persolog®

Develop Organizations Through People!

Research Report

Research Report on persolog® Personality Factor Model

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Develop Organizations Through People!

Renate Wittmann

Director
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Dear Sir or Madam,

The development of the D-I-S-C based persolog Personality Factor Model has a history of 14 years of research in the German-speaking area. Every single investigation has been directed toward the goal of improving the reliability of the profile and deepening the knowledge of the construct. In 2005 we began our current, broad investigation. It was intended to illuminate once again the basis for the construction of the persolog® Personality Factor Model. After a three year time frame for the investigation, the newest results on the reliability and validity of the persolog® Personality Factor Profile are available. This report presents the newest validated version of the profile.

Beginning in 2000 we have intensified our contact with the University of Koblenz/Landau. The statistical method used in our investigation was chosen in consultation with Dr. Alstötter-Gleich. The data processing and interpretation are done in close cooperation. With the procedure devised for the German-speaking area we have established a research process that is binding for all partners of persolog GmbH world wide. In this way we extend continuously not only our methodological competence, but also our insight into cultural differences in behavior. The unified procedure which we have chosen assures that the Profile is comparable in all languages.

Here I would like to thank especially Ms. Altstötter-Gleich for her interest in our model. In addition I would like to thank every reader who has helped us gather the data which has made the research results possible. In the last three years a total of 4320 people have participated in the statistical investigation of the persolog® Personality Factor Model in the German-speaking area. The results described here would not have been possible without their continual willingness to support us in our research.

Director for product development persolog GmbH

Renate Wittmann

Development of the model and theoretical backgrounds

The persolog® Personality Factor Profile was developed in 1970 –1972 at the University of Minnesota. As distinct from the earlier MMPI (Minnesota Multiphasic Personality Inventory, Hathaway and McKinley, 1951) of the same university, Professor Dr. John Geier was given the task of developing a program that would help senior staff members of the university to recognize and overcome performance deficits.

One of the main results was the DISC Personality Factor Profile, a model that reflects the behavior of people in concrete situations, and which can be used especially in the workplace (outside of clinics). Professor John Geier was able to use as foundation parts of his dissertation ("Perceptional Trait"), which had led him to a book (Emotions of Normal People) by Harvard professor William Moulton Marston, a student of Hugo Münsterberg. William Moulton Marston did research in the individual differences among people in the abnormal or clinical population. William Moulton Marston had in 1928 specified the concepts dominance, inducement, submission and compliance to create a perceptual model with four uniquely distinct human emotions. Geier expressed dissatisfaction with the descriptive concepts, which he considered unsuitable for the normal population.

Geier experimented with various questionnaires and scaling, then, using a familiar questionnaire format with 24 word groups and guided by theory, he developed the items of the individual word groups further. He organized the evaluation results on a diagram with a forced choice scale. From the beginning he banked on the test persons' being able to fill out the profile, perform the evaluation and elucidate the interpretation themselves; this was a novelty at that time.

From 1989 to 1994 he revised the Personality Profile System radically. He included his colleagues from the University of Minnesota as team reviewers. His research partner of many years, Dorothy Downey, supported him in the research and development. As a result of this revision the questionnaire was divided into two questionnaires with 24 word groups "most" and "least", in order to improve the pre-selection and with various instructions to create more interpretation possibilities. Thereupon the persolog® Personality Factor Profile was extended by 5 interpretation levels with the respective behavior strategies. Theoretical considerations from Erich Fromm (nonproductive-productive characters), Alfred Adler (the concept of compensation) and Martin Fishbein (attitude research) were incorporated.

Thus the persolog® Personality Factor Model combines a psychological perception model with a behavioral model, and is an instrument for measuring situational behavior (social-cognitive personality theory according to Mischel [see Shoda, Mischel and Wright, 1994]).

Scientific Investigations of the persolog® Personality Factor Model

Studies conducted in the USA

1. Kaplan, Sylvan (1983): The Kaplan Report. A study of the validity of the Personal Profile System. Inscape Publishing Inc., Minneapolis. The Personal Profile System was investigated for construct validation with the following test procedures, which also demonstrate construct and/or predictive validity: WAIS (Wechsler, D. 1995); MBTI (Myers, I.B. Myers-Briggs, 1962), 16 PF (Cattell, R.B., Eber, H.W. and Tasuoba, M.M. 1970), MMPI (Dahlstrom, W.G., Welsh, G.S. and Dahlstrom, L.E. 1975), SCII (Strong, E.K. and Campbell, D.P. 1981).

2. Kaplan, Sylvan (1984): The Winchester Report. The validity of the Child´s Profile, Personal Profile System, Youth Development Profile and the Action Projection System. Inscape Publishing Inc., Minneapolis. Conducted by Kaplan, Sylvan J., Ph.D. WAIS (Wechsler, D. 1955), EAT (Education Abilities Test 1978), HTP (Buck, J.N. 1948); CPQ (Porter, R.B. and Cattell, R.G.1975); HSPQ (Cattell, R.B., and Cattell, M.D.L.1975); MBTI (Myers, I.B. Myers-Briggs 1962).

3. McGlennon, Timothy W., University of Minnesota. (1989): An independent study of the constructs in the Personality Factor Profile for Geier Learning International, Inc., Minneapolis, MN. "Development and Psychometric Properties of the Personality Factor Profile." Conducted by Timothy W. McGlennon, Biodmedical/Behavioral Science Statistical Consultant.

4. Lange Allan L. (1992): A study of the constructs in the Personal Profile System. Inscape Publishing Inc., Minneapolis. A Comparative Study of the Adult Personality Inventory (Krug, Samuel E. Ph.D.), developed according to the 16 PF by Raymond Cattell. Conducted by Allan L. Lange, Ph.D.

5. McGlennon, Timothy W., Alfred Adler Institute (2000): An independent study of the constructs of the Personality Factor Profile Online for Geier Learning International, Inc., Minneapolis, MN. "Geier Criterion Group Patterns as Defined by Jungian Four Letter Temperament Type." Conducted by Timothy W. McGlennon, Biodmedical/Behavioral Science Statistical Consultant.

