement: Deviation 0.5 and 1.0 Ranks	26,42 %	28,30 %	39,62 %
F2 Friends/Colleagues: Conflict skills Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	22,64 %	32,08 %	18,87 %
F2 Friends/Colleagues: Conflict skills Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	35,85 %	24,53 %	5,66 %
Ranking correlation coefficient according to Kendall for F2 Conflict skills Friends/Colleagues	-0,02	0,10	0,43
F3 Friends/Colleagues: Creativity Percental rank agreement: Deviation 0 Ranks	18,87 %	15,09 %	26,42 %

Parameters and method comparison	Comparison questionnaire test (M1/M2) & GraphoPro (M4)	Comparison questionnaire test (M1/M2) & graphologists (M3)	Comparison Graphologists (M3) & GraphoPro (M4)
F3 Friends/Colleagues: Creativity Percental rank agreement: Deviation 0.5 and 1.0 Ranks	41,51 %	47,17 %	52,83 %
F3 Friends/Colleagues: Creativity Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	22,64 %	24,53 %	13,21 %
F3 Friends/Colleagues: Creativity Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	16,98 %	13,21 %	7,55 %
Ranking correlation coefficient according to Kendall for F3 Creativity Friends/Colleagues	0,06	0,11	0,64
F4 Friends/Colleagues: Balance Percental rank agreement: Deviation 0 Ranks	13,21 %	18,87 %	33,96 %
F4 Friends/Colleagues: Balance Percental rank agreement: Deviation 0.5 and 1.0 Ranks	41,51 %	33,96 %	32,08 %
F4 Friends/Colleagues: Balance Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	26,42 %	22,64 %	26,42 %
F4 Friends/Colleagues: Balance Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	18,87 %	24,53 %	7,55 %
Ranking correlation coefficient according to Kendall for F4 Balance Friends/Colleagues	-0,09	0,13	0,41
F5 Friends/Colleagues: Integrity Percental rank agreement: Deviation 0 Ranks	7,55 %	16,98 %	33,96 %
F5 Friends/Colleagues: Integrity Percental rank agreement: Deviation 0.5 and 1.0 Ranks	50,94 %	45,28 %	35,85 %
F5 Friends/Colleagues: Integrity Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	33,96 %	30,19 %	26,42 %
F5 Friends/Colleagues: Integrity Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	7,55 %	7,55 %	3,77 %
Ranking correlation coefficient according to Kendall for F5 Integrity Friends/Colleagues	-0,03	0,14	0,46
F1 Friends: Empathy Percental rank agreement: Deviation 0 Ranks	10,00 %	0,00 %	55,00 %
F1 Friends: Empathy Percental rank agreement: Deviation 0.5 and 1.0 Ranks	60,00 %	50,00 %	20,00 %
F1 Friends: Empathy Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	5,00 %	30,00 %	20,00 %
F1 Friends: Empathy Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	25,00 %	20,00 %	5,00 %
Ranking correlation coefficient according to Kendall for F1 Empathy Friends	0,14	0,09	0,55
F2 Friends: Conflict skills Percental rank agreement: Deviation 0 Ranks	15,00 %	20,00 %	35,00 %
F2 Friends: Conflict skills Percental rank agreement: Deviation 0.5 and 1.0 Ranks	35,00 %	15,00 %	35,00 %
F2 Friends: Conflict skills Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	20,00 %	25,00 %	20,00 %
F2 Friends: Conflict skills Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	30,00 %	40,00 %	10,00 %

