

ORIGINS AND DISCUSSION OF EMERGENETICS® RESEARCH

The following document provides background information on the research and development of the Emergenetics Profile instrument.

Emergenetics Defined

1. Emergenetics is based on research that indicates: (1) individuals have inborn traits to act and think in certain ways, and (2) these traits are modified and shaped as people interact with their surroundings. The combination of experiences and genetics intertwine to form some commonly recognizable patterns of personality traits.

2. There are seven basic sets of attributes described by Emergenetics: four ways of thinking and three ways of behaving. The four Thinking Attributes are Analytical preferences (Blue), Structural preferences (Green), Social preferences (Red) and Conceptual preferences (Yellow). The three Behavioral Attributes (Purple) are Expressiveness behavior, Assertiveness behavior and Flexibility behavior.

3. The Emergenetics instrument is a self-descriptive test. A self-descriptive test is one where people answer questions about themselves; the answers are tallied and the responses are compared with a group norm and reported back. Several factors affect the accuracy of self-descriptive tests:

- a. They are always filtered by personal bias (i.e. our answers indicate how we choose to describe ourselves to others.)
- b. Good tests are based on a sound theory and established test - developed principles, not personal opinions or ill-conceived psychobabble.
- c. Test developers are expected to follow the technical test - development guidelines published in *The Standards for Educational and Psychological Testing*.
- d. Each test factor measured should be comprised of five to seven individual test items to maximize reliability.
- e. Test results represent “patterns” and should never be considered cast in stone.
- f. As a general rule, the traits and behaviors measured by a robust test should remain consistent over time.

Development of the Emergenetics Profile

Several important factors were considered when the Emergenetics Profile instrument was developed. The underlying theory, reliability, validity, and test norms are discussed in the following sections.

The Underlying Theory

For centuries, psychologists and philosophers have been trying to understand why people behave the way they do. The arguments have drifted back and forth between theories that we are

completely shaped by our environment and theories that we are completely shaped by our genetic structure.

During the first half of the 20th century, most psychologists were convinced behaviors developed purely due to the surrounding environment. Ivan Pavlov, B.F. Skinner and John Watson were a few of the behavioral psychologists who shared this belief. For decades, their theories provided the basis for most behavioral research.

In the late 1950s and 1960s, however, the “nature/nurture” argument began to shift back to “nature” in light of truly innovative work done with identical twins. To understand the importance of this research, we have to travel back in time to WWII. Parents in war-torn cities often sent their children to live with different families in the countryside. Many of these children happened to be identical twins.

About twenty years later, psychologists contacted many of these twin-pairs asking them to participate in a study of nature-versus-nurture effects. Their findings showed that behavior was equally influenced by *both* genetics and environment. Today, researchers know that Pavlov, Skinner and Watson were only half right...both nature and nurture play substantial roles in determining behaviors and thinking styles.

Because it is impossible to clearly separate internal factors from behaviors, the theory of Emergenetics combines much of the early work in psychology with the most recent findings from twin research. It proposes that we have a combination of genetic tendencies to think and act in certain ways (nature), and behaviors that have been modified through socialization (nurture).

The Emergenetics Profile instrument lays the groundwork for understanding this combination by measuring four common Thinking Attributes (Analytical, Structural, Social, Conceptual) and three Behavioral Attributes (Expressiveness, Assertiveness, Flexibility). Emergenetics is not a comprehensive or clinical picture of a person’s total psyche, but it captures important everyday patterns that most people recognize.

Reliability

A major concern of test developers is whether each test question reliably measures the construct (i.e. deep-seated mental framework) it is supposed to measure. If a test is well designed, scores from items on one part of the test should correlate with scores from questions measuring the same construct in another part of the test. Thus, test “reliability” refers to the ability of the test to produce consistent scores.

Statistical procedures used in development of the Emergenetics Profile test include inter-item (item by item), reliability split-half (overall) reliability, and test/re-test reliability. Inter-item reliability is an internal measure of how well each item correlates to the total score for that item. Split-half reliability is a measure of relationship between scores on the first half of the test with scores on the last half. Test/re-test reliability is a measure of how consistently a person constructs her or his Profile from one time to the next.

Inter-Item Reliability

During the development of the Emergenetics instrument, both the inter-item and construct relationships were carefully measured. For example, if the response to question 14 was supposed to measure Assertiveness, the value of this response would be expected to increase with the total score for Assertiveness. If the item score and total score were not positively correlated, question 14 would be dropped from the test.