German statistical investigations of the reliability coefficients

After the company persolog GmbH (previously DISC Training GmbH) had obtained the exclusive rights to marketing the DISC model, it began statistical investigations for the German-speaking area (Germany, Austria, Switzerland). The first reliability study was conducted in 1994. 280 people participated. In this investigation the Chronbach's Alpha lay between 0.71 and 0.81. A second study followed in 1996. 360 people participated in this study. The Chronbach's Alpha lay between 0.72 and 0.85. In 2000 another statistical test of the reliability was conducted. In addition, for the first time a test-retest investigation was conducted. The goal of this investigation was to test new items in order to change from a version with 24 words to a version with 28 words. 1111 people participated in this study. 710 people participated in the test-retest investigation which was conducted in 2001. The Chronbach's Alpha lay between 0.82 and 0.92.

First German statistical investigation of the validity of the model

After a change of models in 2004 the fifth investigation of the reliability was begun. This investigation was also intended to demonstrate the validity of the model for the first time. The procedure had several levels. First the original items were tested for reliability. 1029 people participated in this study. Then several items were changed and a second investigation of the reliability was started. 1305 people were questioned as part of this second pre-study. This flowed into a validity study with the BigFive based NEO-PI-R instrument in which 442 people participated. Items were investigated anew after potential for improvement was found. Here, too, the investigation was conducted according to the scales of the NEO-PI-R. 1093 people participated in the most recent study of the reliability; 451 people participated in the investigation of validity. The results of these investigations will be presented in the following. In conclusion the validity of the words will be tested with the BigFive Instrument BFI-K (Form S) according to a test-retest investigation. Parallel investigations are being conducted world wide.

The fundamental behavioral dimensions of the DISC Model

The D-I-S-C Model distinguishes four areas of behavior. Originally Marston described his profile using the concept pairs hostile/friendly and weaker/stronger. In order to give the profile a scientific basis, Prof. Geier developed Marston's theory further at the University of Minnesota. He substituted the "hostile" perception of the environment with "stressful" and "friendly" with "non-stressful". Out of Marston's description "weaker-stronger" Geier developed the reaction to the environment as "assertive" or "nonassertive".

The combination of both axes produced four behavior prototypes, with each assigned specific characteristics.

Dominant behavioral style

The combination "stressful and assertive" was assigned the characteristics "dominant" (dominance[1]) and "directive", translated as dominant and directive in German.

Influencing behavioral style

If one combines "non-stressful and assertive" then one arrives at the characteristics "influencing" (inducement[2]) and "interactive", which describe the ability to prompt other people to do something or to influence them, and is translated with the concept "influencing" in the German-speaking area.

Steady behavior style

When the concepts "non-stressful and non-assertive" are combined, the results are "steady" (submission[3]) and "supportive", which can be translated into "constancy" and "steady".

Cautious behavior style

The connection of "stressful and assertive" results in the characteristics "cautious" (compliance[4]) and "corrective", which mean "cautious" and "corrective" and can be merged into "conscientiousness".

The initial letters of the English characteristic words form the concept "D-I-S-C" which has been transposed into "D-I-S-G" for the German speaking area of persolog®. These four letters describe the four basic dimensions dominance, influence, steadiness and cautious.

People with a dominant and influencing behavior style perceive themselves more strongly than their environment and therefore attempt to shape it according to their standards, so they react assertively on their environment. Steady and conscientious people experience themselves as weaker than their environments, which results in objective and supportive behavior; they react to their environments in a reserved manner.

People with a dominant and cautious style of behavior are more inclined to perceive their environment as hostile, that means that the first emotions in a new situation are initially felt as assertive/stressful, whereas people with influencing and steady styles of behavior perceive their environment initially as friendly, which results in a non-assertive/non-stressful perception.

Geier developed word categories based on this theoretical model, with which dimensions of behavior could be described and behavior measured. A glance at the pictured excerpt from the answer sheet shows what kind of adjectives and short sentences are involved.

[1] *Marston's word for the behavioral dimension D from 1928*

[2] *Marston's word for the behavioral dimension I from 1928*

[3] *Marston's word for the behavioral dimension S from 1928*

[4] *Marston's concept for the behavioral dimension G from 1928*

Description of the four prototypes of personality

Each person combines in himself the four behavior styles that have been discussed: dominance, influence, steadiness and cautious, but in varying degrees. The basic type is derived from the behavior style that is strongest. It results from the highest point in the diagram. The strongest tendency is dependent on which of the four columns (D, I, S or C) it is placed in.

Dominant

A person with high Dominant behavior seeks challenges and wants to outdo his opponent. He makes quick decisions, aims for direct results, is good at solving problems, claims authority and gives directions.

The dominant person questions conventional circumstances and provides new impulses. His behavior in team processes can lead to conflicts. The dominant person wants a minimum of oversight, avoids long-winded discussions and wants direct answers. He needs people who compliment him, who test risks, act prudently, check details in order to prepare decisions and provide sensitivity for the needs of others.

Influencing

The influencing person is ready to help, make contact, can entertain well and spreads enthusiasm. He speaks well and clearly. He gets satisfaction from working with other people. He takes care to make a positive impression.

The environment should give him the feeling of being liked and offer him the opportunity to communicate things to other people, and allow friendly contacts to be made in a pleasant work atmosphere.

The influencing person needs complimentary people who prefer to be concerned with things more than with people, are direct, prefer facts and concentrate on tasks that they can approach systematically and who monitor themselves. In addition he needs specific deadlines because he likes to work on many things at the same time and quickly looses sight of his own goals. He should try to be more objective in his decision making and appear more decisive.

Steady

Patience, loyalty and constancy are characteristics of the steady person. He is an excellent listener who can have a calming effect on people when necessary. The steady person concentrates on his tasks, loves his accustomed environment and follows defined or accepted work patterns, he is strong when he can specialize. He needs an environment that guarantees security and well ordered work flows in a clearly laid out and defined area of responsibility. Appreciation for himself as an individual and his accomplishments is just as important for him as respect for his private sphere and integration into a group.