Parameters and method comparison	Comparison questionnaire test (M1/M2) & GraphoPro (M4)	Comparison questionnaire test (M1/M2) & graphologists (M3)	Comparison Graphologists (M3) & GraphoPro (M4)
Ranking correlation coefficient according to Kendall for F2 Conflict skills Friends	-0,04	0,05	0,31
F3 Friends: Creativity Percental rank agreement: Deviation 0 Ranks	20,00 %	10,00 %	25,00 %
F3 Friends: Creativity Percental rank agreement: Deviation 0.5 and 1.0 Ranks	60,00 %	65,00 %	60,00 %
F3 Friends: Creativity Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	10,00 %	20,00 %	10,00 %
F3 Friends: Creativity Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	10,00 %	5,00 %	5,00 %
Ranking correlation coefficient according to Kendall for F3 Creativity Friends	-0,08	-0,03	0,57
F4 Friends: Balance Percental rank agreement: Deviation 0 Ranks	20,00 %	20,00 %	25,00 %
F4 Friends: Balance Percental rank agreement: Deviation 0.5 and 1.0 Ranks	45,00 %	40,00 %	50,00 %
F4 Friends: Balance Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	20,00 %	20,00 %	10,00 %
F4 Friends: Balance Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	15,00 %	20,00 %	15,00 %
Ranking correlation coefficient according to Kendall for F4 Balance Friends	-0,18	-0,21	0,62
F5 Friends: Integrity Percental rank agreement: Deviation 0 Ranks	0,00 %	20,00 %	30,00 %
F5 Friends: Integrity Percental rank agreement: Deviation 0.5 and 1.0 Ranks	60,00 %	30,00 %	40,00 %
F5 Friends: Integrity Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	35,00 %	45,00 %	25,00 %
F5 Friends: Integrity Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	5,00 %	5,00 %	5,00 %
Ranking correlation coefficient according to Kendall for F5 Integrity Friends	-0,10	-0,03	0,45
F1 Colleagues: Empathy Percental rank agreement: Deviation 0 Ranks	21,21 %	9,09 %	21,21 %
F1 Colleagues: Empathy Percental rank agreement: Deviation 0.5 and 1.0 Ranks	33,33 %	54,55 %	51,52 %
F1 Colleagues: Empathy Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	30,30 %	21,21 %	24,24 %
F1 Colleagues: Empathy Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	15,15 %	15,15 %	3,03 %
Ranking correlation coefficient according to Kendall for F1 Empathy Colleagues	0,27	0,23	0,58
F2 Colleagues: Conflict skills Percental rank agreement: Deviation 0 Ranks	15,15 %	12,12 %	36,36 %
F2 Colleagues: Conflict skills Percental rank agreement: Deviation 0.5 and 1.0 Ranks	21,21 %	36,36 %	42,42 %

Parameters and method comparison	Comparison questionnaire test (M1/M2) & GraphoPro (M4)	Comparison questionnaire test (M1/M2) & graphologists (M3)	Comparison Graphologists (M3) & GraphoPro (M4)
F2 Colleagues: Conflict skills Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	24,24 %	36,36 %	18,18 %
F2 Colleagues: Conflict skills Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	39,39 %	15,15 %	3,03 %
Ranking correlation coefficient according to Kendall for F2 Conflict skills Colleagues	0,00	0,10	0,51
F3 Colleagues: Creativity Percental rank agreement: Deviation 0 Ranks	18,18 %	18,18 %	27,27 %
F3 Colleagues: Creativity Percental rank agreement: Deviation 0.5 and 1.0 Ranks	30,30 %	36,36 %	48,48 %
F3 Colleagues: Creativity Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	30,30 %	27,27 %	15,15 %
F3 Colleagues: Creativity Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	21,21 %	18,18 %	9,09 %
Ranking correlation coefficient according to Kendall for F3 Creativity Colleagues	0,12	0,15	0,72
F4 Colleagues: Balance Percental rank agreement: Deviation 0 Ranks	9,09 %	18,18 %	39,39 %
F4 Colleagues: Balance Percental rank agreement: Deviation 0.5 and 1.0 Ranks	39,39 %	30,30 %	21,21 %
F4 Colleagues: Balance Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	30,30 %	24,24 %	36,36 %
F4 Colleagues: Balance Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	21,21 %	27,27 %	3,03 %
Ranking correlation coefficient according to Kendall for F4 Balance Colleagues	-0,04	0,13	0,34
F5 Colleagues: Integrity Percental rank agreement: Deviation 0 Ranks	12,12 %	18,18 %	36,36 %
F5 Colleagues: Integrity Percental rank agreement: Deviation 0.5 and 1.0 Ranks	45,45 %	51,52 %	33,33 %
F5 Colleagues: Integrity Percental rank agreement: Deviation 1.5, 2.0 and 2.5 Ranks	30,30 %	21,21 %	27,27 %
F5 Colleagues: Integrity Percental rank agreement: Deviation 3.0, 3.5 and 4.0 Ranks	12,12 %	9,09 %	3,03 %
Ranking correlation coefficient according to Kendall for F5 Integrity Colleagues	-0,02	0,18	0,45