Split-half Reliability

The measure of Split-half (overall) reliability used for the Emergenetics Profile instrument test is coefficient alpha. Coefficient alpha refers to the average of all possible inter-item and split-half correlations, both good and bad. Without relying on single indicators of reliability which may contain large amounts of error, coefficient alpha provides an overall measure of the internal reliability of the test. The coefficient alphas for the Emergenetics Profile instrument are:

<i>Attribute</i>	<i>Coefficient Alpha</i>
Analytical	.83
Structural	.76
Social	.76
Conceptual	.76
Expressiveness	.83
Assertiveness	.83
Flexibility	.80

Test/Re-Test Reliability

Test/re-test reliability is a measure of how consistently a person answers the instrument over time. Test/re-test measures were conducted during the development of the Profile test. Results indicate that persons who completed the test after two years tended to respond in much the same manner. Here are the statistical correlations for each attribute for that study (any number .70 or greater is considered a very strong correlation):

<i>Attribute</i>	<i>Correlation</i>
Analytical	.84
Structural	.77
Social	.74
Conceptual	.82
Expressiveness	.80
Assertiveness	.78
Flexibility	.82

Further test/re-test studies were completed in 2004. This time, Emergenetics scores for 171 females and 117 males, some of whom took the test as early as 1993, were measured. This data was examined using the Analysis of Variance (ANOVA) procedure to determine whether change in test scores was due to chance. The ANOVA data showed Conceptual scores increased slightly between the first testing and second testing. This may be due to an Emergenetics “workshop effect” where participants learned that being Conceptual can be a “good thing”.

Validity

The validity of a test refers to how well a test measures what it is supposed to measure. Like reliability, there are several different types of validity.

Face Validity

Face validity refers to whether a test-taker perceives the test to be credible. When measuring thinking styles and behaviors, for example asking questions about bank deposits or religious affiliations would seriously threaten face validity. Irrelevant questions may stimulate respondents to question the validity of the entire test and thereby produce unreliable answers. Questions on the Emergenetics Profile instrument were specifically written to be relevant to everyday events and behaviors.

Content Validity

Content validity refers to the adequacy of the Emergenetics Profile instrument to measure the behavior it is supposed to measure. A typing test, for example, has a clear relationship between what the test measures and a specific skill. Content validity is more difficult to obtain for a general communication instrument. It must rely on personal feedback from people who agree or disagree that the test describes common thinking or behavioral attributes.

Participants who take the Emergenetics Profile instrument almost universally agree the test accurately measures the four Thinking Attributes and the three Behavioral Attributes.

Criterion Validity

Criterion validity is a measure correlating a person’s score with performance in some other area. Using our earlier example, if a high score on the typing test could be later seen as high performance, the typing test could be considered criterion valid. Because the Emergenetics Profile instrument was not developed to predict or measure performance in specific jobs, information about criterion validity was not collected.

Construct Validity

The final form of validity is construct validity. A construct can be described as a deep-seated mental “construction” or characteristic. Construct validity refers to whether Emergenetics Profile instrument measures the four kinds of thinking preferences and the three kinds of behaviors. No attempt was made to “peel open” participants’ minds to evaluate intelligence, deep-seated emotional affects, or clinical or physiological aspects.

Construct validity is often determined using measures similar to those used in determining reliability. That is, the seven Emergenetics factors were statistically examined to see whether they were independent or covaried with one other. The table of Inter-Attributes shows the interrelationships among the four Thinking Attributes and three Behavioral Attributes.

Relationships of the Attributes

Behavioral research is generally filled with overlapping results. How can a person, for example, not be “Assertive” when he or she is also “Expressive”? Much of this confusion comes from the fact that behavioral science is “fuzzy”—that is, one behavior often overlaps another behavior. The similarities between attributes were recognized during our research and an attribute was only included when it helped explain different behaviors between people with similar Thinking Attributes.

Construct Relationships

The relationships between Thinking Attributes and Behavior Attributes are the strength of Emergenetics. They also make understanding Emergenetics slightly more complex. The relationships between the Emergenetics factors are shown in the following table:

INTER-ATTRIBUTE CORRELATIONS TABLE						
	Analytical	Structural	Social	Conceptual	Expressiveness	Assertiveness
Structural	.18					
Social	NS	NS				
Conceptual	.11	-.74	.26			
Expressiveness	.10	-.51	.55	.52		
Assertiveness	.25	-.50	.15	.49	.80	
Flexibility	NS	-.20	.84	.38	.66	.30

Correlations are significant at the $P < .01$ level using a two-tailed test of significance; NS represents a non-significant correlation. A correlation is a measure of agreement between two numbers. It can range from -1.0 (perfect negative correlation) to 0 (no correlation) to +1.0 (perfect positive correlation).

The data from the Emergenetics research base now contains responses from tens of thousands of people. The table above shows how the relationships among behaviors and thinking styles generally vary in strength and direction. The following sections discuss some of the highlights.

Relationships Between Thinking Attributes

There is a minimal correlation between Analytical and Structural (.18, scientifically expressed as $r = .18$), Analytical and Conceptual ($r = .11$), and Social and Conceptual ($r = .26$). Structural showed a strong negative relationship with Conceptual ($r = -.74$), indicating an expected bipolarity between an expressed interest in either creativity or rule-following. Social showed no statistical relationship with either Analytical or Structural. This indicates the four Thinking Attributes tend to measure different factors, two of which move in opposite direction.