A person characterized by steadiness unfolds best in a well organized environment among dependable colleagues, whose capability he trusts. Knowing what contribution he has made to success is just as necessary for him as the request to generate and verbalize ideas.

Cautious

The cautious person submits to rules, conducts himself diplomatically and follows instructions and observes norms. A cautious person pays attention to details, thinks critically and checks everything for accuracy.

People with high C need an environment in which proven procedures are adhered to. The members of this environment must be "ready to compromise", understand basic rules not as absolute obligations, but rather as orientation and be able to make quick decisions.

The cautious person needs concrete work instructions and goals which require a high degree of precision, as well as periodic evaluation of his performance, in order to develop fully.

Assessment of the quality criteria

Objectivity

A test is objective when the results are independent of the test supervisor. The guarantee of equal conditions (standard conditions) is necessary for the test subject and is guaranteed by the nature of the procedure.

Objectivity	Criteria of the persolog® Personality Factor Profile
Implementation	❚ Clear and exact instructions and procedural requirements
Evaluation	❚ Introduction and non-interference by the test supervisor are provided ❚ Standardized evaluation through predefined evaluation steps
Interpretation	❚ Standardized scale values

Table 1: The objectivity of the persolog® Personality Factor Profile

Standardizing

The test-retest investigation for validating the word groups is in process at the moment. The results will be available shortly.

Economy

Can be conducted as individual or group evaluation, minimum of material, easy to use. Time required for taking, approx. 12 minutes, evaluation time approx. 15 Min. Online evaluation in 15 Min.

Comparability

The comparability of the Personality Factor Model with earlier studies and studies in the USA and other countries has been established.

Utility

Moderate utility, because personality characteristics and behaviors which have a practical significance can be determined. The situational consideration of the behavioral styles is especially worthy of note. Individual characteristics can also be identified through other tests.

Accessibility

Good accessibility and diagnostic valence through the adequately described behavioral dimensions (see validity).

Investigations of the measurement values of D-I-S-C-items

by Dr. Christine Altstötter-Gleich, Universität/Koblenz Landau

Method

Random sample

In 2006 data from a total of 1093 people in Germany, Switzerland and Austria were collected. The most important socio-demographic information about the people questioned is collected in Table 1. They are reported separately for the two questions of the investigation because the much more complex validity investigation was only conducted on one partial sample (N = 451).

The data show an image of the samp le taken that corresponds to the target group of the persolog® Personality Factor Profile with respect to gender, age, level of education and profession. Therefore, the results reported elsewhere based on this sample can be considered representative for the people for whom the application of the D-I-S-C is normally of interest.

Table 1: Socio-demographic Information about the control sample

Question		Reliability	Validity
Number of Respondents		1093	451
Country	Germany	74%	73%
	Switzerland	15%	17%
	Austria	11%	10%
Gender	male	54%	48%
	female	46%	52%
Age	Average	37.9	38.2
	Standard deviation	9.9	10.4
Education	High school	8%	11%
	Secondary school certificate	17%	29%
	University entrance diploma	54%	43%
	Technical college	17%	14%
Training	None	3%	3%
	Industrial occupations	6%	10%
	Commercial occupations	27%	27%
	Master craftsman/technician	4%	5%
	Technical or business management Academic studies	24%	19%
	Social or humanities studies	24%	19%
	Other education	11%	18%
Professional groups	Finance/Banking/Insurance	17%	12%
	Processing industry / Printing industry/		
	Whole and retail sales/Trades	20%	25%
	Transport and traffic	1%	4%
	Health and social work	7%	16%
	Services	36%	25%
	Non-profit and other	19%	18%

Investigative instruments

All of the respondents worked through the statements and adjectives of the persolog® Personality Factor Profile. Each item was to be judged according to its fit to the individual on a scale with six levels ranging from the extremes "applies not at all to me" to "applies very well to me". In conclusion, averages were taken from the statements and the adjectives separately, in order to get the aggregate values of the D-I-S-C character dimensions D (Dominant), I (Influencing), S (Steady), and C (Cautious).

According to the current manual, the four dimensions of the persolog® Personality Factor Profile can be characterized as follows.

Dominant

People having dominant behavior styles regard the environment as challenging and stressful. They want to win out over others and attempt to overcome obstacles through strength of purpose. They often work independently. Their basic goals consist in shaping the individual environment and overcoming obstacles in order to achieve results. They are motivated through the possibilities for self affirmation, for measuring themselves against others, for showing what they can do, gaining respect, winning recognition and being successful.

Influencing

People with influencing behavior styles regard the environment as pleasant. In their eyes it consists primarily of people who need to be encouraged and motivated. They are open, friendly and convincing. Their basic goals consist in shaping the individual environment and involving others in order to achieve results. They are motivated by the opportunity for having fun, understanding the feelings of others and dealing with people.

Steady

People with steady behavior styles regard their environment as pleasant when everyone works together to achieve goals. They are predictable, dependable and cooperative. Their main goal is to work together with others in order to achieve results. They are motivated primarily by the opportunity to express their feelings, to reject what contradicts their ideas and for being taken seriously by others.

Cautious

People with cautious behavior styles regard their environment as stressful and often act carefully. They attempt to avoid difficulties and to maintain as much order as possible. They are exemplary for others with regard to carefulness and exactness. An important goal of these people is to talk with others about the possible consequences of activities. They are motivated by the opportunity for treating others fairly, improving the world, eradicating mistakes, justifying their own opinion and judging everything according to a unified idea.

There are two item collections for each of the four character dimensions. The first group consists of statements such as for example I want to win (D), I like contact (I), I am ready to help (S) or I am disciplined (C). The second group consists of adjectives such as assertive (D), communicative (I), understanding (S) and exact (C).