Conclusions from the interlab proficiency test No. 003

- It can be seen that in graphological evaluations (both manual and software-based) on the individual structure of personality traits that a person has at his disposal on the basis of his or her previous experiences, thoughts, feelings and motives, a higher degree of agreement is achieved than in the comparison of graphological evaluations with colleagues and friends (comparisons of M1 with M3 or M1 with M4 achieve higher equivalences than M2 with M3 or M2 with M4)

- Taking together the two categories "Deviation 0" and "Deviation 0.5 and 1.0 Ranks" in the percental rank comparison agreement, the highest degree of agreement can be seen in almost all trait parameters and method comparisons.
- Although no psychologically relevant information about the writers was available when using the GraphoPro® software or when the trait parameters were evaluated by the eight graphologists, both methods (M3 and M4) achieved values of more than 50% in the ranking deviation categories 0, 0.5 and 1.0 across all method comparisons.
- The comparison between the external evaluations of friends and relatives and method 4 shows that the GraphoPro® software achieves from 60.00% to 80.00% in the categories rank deviations of 0, 0.5 and 1.0 for four of the five parameters (empathy, creativity, balance, integrity). The evaluations of the GraphoPro® software often agree with those of close friends. This is not reflected in the rank correlation coefficients according to Kendall.
- The comparison between the external evaluations of friends and method 3 shows that graphologists achieve from 60.00% to 75.00% in the categories rank deviations of 0, 0.5 and 1.0 for two of five parameters (creativity and balance). The remaining three trait parameters do not exceed 50%. The judgments of the graphologists are less often in agreement with those of close friends. This is not reflected in the rank correlation coefficients according to Kendall.
- The trait parameter “conflict ability“ (F2), which contains significant evaluative aspects, shows fewer similarities between the questionnaire results M2 and the graphological methods M3 or M4. When looking at the raw data, one can observe that the graphological methods estimate the ability to deal with conflicts less than the external assessors.
- The comparison between the software-based method (M4) and the classical-graphological determination of trait parameters (M3) shows a high degree of agreement across all method comparisons in the categories ranking deviations of 0, 0.5 and 1.0, which is also reflected in the ranking correlation coefficient according to Kendall, which has values between 0.3 and 0.7.
- When using the GraphoPro® software, fewer graphologists are needed to achieve comparable results to those obtained with the classic manual graphological method.
- Kendall's ranking correlation coefficient requires the supplementary evaluation of the percental rank comparison agreement per test person, since the significance of the coefficient is limited due to the large number of binding and half ranks in all data series to be compared. Furthermore, the comparison of rank distributions within a test person (percental rank comparison agreement) provides valuable information in parallel to the comparison of value pairs among each other across all test persons (Kendall's ranking correlation coefficients), since these are different approaches.

Scientific background to the study

The present method comparison for the determination of nine trait parameters is based on retrospective assessments of the respective writers themselves (M1), their colleagues or friends (M2, M2a and M2b) as well as on graphological assessments (M3 and M4). M1, M2, M2a and M2b require a high degree of self-reflection, observation and honesty. M3 and M4, on the other hand, require not only knowledge and experience but also an understanding of the nine trait parameters collected in the questionnaire and a high degree of transfer thinking with regard to manual assessment and the use of the GraphoPro® software. In order to reduce the degree of subjectivity, several external assessments were taken into account for M2, eight instead of just one graphologist using the classical manual method for M3 and graphological software for M4.

According to Stemmler et al. (2016), there are sources of error in self assessment and external evaluation when using questionnaires:

- Intentional adjustment

- Social desirability
- Acquiescence (independent consent for questions)

Nevertheless, the authors emphasise that questionnaire test procedures based on self-assessment and external evaluation show sufficient validity despite the possible sources of error.

With regard to external assessments, the following has been recognised in the context of current investigations, which is of interest for the present interlab proficiency test:

- With regard to the meaningfulness of external assessments, it is relevant whether the trait parameters to be assessed are easily observable. If they are well observable, they can also be assessed well and vice versa (Ready et al., 2000).
- The more psychologically relevant information available to the external evaluators, the better the agreement between the self-evaluators and the external evaluators (Letzring et al., 2006).
- If characteristics are socially desirable in a strong way (therefore containing clearly judgmental aspects), this reduces the correspondence between different external evaluators (John & Robins, 1993).
- In a study of 1504 friendly couples, Lee et al. (2017) found out: The agreement of foreign assessments among close friends contains fewer deviations than among less close friends.

