EVERYTHING DiSC® APPLICATION LIBRARY

EVERYTHING DISC ASSESSMENT RESEARCH REPORT

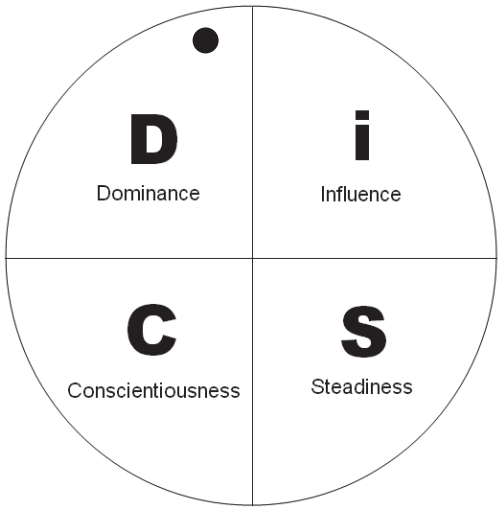
inscape publishing

The DiSC® Model

DiSC® is a model of behavior and personality. The circle, or circumplex, below shows one of the most common ways to represent this model. Although all points around the DiSC circle are equally meaningful and interpretable, the DiSC model discusses four reference points around the circle. These are D (Dominance), i (Influence), S (Steadiness), C (Conscientiousness), and they are summarized briefly below.

Dominance: direct, strong-willed, and forceful
Influence: sociable, talkative, and lively
Steadiness: gentle, accommodating, and soft-hearted
Conscientiousness: private, analytical, and logical

Although some people tend equally toward all of these regions, research indicates that most of us lean toward one or two. Each person who takes the *Everything DiSC*® assessment is plotted on the circle, also known as the DiSC Map. The example below shows a person (represented by the dot) who tends toward the D region, but also somewhat toward the i region. This represents a Di style.



This person, therefore, is probably particularly active, bold, outspoken, and persuasive, as these qualities generally describe people who share both the D and i styles. The distance of the dot from the center of the circle is also meaningful. People whose dots fall toward the edge of the circle, as shown in the picture above, are much more committed to their DiSC styles and may have greater difficulty shifting to other styles which are farther away from their dots. People whose dots fall close to the center of the circle are less committed to a particular style and can probably shift into other styles with less effort or stress.

Assessment and Scoring

The *Everything DiSC*® assessment asks participants to respond to 79 adjectives on a five point ordered response scale, indicating how often each adjective describes them. These responses are used to form scores on eight scales (standardized to have a mean of zero and standard deviation of one) that are located around the DiSC® circle, as shown below. The eight scales are as follows:

D measures a direct, dominant disposition using adjectives such as aggressive, strong willed, and forceful.

Di measures an active, fast-paced disposition using adjectives such as dynamic, adventurous, and bold.

i measures an interactive, influencing disposition using adjectives such as sociable, lively, and talkative.

iS measures an agreeable, warm disposition using adjectives such as trusting, cheerful, and caring.

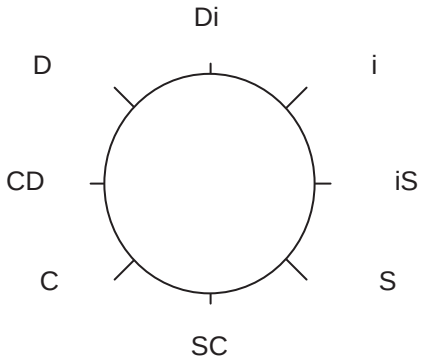
S measures an accommodating, steady disposition using adjectives such as considerate, gentle, and soft-hearted.

SC measures a moderate-paced, cautious disposition using adjectives such as careful, soft-spoken, and self-controlled.

C measures a private, conscientious disposition using adjectives such as analytical, reserved, and unemotional.

CD measures a questioning, skeptical disposition using adjectives such as cynical, stubborn, and critical.