9

In addition to the items of the persolog® Personality Factor Profile which were answered by all responders, part of the total sample was also presented with the German language version of the NEO-PI-R (Ostendorf & Angleitner, 2004) which in its original version was developed by Paul Costa and Robert McCrae (1992) as the "Revised NEO Personality Inventory (NEO-PI-R)." The NEO-PI-R is designed to register the differentiated characteristic areas of the five factor model, which is one of the most influential models of personality psychology. It postulates five basic dimensions, each of which can be subdivided into six facets (see Table 2). Based on the NEO-PI-R essential personality characteristics in the area of interpersonal attitudes, experiences and motivations can be registered and described. Personal attitudes, experiences and motivations can be registered and described.

**Table 2:
Dimensions
and facets
of the NEO-PI-R**

Dimensions	Facets
Neuroticism	Anxiety, Angry hostility, Depression, Self-Consciousness, Impulsiveness, Vulnerability
Extraversion	Warmth, Gregariousness, Assertiveness, Activity, Excitement seeking, Positive Emotions
Openness to experience	Openness to fantasy, Openness to aesthetics, Openness to feelings, Openness to action, Openness to ideas, Openness to values
Agreeableness	Trust, Straightforwardness, Altruism, Compliance, Modesty, Tender-mindedness
Conscientiousness	Competence, Order, Dutifulness, Achievement striving, Self-Discipline, Deliberation

Statistical analyses

The statistical analyses which were conducted can be divided into three areas: dimensionality, reliability and validity.

Dimensionality

First it was investigated whether the statements or adjectives of the persolog® Personality Factor Profile which are intended to measure one of the dimensions Dominant, Influencing, Steady or Cautious are actually based on one of the common dimensions of character. In order to determine this, for the statements or adjectives respectively one of the four characteristics were calculated by means of factor analysis.

As an indicator for one-dimensionality, first the level of the value of the first factor is compared to all the other possible factors. The greater the difference between the values of the first and second factors, the more it can be assumed that the items analyzed measure a common character dimension (a so-called factor). A value can have a maximum value as large as the number of the analyzed items. In order to support the decision, further parallel analysis according to Horn (1965) was implemented. In the framework of this analysis, the values from analysis of the control samples were compared with values which resulted from a factor analysis of random data. Empirically acquired factors, the values of which are greater than those which are acquired through the analysis of random data, are interpreted as significant.

In a further step, the loadings of the item on the first factor were determined. According to the rules of interpretability of relevant factor loads compiled in Fabrigar, Wegener, McCallum and Strahan (1999), it was investigated whether all items had loadings greater than 0.4.

Reliability

In order to assess the reliability – the question of how much the scales of the persolog® Personality Factor Profile are affected by measurement errors – the internal consistencies of the scales developed from the D-I-S-C items were calculated. The calculated coefficient (Cronbach's Alpha) can accept values between 1 (no measurement errors) and 0 (exclusively measurement errors). In general the reliability should be as high as possible. The lowest limit for the use of an instrument that is usually acceptable is a reliability value of 0.7. Values smaller than 0.8 are classified as low, values between 0.8 and 0.9 as mid, and values above 0.9 indicate high reliability (see for example Bühner, 2006).

Validity

Whereas reliability represents the degree of accuracy of a result, the degree of validity can be used to determine what a test measures with respect to content. Validity coefficients are used to determine whether a test measures what it claims to measure. They are usually correlations which indicate the strength of the connection between two measurements. Similar to reliability coefficients, correlation coefficients can have values between 1 and 0, however their level must be interpreted differently. Most important are considerations of content concerning which connections with other test procedures a test that is being tested for validity should show. Connections which are at 0.5 are considered as high, those around 0.3 as mid-range and those at 0.1 as low (see Cohen, 1977).

The sign in front of the correlation coefficient must also be taken into consideration when an interpretation is made. If it is positive, then one can assume that when values of one measurement increase the values of the other measurement will also increase. However, if the sign is negative, when the values of one measurement increase, the values of the other measurement decrease.

Results for the Dominant items

An inspection of the values of factor analyses of the 21 statements and 20 adjectives results for both item groups in the classical picture of a eigenvalue distribution which indicates a single main factor. In addition, by means of parallel analysis it can be determined that for both item groups only the first factor has a higher value than factors which were generated from random numbers. The level of the factor load of the Dominance items investigated is between 0.82 and 0.46. None of the items is below the limiting value of 0.4.

In summary, it can be concluded from the results of the dimensionality investigation that the items combined in both Dominance scales are each supported by a common dimension, and that their loadings in these dimensions meet the scientific criterion of interpretability.

Table 3
Information on the dimensionality and reliability of the Dominant items

Dominant	Eigenvalue of the first factor	Eigenvalue of the second facator	Lowest loading	Cronbach's Alpha
Statements	9.9	1.5	0.46	0.94
Adjectives	10.2	1.3	0.59	0.95

This first positive judgement is supported by the assessment of reliability made by means of Cronbach's Alpha. This coefficient displays high values for the statements (Cronbach's Alpha = 0.94) as well as for the adjectives (Cronbach's Alpha = 0.95). These findings support the conclusion that both Dominance scales are affected only slightly by measurement error.

The correlation of the two Dominance scales with the facets of the NEO-PI-R collected in table 3 should make clear whether or not it can actually be assumed that with the aid of the respective D-I-S-C items a dimension can be measured not only formally, but that this can also be interpreted as a Dominance dimension with respect to content. For improved interpretation the correlations within the five basic dimensions Neuroticism, Extraversion, Openness, Tolerance and Conscientiousness have been organized according to size. Significant coefficients are colored.

Corresponding to their level and sign, the correlations show the following picture: The more dominance people ascribe to themselves with the items of the persolog® Personality Factor Profile, the more active and assertive they describe themselves in NEO-PI-R, and the higher they assess their achievement striving, their competence and their self-discipline. At the same time, increased Dominant values correspond with values for lower vulnerability, anxiety and depression on the NEO scales. Finally, people with high Dominant values are more inclined to describe themselves as less self-conscious, as straightforward and modest. Above all, they appear to be open for new opportunities for behavior.