Relationships Between Behavioral Attributes

These relationships were straightforward. Expressiveness was strongly related with Assertiveness ($r = .80$) and Flexibility ($r = .66$). While it is difficult to separate assertiveness in a social situation from assertiveness in a task situation, it is possible to be task assertive without being socially assertive. Therefore, the two Attributes, Assertiveness and Expressiveness, were chosen to determine the presence of autocratic behavior. Flexibility, on the other hand, should have a lower correlation with Assertiveness than with Expressiveness, and this was confirmed by the data (.30 compared with .66).

Relationships Between Thinking Attributes and Behavioral Attributes

The three Behaviors showed the expected relationships with each other, that is, Expressiveness and Assertiveness are highly correlated with each other, and Flexibility has a lower correlation with Assertiveness, yet it has a higher correlation with Expressiveness. The Behavioral Attributes' relationships with the Thinking Attributes were more complex. Flexibility moved independently from Analytical ($r = .07$, ns); negatively with Structural ($r = -.20$); very positively with Social ($r = .84$); and generally positive with Conceptual ($r = .38$). These relationships showed that people who rated themselves as socially or conceptually oriented thinkers also tended to rate themselves as being flexible (a beneficial trait in social and creative situations). Analytical thinking and Flexibility had no statistically significant correlations. Structural thinking was negatively related to Flexibility, which meant that people who valued rules and order were also likely to be less flexible than others.

People who rated themselves as Assertive were slightly correlated with Analytical ($r = .25$) and Social ($r = .15$); negatively related with Structural; ($r = -.50$); and moderately correlated with Conceptual ($r = .49$). These relationships indicate that Assertiveness is largely associated with rule-breaking (a negative Structural characteristic) and risk-taking (a positive Conceptual characteristic).

Expressiveness is negatively associated with Structural ($r = -.51$) and positively associated with Analytical ($r = .10$), Social ($r = .55$), and Conceptual ($r = .52$). These patterns indicate that rule followers are likely to be quiet and reserved; problem solvers tend to go either way; and social and conceptual thinkers are likely to be more outgoing.

Flexibility is negatively associated with Structural ($r = -.20$) and positively associated with Social ($r = .84$) and Conceptual ($r = .38$). These relationships indicate that Social thinkers will almost always also be Flexible and that Conceptual thinkers are likely to be Flexible.

Putting It Together

A person's primary Thinking style does not always predict how he or she will behave. Social thinking is likely to be Expressive and Flexible, and only slightly Assertive. Conceptual thinking is probably more Expressive and Assertive and may be somewhat Flexible. Structural thinking tends to be non-Expressive, non-Assertive and, slightly, Inflexible. Analytical thinking has little association with any of the behaviors. It correlates slightly with Expressiveness and Assertiveness and not at all with Flexibility.

Gender Differences and Normative Information

In general, the mean raw scores for males and females show interesting differences. Females scored significantly higher in Structural, Social, Expressiveness and Flexibility attributes. Males scored higher in Analytical, Conceptual and Assertiveness attributes. These differences are not good or bad; they are just differences. The following T-score comparisons are statistically significant at the $P = <.01$ level. They represent averages, not individual scores, and should be considered with interest, not judgment.

Analytical....Male preference is 5 points higher than female
Structural.....Female preference is 2 points higher than male
Social.....Female preference is 6 points higher than male
Conceptual....Male preference is 2 points higher than female
Expressiveness.....Female preference is 2 points higher than male
Assertiveness.....Male preference is 2 points higher than female
Flexibility.....Female preference is 3 points higher than male

Because of these differences, a person's final score for each Emergenetics factor is reported in relation to others of the same sex. Gender-based norms were used to avoid sexual bias. Emergenetics norms have a standard error of less than 1.0.

Normative Updates

Emergenetics is periodically re-normed to account for test bias and to reflect changes in the culture. Through the years the norms have not shown substantive change, with two exceptions. When we compared the 1991, 1995 and 2002 data, we found there was a shift in the means and point differences in some of the attributes as the following chart reveals:

GENDER GAP				
	Mean	1991	1995	2002
Analytical	Males higher	5 points	4 points	5 points
Structural	Females higher	2 points	2 points	2 points
Social	Females higher	7 points	6 points	6 points
Conceptual	Males higher	3 points	3 points	2 points
Expressiveness	Females higher	1 point	1 point	2 points
Assertiveness	Males higher	5 points	3 points	2 points
Flexibility	Females higher	5 points	3 points	3 points

This latest data was drawn from a base of 44,602 respondents and all of these numbers represent statistically significant changes.

Conclusion

The Emergenetics Profile instrument meets the criteria for face validity, construct validity, content validity, split-half reliability and inter-item reliability.

It provides valuable information about four Thinking styles and three Behavioral styles using norms generated from analyzing tens of thousands of Profiles.

The Emergenetics Profile instrument has been found to provide valuable feedback to people who wish to use the instrument for improving interpersonal effectiveness, whether in a personal or occupational setting and it appears to reflect cultural norms over time.

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