An individual's scores on these eight scales are then weighted (according to the scale's location on the circle) and used to plot an individual inside the DiSC Map, as represented by a dot. (Note that these eight scale scores are not directly reported in the profile.) The DiSC Map is divided into 12 sections, or styles, as shown in Appendix 3. Each section represents 30 degrees within the circle. An individual's feedback is based on the section in which his or her dot falls.



Overview of the Validation Process

Psychological instruments are used to measure abstract qualities that we can't touch or see. These are characteristics like intelligence, extroversion, or honesty. So how do researchers evaluate these instruments? How do we know whether such tools are actually providing accurate information about these characteristics or just generating haphazard feedback that sounds believable? Simply put, if an instrument is indeed useful and accurate, it should meet a variety of different standards that have been established by the scientific community. Validation is the process through which researchers assess the quality of a psychological instrument by testing the tool against these different standards. This paper is designed to help you understand these different standards and see how the *Everything DiSC*® assessment performs under examination.

Validation asks two fundamental questions:

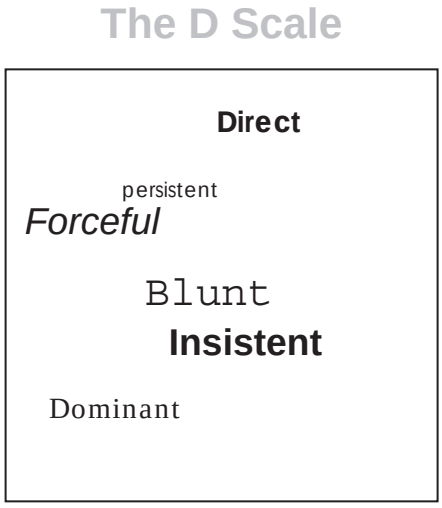
1. **How reliable is the tool?** That is, researchers ask if an instrument measures in a way that is consistent and dependable. If the results from a tool contain a lot of random variation, it will be deemed less reliable.

2. **How valid is the tool?** That is, researchers ask if an instrument measures accurately. The more that a tool measures what it proposes to measure, the more valid the tool is.

Note that no psychometric tool is perfectly reliable or perfectly valid. All psychological instruments are subject to various sources of error. Reliability and validity are seen as matters of degree on continuous scales, rather than reliable/unreliable and valid/invalid on dichotomous scales. Consequently, it is more appropriate to ask, "How much evidence is there for the reliability of this tool?" than "Is this tool reliable?"

Reliability

Internal Reliability evaluates the degree of correlation among questions that profess to measure the same thing. That is, each of the eight scales in the DiSC® model is measured using a series of different items (i.e., questions in the form of adjectives, such as *direct, adventurous, cautious, cheerful)*. Researchers recognize that if all of the items on a given scale (e.g., the D scale) are in fact measuring the same thing (e.g., Dominance), they should all correlate with each other to some degree. In other words, all of the items on a scale should be consistent with each other. A statistic called Cronbach's Alpha is usually regarded as the best method of evaluating internal consistency.



Cronbach's Alpha expresses the degree of correlation as a specific number, which typically varies between 0.0 and 1.0. If the value of Alpha is 0.0, then there is no relationship among the items/statements on a given scale. On the other hand, if all the statements in a questionnaire measure in an identical fashion, then the value of Alpha will be 1.0, which indicates absolute internal consistency. Cronbach's Alpha is calculated separately for each of the assessment's eight scales.

The following guidelines are frequently used to evaluate the quality of a scale's internal reliability: Alpha values above .70 are generally considered acceptable and satisfactory, Alpha values above .80 are usually considered quite good, and values above .90 are considered to reflect exceptional internal consistency. In fact, Alpha values that are too high may indicate that the items on a scale are redundant or too similar. In such cases, many of the instrument's items may provide very little new information about a respondent.

Alpha coefficients were calculated for sample of 811 respondents. The demographics of this sample are included in Appendix 1.

The scales on the *Everything DiSC*® instruments demonstrate good-to-excellent internal consistency, as shown by the Alpha values listed on Table 1. All reliabilities are well above .70 with a median of .85.