This correlation pattern confirms the validity of the Dominant items of the D-I-S-C, because it harmonizes very well with the description of this dimension which is presented in the context of the persolog® Personality Factor Model. According to it, people having high values on the Dominant scale are characterized by an active behavioral style, goal-orientation, independence, assertiveness as well as the desire to measure themselves against others. Both item groups correlate at 0.91. This high value, together with the fact of very similar correlation patterns, makes it evident that the statements and adjectives measure comparable characteristics not only formally but also with respect to content.

	Statements	Adjectives
Neuroticism	**-0.44**	**-0.37**
Vulnerability	-0.53	-0.46
Self-Consciousness	-0.47	-0.43
Anxiety	-0.41	-0.35
Depression	-0.47	-0.43
Angry hostility	-0.15	-0.05
Impulsivity	-0.05	0.01
Extraversion	**0.46**	**0.49**
Assertiveness	0.74	0.71
Activity	0.51	0.54
Positive Emotions	0.25	0.29
Excitement-seeking	0.07	0.16
Warmth	0.20	0.16
Gregariousness	0.08	0.13
Openness to experience	**0.27**	**0.25**
Openness to actions	0.36	0.32
Openness to ideas	0.29	0.24
Openness to feelings	0.22	0.23
Openness to fantasy	0.07	0.11
Openness to values	0.11	0.05
Openness to aesthetics	0.10	0.10
Agreeableness	**-0.27**	**-0.34**
Modesty	-0.37	-0.36
Straightforwardness	-0.33	-0.48
Tender-mindedness	-0.25	-0.18
Trust	0.20	0.11
Complinace	-0.15	-0.14
Altruism	-0.11	-0.20
Conscientiousness	**0.36**	**0.24**
Competence	0.57	0.45
Achievment striving	0.50	0.42
Self-Discipline	0.37	0.29
Dutifulness	0.21	0.12
Order	0.07	0.00
Deliberation	-0.03	-0.16

**Table 4:
Correlation of the
Dominant items with
the facets of the
NEO-PI-R**

Results for the Influencing items

These item groups include 17 statements and 19 adjectives. Both indicate an eigenvalue distribution that points to a single main factor for each. The parallel analyses conducted come to the conclusion that only the first factor respectively had a higher eigenvalue than factors based on random numbers. The loadings of the Influence items were between a maximum of 0.82 and the lowest value at 0.40 which was held by one adjective.

First, these results can be interpreted as showing that the items of each respective scale are supported by a common latent dimension. Second, the loadings of all items meet the criterion of interpretability.

In addition the analysis of reliability by means of Cronbach's Alpha resulted in a value of 0.93 for the statements as well as for the adjectives, which can be judged high and which indicates that the measurements were only slightly affected by measuring errors.

**Table 5:
Information on the
dimensionality and
reliability of the
Influencing items**

Influencing	Eigenvalue of the first factor	Eigenvalue of the second factor	Lowest loading	Cronbach's Alpha
Statements	8.5	1.6	0.43	0.93
Adjectives	8.0	1.5	0.40	0.93

In table 6 the correlations between both groups of Influence items and the facets of the NEO-PI-R are combined. Accordingly, they have high correlation primarily with facets of Extraversion. People with high values in this dimension are characterized above all by cheerfulness, marked warmth and sociability.

The more people assess themselves as Influencing on the items of the persolog® Personality Factor Profile, the more they describe themselves as impulsive and open for feelings and willing to trust others. This correlation pattern corresponds very well with the characteristics which are ascribed to people with high values on the Influence dimension according to the definition of the D-I-S-C – openness, friendliness and the tendency to encourage others, to include and understand them, which can be considered as proof for the validity of the items.

The correlation patterns for the adjectives and the statements are very similar. That can be interpreted to the effect that both item groups measure the same characteristic with respect to content. These findings are supported by the fact that their correlation with each other is 0.90.

	Statements	Adjectives
Neuroticism	**-0.09**	**-0.08**
Impulsiveness	0.35	0.31
Depression	-0.27	-0.23
Self-Consciousness	-0.25	-0.23
Vulnerability	-0.14	-0.11
Angry hostility	0.10	0.04
Anxiety	-0.09	-0.06
Extraversion	**0.80**	**0.76**
Positive Emotions	0.66	0.65
Warmth	0.64	0.66
Gregariousness	0.61	0.55
Activity	0.59	0.54
Assertiveness	0.47	0.46
Excitement-seeking	0.34	0.29
Openness to experience	**0.47**	**0.52**
Openness to feelings	0.50	0.53
Openness to aesthetics	0.42	0.46
Openness to fantasy	0.36	0.41
Openness to actions	0.34	0.32
Openness to ideas	0.22	0.26
Openness to values	0.08	0.13
Agreeableness	**0.05**	**0.05**
Trust	0.31	0.33
Modesty	-0.23	-0.24
Altruism	0.19	0.18
Compliance	-0.19	-0.17
Tender-mindedness	0.13	0.14
Straightforwardness	0.08	0.08
Conscientiousness	**-0.06**	**-0.11**
Deliberation	-0.35	-0.34
Competence	-0.31	0.24
Order	-0.19	-0.20
Achievement striving	0.16	0.16
Dutifulness	-0.07	-0.13
Self-Discipline	-0.01	-0.09

**Table 6:
Correlation of the Influencing items with the facets of the NEO-PI-R**

Results for the Steady items

The two item groups of this dimension contain 19 items each. Their eigenvalue distribution corresponds to the pattern that can be expected when the items are based on a common factor. The parallel analyses conducted come to the conclusion that only the first factor respectively had a higher eigenvalue than factors based on random numbers. The loadings of the items have values between 0.80 and 0.45.

Thus the dimensionality test indicates clearly the single dimensionality of both item groups. The levels of the loading all exceed the value of 0.40, which is an important condition for the interpretability of the items.