Organization, material, methods and statistics of the interlab proficiency test 003

Organization, operation and evaluation

Claudia Caspers, Rosemarie Gosemärker and Bruno Keel from Mai to November 2017.

Participants of the interlab proficiency test

Two graphologist by means of the GraphoPro® software

Research Materials

1. 53 handwriting samples of self-assessors
2. 53 self assessment questionnaires by 53 writers to determine four personality trait parameters
3. 152 external assessment questionnaires to determine five personality trait parameters by colleagues and friends of the 53 writers
4. 53 independently analysed handwritings by eight graphologists with the classical-manual graphological method. Per handwriting nine personality trait parameters specified in the two above-mentioned points number two and three (nine parameters based on self and external assessment questionnaires) had to be analysed without listing the handwriting signs that were relevant for determining the personality trait parameters.
5. 53 independently analysed handwritings by one graphologist with the GraphoPro® software. Per handwriting nine personality trait parameters specified in the two above-mentioned points number two and three (nine parameters based on self and external assessment questionnaires) were analysed by the software. In the case of the software, the graphologist has only analysed the handwriting signs and not the personality trait parameters, since the software has carried out the latter according to a standardised method for all 53 handwritings.

The research material 1 to 4 comes from the already completed interlab proficiency test 001 (http://www.schriftanalyse-validierung.info/ringtrials/summaries/Summary_001_en.pdf). In the present interlab proficiency test, point 5 was newly ascertained.

Tabular overview of the research material and the measured parameters

Trait parameters	F1: Empathy	F2: Conflict skills	F3: Creativity	F4: Balance	F5: Integrity	S1: Inner security	S2: Own initiative	S3: Conflict optimism	S4: Flexibility
Evaluation by self assessment (Questionnaire)						x	x	x	x
Evaluation by external assessment (Questionnaire)	x	x	x	x	x				
Evaluation by 8 Graphologists (manual method) on 53 handwritings	x	x	x	x	x	x	x	x	x
Evaluation by GraphoPro® (Software-based method) on 53 handwritings	x	x	x	x	x	x	x	x	x

Details on the four measurement methods used

The psychological test, which served as a basis for comparison for the graphological interlab proficiency test, originates from the Department of Psychology at the University of Hamburg and is used as a supplementary instrument for the selection of applicants within the framework of the continuing education programme "internal conflict advisor". The goal of the test design was a particularly short and practicable procedure. The factor analysis was used to determine the trait parameters. The test consists of two parts, a self and external assessment test (method 1 and method 2).

Method 1: Self assessment questionnaire test to determine four trait parameters

- Number of questions to determine four trait parameters: 12
- Answering the questions: 5-step answer scale from "fully applicable" to "not applicable at all".
- Once the questions have been answered, a calculation of pre-defined scores per question is performed for each trait parameter. The scores per trait parameter are then formed by adding the individual point values per answered question. In this way, the assessed person receives a value assigned to him/her for each of the four self assessed trait parameters.

Method 2: External assessment questionnaire test to determine five trait parameters

- Number of questions to determine five trait parameters: 16
- Answering the questions: 5-step answer scale from "fully applicable" to "not applicable at all" and the possibility of "non assessable" (no evaluation)

- Once the questions have been answered, a calculation of pre-defined scores per question is performed for each trait parameter. The scores per trait parameter are then formed by adding the individual point values per answered question. In this way, the assessed person receives a value assigned to him/her for each of the five foreign assessed trait parameters.
- At least two foreign-assessors were required for each self-assessor to participate in the test. The single results of all foreign-assessors per trait parameter were averaged to a single value for each writer in the final evaluation.

