The Emergenetics®Technical Report for Youth

The Office of Research

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Dedication

This technical report is dedicated to Dr. Geil Browning, whose brilliant vision continues to inspire our commitment to improving the lives of young people.

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Introduction

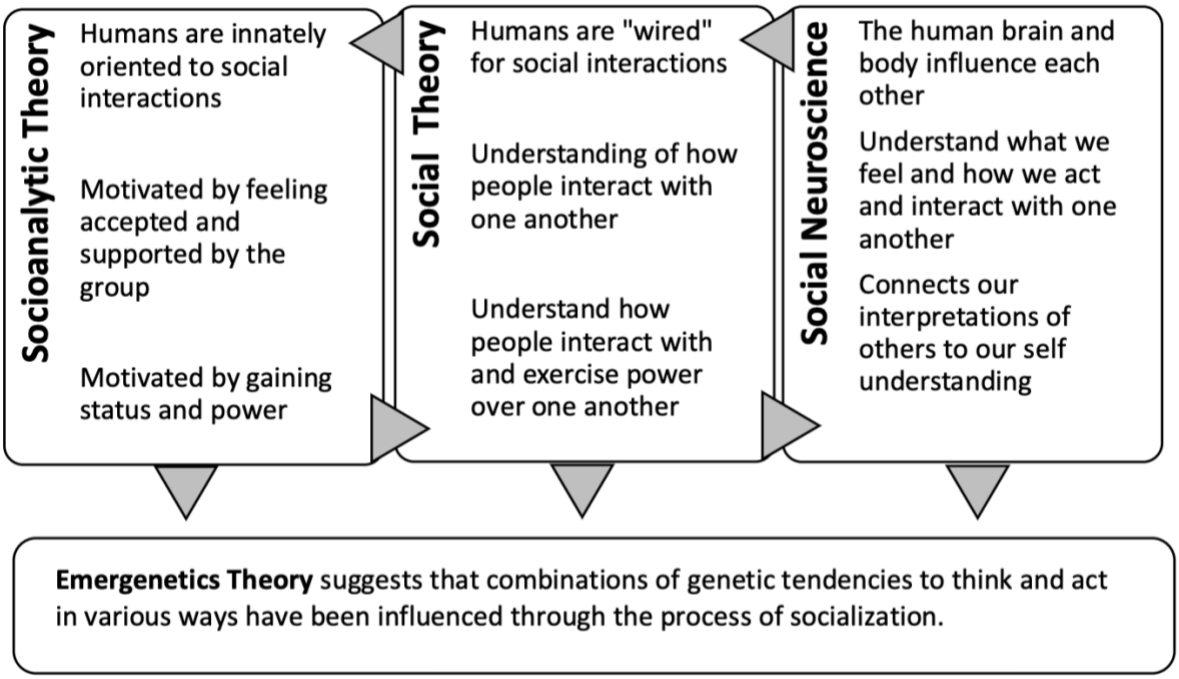
"If we only knew how children preferred to learn, we could do a better job of teaching them."
Geil Browning, Ph.D.

As a child, the founder of Emergenetics International, Geil Browning, Ph.D., would listen to her mother and grandmother discuss their worry about their students having trouble in school. At a very young age, Dr. Browning began to consider the idea that *if we only knew how children preferred to learn, we could do a better job of teaching them.* This idea stayed with Dr. Browning throughout her professional journey as she became a classroom teacher, school principal, University faculty member and the founder of Emergenetics International. Dr. Browning's passion for education was the impetus for the development of the Emergenetics® Youth Report. The Youth Report, like its adult counterpart, the Emergenetics Profile, captures how children from ages 10-18 prefer to think, learn, problem-solve and communicate.

Building from the norming studies of the adult Emergenetics Profile, co--creators Drs. Browning and Williams initiated the development of the Youth Report in 1997 with students at a high school in Louisiana. In 1998 the first norming study was conducted. The initial norming study normed by age and gender, with one hundred children represented at each age from 10-18.

The Emergenetics Youth Report survey items were assembled to form a nomological and empirical approach to behavior based on simplified verifiable observation. Emergenetics theory measures fundamental preferences for thinking and behaving at a situational level. These fundamental preferences follow socioanalytic theory and social theory, which suggest that specific human behaviors evolved as people learned to get along with each other, gain status, secure power and understand their place in the world.[16,17] Social neuroscience and Emergenetics theory have grown and evolved from the foundation of socioanalytic and social theories. Social neuroscience connects the human brain and the body's physiology to understand behavior and how we interact with one another.[18] By continuing to grow, the more comprehensive theories of social neuroscience and Emergenetics theory allow for the capacity to incorporate global and societal changes.[19] Importantly, this allows Emergenetics to be at the forefront of the modern world, adapting to changing demands and meeting the needs of individuals.