The positive results of the Dimensionality verification were supplemented by assessments of reliability by means of Cronbach's Alpha, which is high for both groups at a value of 0.93. A low effect from measurement errors can be assumed for the statements as well as for the adjectives.

**Table 7:
Information on
dimensionality and
reliability of the
Steady items**

Steady	Eigenvalue of the first factor	Eigenvalue of the second factor	Lowest loading	Cronbach's Alpha
Statements	6.5	1.3	0.54	0.93
Adjectives	7.9	1.3	0.45	0.93

The correlations of the item groups with the facets of the NEO-PI-R which are displayed in table 8 serve to test the validity. In the forefront there are the high connections of the dimension Steadiness with various aspects of agreeableness.

The higher the test person assesses their steadiness by means of the statements or adjectives, the more they also assess their own altruism and claim to trust others. At the same time they describe themselves as cooperative and outspoken, a characteristic that includes qualities such as frankness, sincerity and straightforwardness. High values in the Steadiness items correlate with marked warmth and openness for aesthetic experiences. In the context of the persolog® Personality Factor Profile people with high Steadiness values are described as predictable, dependable and cooperative. Above all, the high connections with the facets of agreeableness justify this characterization and support a positive assessment of the validity of the scales.

The correlation patterns of both item groups correspond very well. The coefficient for the adjectives is significantly lower than that for the statements only in the facet "openness for feelings". However, with a correlation at the level of 0.84 it can still be assumed that both item groups measure the same content.

	Statements	Adjectives
Neuroticism	**-0.02**	**-0.09**
Angry hostility	-0.13	-0.29
Self-Consciousness	0.07	0.08
Vulnerability	-0.06	-0.07
Anxiety	0.03	-0.03
Depression	-0.03	-0.02
Impulsiveness	0.00	-0.12
Extraversion	**0.24**	**0.00**
Warmth	0.55	0.45
Positive Emotions	0.28	0.18
Gregariousness	0.19	0.00
Activity	0.08	-0.13
Assertiveness	-0.03	-0.23
Excitement-seeking	-0.03	-0.17
Openness to experience	**0.32**	**0.16**
Openness to Aesthetics	0.39	0.29
Openness to Feelings	0.32	0.15
Openness to Ideas	0.26	0.16
Openness to Fantasy	0.17	0.04
Openness to Values	0.09	0.07
Openness to Actions	0.05	-0.07
Agreeableness	**0.54**	**0.61**
Altruism	0.70	0.69
Compliance	0.34	0.46
Trust	0.33	0.30
Straightforwardness	0.29	0.32
Tender-mindedness	0.28	0.27
Modesty	0.17	0.28
Conscientiousness	**0.13**	**0.19**
Competence	0.27	0.23
Dutifulness	0.16	0.22
Deliberation	0.11	0.19
Self-Discipline	0.05	0.09
Achievement striving	0.04	0.04
Order	0.02	0.11

Table 8: Correlation of the Steady items with the facets of the NEO-PI-R

Results for the Cautious items

The group of cautious items is composed of 15 statements and 18 adjectives. Whereas the eigenvalue distribution of the statements and the results of a parallel analysis indicate that a common, latent dimension underlies both, the results for the adjectives are not so clear. It is true that here, too, the first factor is significantly stronger than the second, but the parallel analysis according to Horn indicates that the second factor also has a higher value than can be expected from one based solely on random data.

However, the difference between both eigenvalues is so low at 0.4, and the first factor so much stronger than the second, that it does not seem justified to regard the items as multi-dimensional. Nevertheless, the future development of the D-I-S-C should work toward defining the characteristic Cautious at the level of the adjectives more clearly. That this is important also becomes evident when the loading of the items is considered. These vary with the statements between 0.79 and 0.43 and thus are above the value of 0.4, which has been defined as the limiting value in the context of the analyses presented here.

However, two of the adjectives do not meet this criterion. However, the adjectives critical, with a loading of 0.37, and peaceful, with a loading of 0.38, lie just below the value, and so it seems that also with respect to the loading of the items there is no cause to question the quality of the measurement made by the scale.

An assessment of the reliability using Cronbach's Alpha resulted in a value of 0.87 for the statements and a value of 0.88 for the adjectives. Both values approach the value of 0.90, above which reliability can be classified as high. The effect of measurement errors can be considered satisfactorily low for both groups of Cautious items, and no significant distortion of the measurements through errors is to be feared. Comparison with the other three dimensions of the persolog® Personality Factor Profile, in which reliability is over 0.90, make it clear that both Cautious scales can also be optimized further with respect to reliability.

Table 9:
Information on dimensionality and reliability of the Cautious items

Cautious	Eigenvalue of the first factor	Eigenvalue of the second factor	Lowest loading	Cronbach's Alpha
Statements	4.5	1.6	0.43	0.87
Adjectives	6.4	2.1	0.37	0.88

The correlation with the facets of the NEO-PI-R gives a clear answer to the question whether or not the items measure the content that they claim to measure. As the name of the D-I-S-C scale which is behind the concept of the items clearly states, high correlations should be found with the facets of the dimensions of the same name in the NEO-PI-R in order to verify the validity of the items. Inspection of the values collected in table 10 shows that these expectations are met, because the higher people's values in the facets consciousness of duty, love of order, prudence and self-discipline are, the more they also ascribe to themselves the characteristic Cautious corresponding to the D-I-S-C items. At the same time people with high Cautious values assess themselves as low in impulsiveness and describes themselves as only slightly seeking for excitement, a dimension of the NEO-PI-R which includes characteristics such as love of adventure and readiness to take risks.

The positive assessment of the validity of both item groups for determining cautious is supported by the fact that their correlation patterns compare very well and they correlate with each other at a value of 0.86. Both findings support the conclusion that both item groups measure the content of the same dimension.