Table 1. Scale Reliabilities

Scale	Cronbach's Alpha
D	.88
Di	.91
i	.91
iS	.88
S	.82
SC	.82
C	.80
CD	.75

Validity

As already mentioned, validity indicates the degree to which a tool measures that which it has been designed to measure. Assessing the validity of a psychological tool that measures abstract qualities (like intelligence, extroversion, or honesty) can be tricky. There are, however, a number of basic strategies that researchers use to answer the question, "How well is this instrument measuring what it says it's measuring?" The validation strategies that will be discussed here fall under the heading of **construct validity.**

Construct Validity

Construct validity examines the validity of a tool on a highly theoretical level. A *construct* is an abstract idea or concept (such as intelligence, dominance, or honesty) that is used to make sense of our experience. The Di scale of the *Everything DiSC*® instruments, for example, measures a particular construct (i.e., the tendency to be bold, adventurous, and fast paced) This "bold" construct , in turn, is theoretically related to a variety of other constructs. For instance, it is reasonable to assume that someone who is very bold will not be particularly cautious in nature. Thus, bold tendencies and cautious tendencies are theoretically linked in a negative manner. Consequently, if our measure of a bold tendency has high validity, people scoring high on the Di scale should score relatively low on a scale measuring cautiousness, such as the SC scale. This is essentially what researchers do when they examine construct validity. First, they specify a series of theoretical relationships (e.g., the

construct of boldness is theoretically related to the constructs of X, Y, and Z). Then they test these theoretical relationships empirically to see if the relationships actually exist. If the proposed relationships do exist, the instrument is thought to have higher validity.

Scale Intercorrelations

As you might imagine, there are a variety of different ways to test construct validity. First, we can examine the validity of an instrument as a whole. Instruments like the *Everything DiSC*® assessment propose an underlying model in which the scales within the tool have a specific relationship to each other. Researchers examine the actual relationship among the scales to see if they reflect the theoretical relationship proposed by the model.

The DiSC® model proposes that adjacent scales (e.g., Di and i) will have moderate correlations. That is, these correlations should be considerably smaller than the alpha reliabilities of the individual scales. For example, the correlation between the Di and i scales (.51) should be substantially lower than the alpha reliability of the Di or i scales (both .91). On the other hand, complementary scales (e.g., i and C) are theoretically opposite and so they should have strong negative correlations. Table 2 below shows data obtained from a sample of 811 respondents who completed the *Everything DiSC* assessment. The correlations among all eight scales show strong support for the model. That is, moderate positive correlations among adjacent scales and strong negative correlations are observed between opposite scales.

Table 2. Scale Intercorrelations

	D	DI	I	IS	S	SC	C	CD
D	**.88**							
DI	.37	**.91**						
I	-.04	.51	**.91**					
IS	-.49	-.10	.38	**.88**				
S	-.71	-.42	-.05	.49	**.82**			
SC	-.52	-.75	-.63	-.11	.37	**.82**		
C	-.05	-.55	-.76	-.44	-.06	.54	**.80**	
CD	.35	-.18	-.50	-.69	-.51	.15	.39	**.75**

Cronbach's Alpha reliabilities are shown in bold along the diagonal, and the correlation coefficients among scales are shown within the body of the table. Correlation coefficients range from -1 to +1. A correlation of +1 indicates that two variables are perfectly positively correlated such that as one variable increases, the other variable increases by a proportional amount. A correlation of -1 indicates that two variables are perfectly negatively correlated, such that as one variable increases, the other variable decreases by a proportional amount. A correlation of 0 indicates that two variables are completely unrelated; N=811, as shown in Appendix 1.

Because the *Everything DiSC*® assessment model proposes that the eight scales are arranged as a circumplex, an even more strict set of statistical assumptions are required of the data. The pattern of correlations for a given scale are expected to be arranged in a particular order. As can be seen in Table 3 below, the strongest theorized correlation for a given scale is labeled r_1. The second strongest is labeled r_2, and so on. In this case, r_4 represents the correlation with a theoretically opposite scale. Consequently, r_4 should be a reasonably strong negative correlation. For each scale, we should observe the following relationship if the scales support a circumplex structure: $r_1 > r_2 > r_3 > r_4$.