Figure 1. The influences between socioanalytic theory, social theory, social neuroscience and Emergenetics theory



Nomological framework

A nomological framework provides a robust model that encourages participants to think of their Youth Report results as useful patterns that influence how they may interact with others. Importantly, while this approach allows for individuals to identify and think about important patterns in their own behavior and thinking, it does not constrain interpersonal interactions and allows for all individuals to engage in all behaviors and thinking patterns.

Below are a few examples of the nomological items gathered by the founders during the development of the Emergenetics Profile:

- Enjoys problem-solving and figuring out how things work
- Tends to be methodical
- Checks in with others for decision making
- Bases decisions on intuition rather than rigorous analysis
- Is willing to engage in dialogue or introspection
- Depending on the situation, takes a calm or driven approach
- Decides easily or is open to revision

As with all self-descriptive instruments, the Emergenetics Youth Report does not necessarily predict specific skills; however, when delivered in combination with an interactive workshop, participants are exposed to:

- Basic tools to improve job performance and communication
- Basic motivational drivers within a work environment
- Strengths and interests based on a heightened knowledge of personal preferences
- Techniques to understand how behavior affects others and how to translate this knowledge into more confidence and self-acceptance when working with others
- Ways to build a collaborative organizational workforce
- Tools for engaging in meaningful dialogue and information about the way they go about work

What does all this mean?
The Emergenetics Youth Report uses the same nomological framework as the Adult Profile to allow for individuals to self-identify with all thinking preferences and behaviors rather than constraining individuals to a particular type of thinking or behaving.

Professional Development of an Instrument

Put simply; a professionally developed survey should:

- Include a useful theory of behavior (i.e., practical)
- Be stable (i.e., reliable)
- Accurately measure what it is supposed to measure (i.e., valid)

These processes are expressly described in the Standards for Educational and Psychological Testing, an internationally accepted digest of best survey practices.[20] The Emergenetics instrument was developed in line with these standards that specify the criteria that all surveys must meet to be considered reputable.

The Standards for Educational and Psychological Testing

1. Items that load on a specific factor must be consistent with each other and with the factor score.
2. Factors within the test that are associated with each other should correlate, and factors that are independent should not.
3. Scores on the survey should directly relate to the content, construct, or criterion it is supposed to measure.
4. Items should resemble "legitimate" questions.
5. To an extent justified by the intended uses of the survey, steps should be taken to keep scores and scoring methods secure from tampering or observation by unauthorized people, detect and prevent faking (whether good or bad), and limit the ability of users to be 'coached' on how to make results more favorable.*

* This standard largely applies to instruments used for high stakes selection, compensation, or other administrative decisions,[21] and not personal development or self-reflection; it did not factor heavily into the development of this instrument.

Following the guidelines outlined above, the founders took the following steps in developing the Emergenetics tool:

- Assembled lists of nomological items
- Constructed the questionnaire
- Administered the questionnaire to participants attending workshops
- Analyzed the questionnaire using a factor analysis
    - Examined scree-plots to identify discrete factors that were both statistically and rationally related
- Repeated this process to identify items that formed factors or clusters

The results were seven specific homogenous factors of item composites that define a specific personality space.[17] The identified factors had suitable inter-item reliabilities within each factor

and were considered theoretically useful. Importantly, dysfunctional and socially undesirable items such as neuroticism, morality, ethics, and so forth were outside the scope of the survey and were excluded from the analysis.

Since the intent of the Profile was to provide robust and useful comparisons between and among individuals, two steps were taken to facilitate this process:

1. Raw scores for each factor were converted into normative percentile scores.
2. The four thinking preferences are additionally represented as a percentage mix.
    - This provides individuals with a robust profile (and partially corrects for survey-response bias) that accounts for what a person themselves considers important, how these preferences interact, and how strongly they present these preferences in a relationship.

Importantly, Emergenetics separates behavioral and thinking preferences. This separation improves upon a historical limitation in which there has been a tendency for many personality profiles to confound thinking preferences with behavioral preferences.

What does all this mean?

The Emergenetics Youth Report was developed in line with the educational and psychological standards. The seven Attributes of the Emergenetics Profile (four thinking Attributes and three behavioral Attributes) are based on a theory that is useful and practical, with results that are reliable and valid. The following sections will demonstrate the reliability and validity of the Attributes.

The Emergenetics Youth Report

The Emergenetics Youth Report includes:

- 84 Items
- Four-point Likert-scaled normative scored factors (with 8-12 items per factor)
- Within-factor inter-item reliabilities ranging between $\alpha = 0.43$ and $\alpha = 0.78$
- Ten-year test-retest reliabilities between $r = .42$ and $r = .55$
- Construct validation convergent/discriminate validation, and face validity
- Four thinking-style preferences based on percentile strength (interpersonal measure) and percentage mix (intrapersonal measure):
    - Analytical (ANA): having an interest in problem-solving, understanding complex subjects, and mental analysis
    - Structure (STR): prefers rules and regulations, stability, a hands-on approach, and avoiding risk
    - Social (SOC): intuitive about people, social concerns, working in teams, seeks approval from others
    - Conceptual (CON): intuitive about ideas, seeks unique activities, experimentation, futuristic
- Three behavioral descriptions based on percentile strength (interpersonal measure):
    - Expressiveness (EXP): based on a continuum from quiet and introspective to gregarious and exuberant
    - Assertiveness (ASR): based on a continuum from calm and peacekeeping to fast-paced and driven
    - Flexibility (FLX): based on a continuum from firm and focused to energized by change