	Statements	Adjectives
Neuroticism	**-0.06**	**0.04**
Impulsiveness	-0.50	-0.42
Self-Consciousness	0.16	0.26
Angry hostility	-0.12	0.00
Vulnerability	-0.09	-0.03
Depression	0.09	0.20
Anxiety	0.06	0.09
Extraversion	**-0.37**	**-0.40**
Excitement-seeking	-0.41	-0.35
Positive Emotions	-0.27	-0.30
Gregariousness	-0.27	-0.29
Activity	-0.26	-0.35
Assertiveness	-0.21	-0.27
Warmth	-0.08	-0.09
Openness to experience	**-0.22**	**-0.25**
Openness to Actions	-0.36	-0.39
Openness to Fantasy	-0.35	-0.35
Openness to Feelings	-0.18	-0.18
Openness to Values	-0.14	-0.15
Openness to Ideas	0.12	0.04
Openness to Aesthetics	-0.05	-0.02
Agreeableness	**0.18**	**0.11**
Altruism	0.27	0.18
Compliance	0.22	0.13
Straightforwardness	0.22	0.24
Trust	-0.21	-0.31
Modesty	0.18	0.25
Tender-mindedness	-0.04	-0.10
Conscientiousness	**0.73**	**0.68**
Dutifulness	0.70	0.66
Order	0.68	0.67
Deliberation	0.67	0.63
Self-Discipline	0.51	0.45
Achievement striving	0.40	0.31
Competence	0.23	0.18

Table 10:
Correlation of the Cautious items with the facets of the NEO-PI-R

Summary consideration of the results of the studies of the dimensionality, reliability and validity of the D-I-S-C items

The worth of items for measuring personality characteristics can be judged according to a series of criteria.

1. It must be verified that items which are supposed to measure a specific characteristic demonstrate qualities which support the conclusion that a common character dimension underlies them, and that they represent this to a sufficient degree.

2. It must be verified that a measurement by means of scales which are composed of these kinds of items can be made with sufficient exactness in the sense of the lowest possible distortion through measurement errors.

3. It must be made clear that with respect to content that the scales measure what they are supposed to measure.

If the eigenvalues obtained in the context of a factor analysis show a distribution according to which the first factor has a significantly larger eigenvalue than the second, then this is an initial indication that criterion 1 is met. In addition, if a parallel analysis indicates that only the first factor has an eigenvalue which is greater than the eigenvalue that analysis of random data would produce, and if the individual items have loadings to this factor which are greater than 0.4, it can be assumed with a high degree of certainty that these items can be considered as indicators of a common dimension and that they represent it very well.

Of the eight scales of the D-I-S-C investigated here (two per character dimension) seven of these meet the very strict criteria in an exemplary fashion. Only the adjectives for measuring Cautious are slightly under the standards being applied. To be sure, the eigenvalue of the first factor of this item is significantly greater than the second factor, but the eigenvalue of this factor is also slightly greater than a value which results from the analysis of random data and two of the 18 adjectives have loadings slightly below 0.4. However, the deviations observed are so slight, and the standards applied here so strict, that no serious distortion of measurement quality can be assumed.

The second criterion holds that the reliability of item groups which are intended to measure a personality characteristic should approach the value of 1 as closely as possible, but one cannot assume that this is realistically possible, for in this case the measurement error would equal zero. Even with physical values this is only to be expected in extremely controlled laboratory conditions.

Values above 0.9 are considered very good, and six of the eight scales investigated here are significantly greater than this very strict criterion. With reliability coefficients of 0.87 for the statements and 0.88 for the adjectives, both item groups for capturing Cautious came slightly under the value of 0.9, yet still lie within a range that supports the statement that the scales of the persolog® Personality Factor Profile are only affected slightly by measurement errors and thus are very reliable.

The results of the first two criteria of measurement worth of the D-I-S-C items investigated here are collected in table 11.

Whereas the first two criteria of value target formal aspects of items and scales, the third criterion, validity, is related to aspects of content. Basically, here one expects correlations between the scales being tested and already established personality scales, that indicate that with regard to content that which the scales claim to measure is actually measured.

	Eigenvalue of the first factor	Eigenvalue of the second factor	Lowest loading	Cronbach's Alpha
Dominant				
Statements	9.9	1.5	0.46	0.94
Adjectives	10.2	1.3	0.59	0.95
Influencing				
Statements	8.5	1.6	0.43	0.93
Adjectives	8.0	1.5	0.40	0.93
Steady				
Statements	6.5	1.3	0.54	0.93
Adjectives	7.9	1.3	0.45	0.93
Cautious				
Statements	4.5	1.6	0.43	0.87
Adjectives	6.4	2.1	0.37	0.88

Table 11: Information on the Dimensionality and Reliability of the D-I-S-C items.

All eight D-I-S-C scales analyzed meet this criterion in an ideal manner. The correlation patterns for Dominant, Influencing, Steady and Cautious are presented together in table 12. For each character dimension the six highest correlation coefficients are marked with strong colors. Cells with characteristics having correlation coefficients of at least 0.3 are highlighted with somewhat weaker colors. This value is the threshold for significant connections between the respective characteristics.

In high agreement with the description of the dimension in the D-I-S-C manuals, the correlation pattern of Dominant is characterized by high psychic stability (negative correlation with the facets of Neuroticism). At the same time, there are high values for the facets of Extraversion, which are less related to social and more toward task-oriented personality characteristics. Task-orientation is also reflected by the correlation with the facets performance and self-ascribed competence in the dimension Cautious. The rather low values for partial aspects of agreeableness support this impression.

On the other hand, the pattern in the dimension Influence is clearly marked by Extraversion, which is not only related to task-orientation but also to other people, which is also described in the persolog® Personality Factor Model manuals as a typical characteristic of the Influence dimension. In this connection the high correlations with facets of openness and characterization through high impulsiveness and low prudence are also coherent.

The correlation pattern of the dimension Steadiness is characterized by high connections to almost all facets of Agreeableness. This corresponds to the basic characteristics of people with high Steadiness values described in the manuals, and makes it evident that also for these items the intended content measurement can be empirically supported.