Table 3. Expected Scale Intercorrelations

	D	DI	I	IS	S	SC	C	CD
D	1.00							
DI	r_1	1.00						
I	r_2	r_1	1.00					
IS	r_3	r_2	r_1	1.00				
S	r_4	r_3	r_2	r_1	1.00			
SC	r_3	r_4	r_3	r_2	r_1	1.00		
C	r_2	r_3	r_4	r_3	r_2	r_1	1.00	
CD	r_1	r_2	r_3	r_4	r_3	r_2	r_1	1.00

Looking at Table 2, we do, in fact, observe a $r_1 > r_2 > r_3 > r_4$ pattern for each scale. In addition, we can examine the magnitude of these correlations in comparison to the theoretically expected magnitudes. The predicted magnitudes of r_1, r_2, r_3, r_4 under a circumplex structure are listed in Table 4, as described by Wiggins (1995). The "actual" r_x values are the median correlations for a given r_x. Although the actual and predicted values are not exactly the same (a near impossible standard for practical purposes), the magnitude of the actual and predicted correlation values is quite similar, thus providing additional support for the DiSC circumplex model and the ability of the *Everything DiSC* assessment to measure this model.

Table 4. Actual and Predicted Scale Relationships

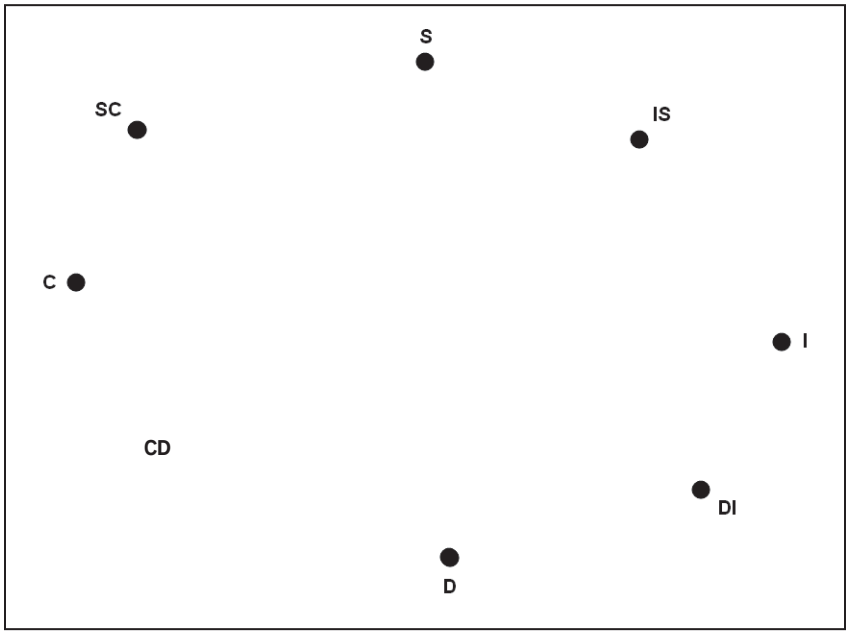
r_1	>	r_2	>	r_3	>	r_4	
.43	>	-.05	>	-.51	>	-.73	Actual (average)
.42	>	.03	>	-.36	>	-.73	Predicted

The Dimensionality of the DiSC® Model: Multidimensional Scaling (MDS)

A statistical technique called multidimensional scaling also adds support to the DiSC® model as a circumplex. This technique has two advantages. First, it allows for a visual inspection of relationship among the eight scales. Second, this technique allows researchers to look at all of the scales simultaneously. In Figure 1 below, scales that are closer together have a stronger positive relationship. Scales that are farther apart are more dissimilar. The circumplex DiSC model predicts that the eight scales will be arranged in a circular format at equal intervals.

As can be seen in Figure 1, the scales are arranged in a way that is expected by the DiSC model. (Keep in mind that the original MDS rotation is presented below and this rotation is arbitrary.) Although the eight scales do not form a perfectly equidistant circle (as predicted by the model), this theoretical ideal is nearly impossible to obtain with actual data. The actual distance between the scales, however, is roughly equal, providing strong support for the model and its assessment.