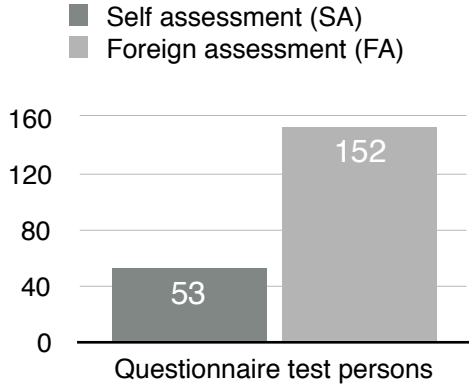
Method 3: Manual determination of nine trait parameters by eight graphologists

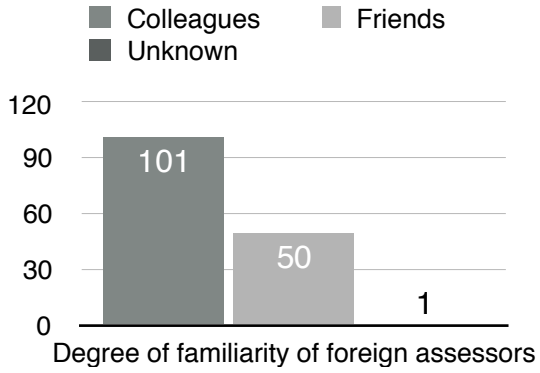
Eight graphologists had high-quality copies of 53 handwritings with references to gender, age and type of education. The graphologists' task was to assess the nine defined trait parameters according to the questionnaire test based on their knowledge and experience on the same scale as the test. In the final evaluation, the eight results per trait parameter and writer were averaged to a single value.

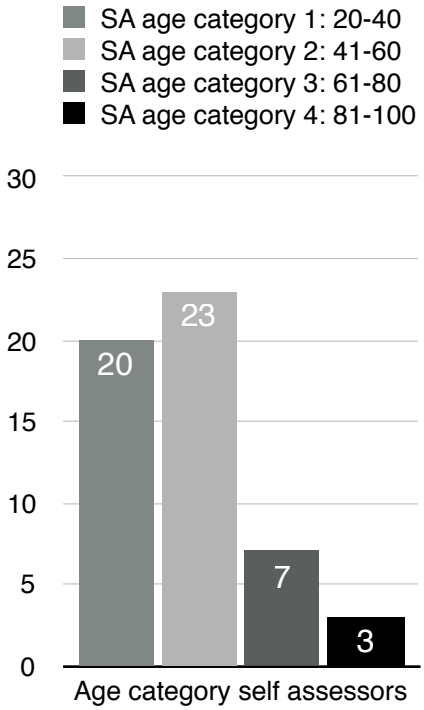
Method 4: Trait parameter computation of nine trait parameters by software GraphoPro®

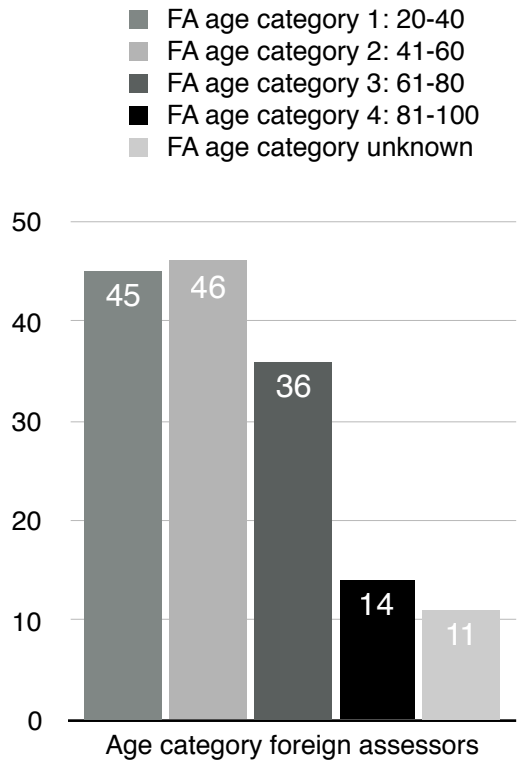
By means of the GraphoPro® software, 235 standardised handwriting signs of the 53 handwritings of the self-assessors were estimated quantitatively by a graphologist. In preliminary stage to this, a second graphologist, based on his knowledge and experience, determined out of 235 available handwriting signs of GraphoPro® a set of appropriate signs for each trait described in the self and external assessment test. This process is called „mapping“. Based on these, GraphoPro® calculates automatically the value of each trait parameter after the quantitative estimation of each handwriting sign.

Statistical data of the questionnaire test persons









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