Although the scales for Cautious relating to the formal criteria 1 and 2 do not achieve quite the same degree of quality as the other scales, this is not the case with respect to their content. As is to be expected, the highest correlations are to be found with precisely those facets of the NEO-PI-R that are also intended to register Cautious. This orientation is supported by the negative correlation with the scales impulsiveness and hunger for experience.

Aside from a few insignificant exceptions, the correlation patterns of the two sub-scales (statements and adjectives) correspond to one characteristic. It can be concluded from this that they are very comparable with respect to content. This is supported by the respective correlation coefficients of the sub-scales for one dimension.

Table 12: Correlation of the sub-scales of the D-I-S-C with the facets of the NEO-PI-R

	Dominant		Influe
	Statements	**Adjectives**	**Statements**
Neuroticism	**-0.44**	**-0.37**	**-0.09**
Self-Consciousness	-0.47	-0.43	-0.25
Vulnerability	-0.53	-0.46	-0.14
Angry hostility	-0.15	-0.05	0.10
Impulsiveness	-0.05	0.01	0.35
Anxiety	-0.41	-0.35	-0.09
Depression	-0.47	-0.43	-0.27
Extraversion	**0.46**	**0.49**	**0.80**
Activity	0.51	0.54	0.59
Assertiveness	0.74	0.71	0.47
Gregariousness	0.08	0.13	0.61
Warmth	0.20	0.16	0.64
Positive Emotions	0.25	0.29	0.66
Excitement-seeking	0.07	0.16	0.34
Openness to experience	**0.27**	**0.25**	**0.47**
Openness to Actions	0.36	0.32	0.34
Openness to Ideas	0.22	0.23	0.50
Openness to Values	0.11	0.05	0.08
Openness to Feelings	0.29	0.24	0.22
Openness to Fantasy	0.07	0.11	0.36
Openness to Aesthetics	0.10	0.10	0.42
Agreeableness	**-0.27**	**-0.34**	**0.05**
Trust	0.20	0.11	0.31
Compliance	-0.33	-0.48	-0.19
Straightforwardness	-0.15	-0.14	0.08
Modesty	-0.37	-0.36	-0.23
Tender mindedness	-0.25	-0.18	0.13
Altruism	-0.11	-0.20	0.19
Conscientiousness	**0.36**	**0.24**	**-0.06**
Achievement striving	0.50	0.42	0.16
Competence	0.57	0.45	0.31
Self-Discipline	0.37	0.29	-0.01
Dutifulness	0.21	0.12	-0.07
Order	0.07	0.00	-0.19
Delibeation	-0.03	-0.16	-0.35

...encing	Steady		Cautious	
Adjectives	Statements	Adjectives	Statements	Adjectives
-0.08	-0.02	-0.09	-0.06	0.04
-0.23	0.07	0.08	0.16	0.26
-0.11	-0.06	-0.07	-0.09	-0.03
0.04	-0.13	-0.29	-0.12	0.00
0.31	0.00	-0.12	-0.50	-0.42
-0.06	0.03	-0.03	0.06	0.09
-0.23	-0.03	-0.02	0.09	0.20
-0.76	0.24	0.00	-0.37	-0.40
0.54	0.08	-0.13	-0.26	-0.34
0.46	-0.03	-0.23	-0.21	-0.27
0.55	0.19	0.00	-0.27	-0.29
0.66	0.55	0.45	-0.08	-0.09
0.65	0.28	0.18	-0.27	-0.30
0.29	-0.03	-0.17	-0.41	-0.35
0.52	0.32	0.16	-0.22	-0.25
0.32	0.05	-0.07	-0.36	-0.39
0.53	0.32	0.15	-0.18	-0.18
0.13	0.09	0.07	-0.14	-0.15
0.26	0.26	0.16	0.12	-0.04
0.41	0.17	0.04	-0.35	-0.35
0.46	0.39	0.29	-0.05	-0.02
0.05	0.54	0.61	0.18	0.11
0.33	0.33	0.30	-0.21	-0.31
-0.17	0.34	0.46	0.22	0.13
0.08	0.29	0.32	0.22	0.24
-0.24	0.17	0.28	0.18	0.25
0.14	0.28	0.27	-0.04	-0.10
0.18	0.70	0.69	0.27	0.18
-0.11	0.13	0.19	0.73	0.68
0.16	0.04	0.04	0.40	0.31
0.24	0.27	0.23	0.23	0.18
-0.09	0.05	0.09	0.51	0.45
-0.13	0.16	0.22	0.70	0.66
-0.20	0.02	0.11	0.68	0.67
-0.34	0.11	0.19	0.67	0.63

Additional statistical analyses

The calculation of correlations of the D-I-S-C items with central facets of personality serves to answer the question whether the D-I-S-C items show similarities with these characteristics that are related to the D-I-S-C scales with respect to content. Independent of this, two groups of different hypotheses were investigated, which can be formulated based on the characteristics that the persolog® Personality Factor Model registers.

For one thing, gender differences could be observed with respect to the characteristics in the individual item groups. This is true above all for the items which register dominance and steadiness. With respect to Dominance, it is to be expected that men have higher values than women. With Steadiness, which is focused on cooperation and communication, women should have higher values.

The statistical analyses confirm these hypotheses. To be sure, the gender differences are not very great, but men have higher values than women independent of whether the statements or the adjectives form the basis for the analysis.

On the other hand, they have higher values in the dimension Steadiness than men. In addition to gender differences, it was also investigated whether people having responsibility for employees are different from people who have no co- workers. Here the differences were more marked than those between men and women. They were related exclusively to the two item groups which register dominance. People with responsibility for employees have higher values than people having no responsibility for employees.

Concluding Assessment
of the Measurement Quality of the D-I-S-C items

When the findings reported here on the D-I-S-C items are summarized, it can be stated that they have very good measurement qualities. They meet high expectations formally as well as with respect to content. In any case, there is a need for the optimization of the adjectives used for registering Cautious. Yet it should be realized that the quality criteria in the framework of this study were set so high that it can be tolerated when some of the items fall short of the criteria as slightly as was seen with some of the items on cautious.

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