Figure 1. MDS Two Dimensional Solution



Stress = .00956
RSQ = .99908
N = 811

As can be seen above, all scales are closest to the scales that are theoretically adjacent to them in the model. For instance, the Di is closest to the D scale and i scale, as predicted by the model. In

addition, scales that are theoretically opposite (e.g., the i or C) are generally furthest away from each other on the plot, although there were two exceptions to this finding. Consequently, this analysis adds strong support for the two-dimensional DiSC® model and the ability of the *Everything DiSC®* assessment to measure that model.

Additionally, the S-stress of the model is .00956 and the RSQ value is .99908. These values reflect the ability of a two-dimensional model to fit the data. Lower S-stress values are preferred (with a minimum of 0) and higher RSQ values are preferred (with a maximum of 1). Both of these values are almost ideal in the data, suggesting that the two-dimensional DiSC model fits the participant data exceptionally well.

The Dimensionality of the Circumplex DiSC® Model: Factor Analysis

(Note that this section may require some statistical background to understand fully)

To further explore the dimensionality of the model, a principle components factor analysis was performed on all eight scales using a varimax rotation. The eigenvalues below clearly reinforce the two dimensional structure underlying the eight scales, as shown in Table 5. Only two components demonstrate eigenvalues above one, and both of these are well above one. Further, components 3 through 8 all have eigenvalues that decrease smoothly and are meaningfully below zero. Consequently, regardless of whether we use Kaiser's Criterion or a scree plot method of determining the number of factors to extract, the number of retained factors is two, as predicted by the model.

Table 5. Factor Analysis Eigenvalues

Component	Eigenvalues
1	3.25
2	2.85
3	0.51
4	0.48
5	0.36
6	0.28
7	0.26
8	< 0.01

N=811

The rotated factor loadings are listed in Table 6. (Note that the loadings were rotated such that the loadings reflect the original DiSC rotation). The pattern of loadings is as expected for a circumplex model, as listed under the Ideal Loadings column. That is, with a circumplex model, we would expect the some scales would have high loadings on one component and near zero loadings on the other

component (i.e., Di, iS, SC, and CD) and some scales would have moderately high loadings on both components (e.g., D, i, S, and C).

Table 6. Factor Loadings for the Eight DiSC® Scales.

	Actual Loadings		Ideal Loadings	
Scale	Vertical Dimension	Horizontal Dimension	Vertical Dimension	Horizontal Dimension
D	.621	-.605	.707	-.707
Di	.865	.065	1.000	.000
i	.657	.598	.707	.707
iS	-.068	.861	.000	1.000
S	-.585	.662	-.707	.707
SC	-.901	-.127	-1.000	.000
C	-.634	-.590	-.707	-.707
CD	-.071	-.851	.000	-1.000

Further, the pattern of negative and positive loadings are as expected. For example, the i and C scales share no common dimensions, and consequently show an opposing pattern of negative loadings (the C scale) and positive loadings (the i scale). However, the D and i scales would be expected to share one component but be opposite on the other component. This is what we observe, since both scales are negatively loaded on component 1, but have opposite loadings on component 2.

Table 7. Angular locations for the Eight DiSC Scales.

Scale	Actual Angle	Ideal Angle	Deviation	Vector Length
D	316	315	1	.87
Di	4	0	4	.87
i	42	45	-3	.89
iS	95	90	5	.86
S	131	135	-4	.88
SC	188	180	8	.91
C	223	225	-2	.87
CD	265	270	-5	.85

Table 7 shows the ideal and actual angular locations for the eight DiSC® scales. The deviation column indicates that the actual angles are very similar to the ideal angles. The absolute average deviation is 3.8, which is lower than many of the interpersonal-based instruments currently available. Vector length, as shown in the last column of Table 7, reflects the extent to which the scale is represented by the two underlying dimensions (Kiesler et al., 1997). These values can range from 0.0 to 1.0. A length of .80 is considered very good and a length above .90 is considered exceptional. The mean vector length of .87 suggests that the scales have a strong relationship with the dimensions they are intended to measure.

Summary

Evaluation of the *Everything DiSC*® assessment indicates that there is strong support for the reliability and validity of this tool. Analyses suggest that the scales' reliabilities are in the good-to-excellent range with a median coefficient alpha of .85. Analyses examining the validity of the tool were also very favorable. The relationships among the eight scales are highly supportive of the circumplex structure, and strongly reflect the expected pattern of correlations hypothesized under the DiSC model.

Appendix 1. Development Sample Demographics (N=811)

Gender	Male	49 %
	Female	51 %
Age	Under 18	>1 %
	18-25	15 %
	26-35	17 %
	36-45	26 %
	46-55	29 %
	56 or older	13 %
Education	Some high school	1 %
	High school graduate	5 %
	Technical/Trade school	2 %
	Some college	24 %
	College graduate	35 %
	Graduate/Professional degree	33 %
Heritage	African American	10 %
	American Indian	1 %
	Asian American	2 %
	Caucasian	79 %
	Hispanic	6 %
	Other	3 %
Employment	Secretary/Clerical	4 %
	Executive	11 %
	Mid-Level Management	13 %
	Supervisory	3 %
	Professional	34 %
	Mechanical-Technical	2 %
	Customer Service	3 %
	Sales	6 %
	Health care Worker	1 %
	Teacher/Educator	6 %
	Skilled Trades	2 %
	Student	6 %
	Self-Employed	1 %
	Homemaker	1 %
	Other	7 %

Appendix 2. Ethnic and Gender Differences

It is important to understand the relationship between ethnic background and profile score. An analysis of variance (ANOVA) was performed on the eight scale means across the ethnic groups within the sample (see Appendix 1). Results indicated that there was no significant difference ($p<.05$) on seven of the eight scales based on ethnic background ($df=804$). The ANOVA indicated that there was a statistically significant difference ($p=.02$) across ethnic groups on the iS scale. These differences, however, accounted for only 1.7% of the variance on this scale, suggesting that ethnic classification does not have a practically meaningful relationship to scores on the iS scale. Further, ethnic background accounted for less than 1% of the variance on each of the other seven scales.

Gender differences were also examined across the eight *Everything DiSC®* scales. Although these differences were still generally small, they were larger than differences based on ethnicity. Again, the largest differences were seen on the iS scale, in which gender accounted for 10.2% of scale variance. Gender accounted for 4.2% of the variance on the DC scale, which is theoretically opposite the iS scale. Women tended to score higher on the IS scale and men tended to score higher on the DC scale. For the other six scales, statistically significant differences were found, but as the table below shows, these differences did not appear to be large in practical terms.

	Percent of variance accounted for by:	
Scale	Gender	Heritage
D	0.3	0.2
Di	0.5	0.6
i	2.9	0.7
iS	10.2	1.7
S	2.4	0.3
SC	1.5	0.9
C	2.5	0.7
CD	4.2	0.5

Appendix 3. The Distribution of DiSC® Style Scores (N=811)

The distribution of DiSC® styles is presented below. Each style covers 30 degrees of the DiSC circle. The Di style, for example, indicates that a person's score falls in the D quadrant, but tends toward the i quadrant. A person is assigned to a given style if their DiSC score falls in the area of the circle corresponding to that style. Although there is some variability in style distribution, all of these roles are within 4.5 percentage points of each other.

Style	Frequency (%)
DC	8.0
D	6.1
Di	8.3
iD	10.6
i	9.5
iS	7.7
Si	7.9
S	6.4
SC	8.4
CS	8.5
C	8.0
CD	10.4

Bibliography

Wiggins, J. S. (1995). *Interpersonal Adjective Scales: Professional Manual*. Odessa, FL: Psychological Assessment Resources, Inc.

Kiesler, D. J., Schmidt, J. A., & Wagner, C. C. (1997). A circumplex inventory of impact messages: An operational bridge between emotion and interpersonal behavior. In R. Plutchik & H. Conte (Eds.), *Circumplex models of personality and emotions*. Washington, DC: American Psychological Association.