EMERGENETICS® | YOUTH

MADISON - AGE - 13

HOW YOU THINK: PERCENTAGES

ANALYTICAL = 37%

- Enjoys technical problem solving
- Logical
- Solves problems rationally
- Likes exploring how things work
- Enjoys complex concepts

CONCEPTUAL = 30%

- Enjoys creative process
- Imaginative
- Likes the unusual
- Solves problems intuitively
- Likes to try new things
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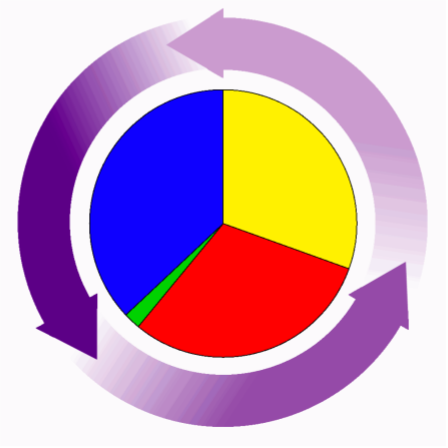


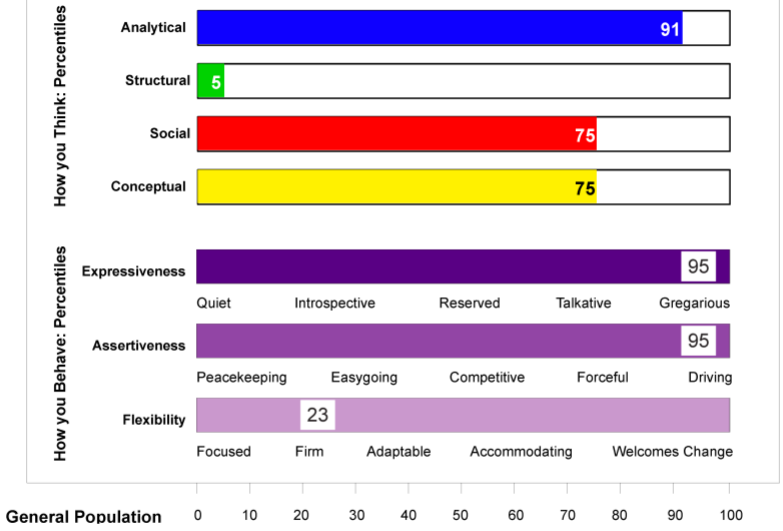
STRUCTURAL = 2%

- Enjoys direction
- Predictable
- Practical
- Makes and follows plans
- Likes closure

SOCIAL = 30%

- Enjoys helping others
- Emotional
- Relational
- Intuitive about people
- Likes working in groups

HOW YOU COMPARE TO THE GENERAL POPULATION:



Geil Browning, Ph.D. / Wendell Williams, Ph.D.

Reliability

Reliability is a statistical test that evaluates the consistency of scores. This applies to both the consistency of the factors themselves or how the items that make up a factor are related (e.g., inter-item reliability) and whether factor scores are consistent over time (e.g., test-retest reliability).

Inter-Item Reliability

Inter-item reliability is a measure of how well individual item scores correlate with the overall factor score. We used the gold standard of Cronbach's Coefficient-Alpha to evaluate the reliability of each factor in the Emergenetics survey. Cronbach's Alpha refers to the average of all possible inter-item and split-half correlations, both strong and weak. Importantly, it does not rely on a single indicator of reliability which may contain large amounts of error.[23,24]

The inter-item reliabilities of the Emergenetics Profile (N = 72,216) ranged from $\alpha = .48$ to $\alpha = .78$, with 8-12 items in each factor. Flexibility's reliability is on the lower side. This is likely due to misunderstanding or misinterpretation of the items that represent Flexibility. As we consider the differing developmental levels, youth may distinguish that their natural response is not aligned with their peer group or societal norms. Therefore, they may be providing an answer that may not be less reflective of their true behaviors and more in line with how they would like to be perceived.

Inter Item Reliability

Emergenetics Factor	**Coefficient Alpha**
Analytical	$\alpha = 0.82$
Structural	$\alpha = 0.63$
Social	$\alpha = 0.67$
Conceptual	$\alpha = 0.78$
Expressiveness	$\alpha = 0.78$
Assertiveness	$\alpha = 0.73$
Flexibility	$\alpha = 0.48$

Test-Retest

Test-retest reliability refers to the stability of the survey over time. In other words, whether survey scores remain the same if the test is taken more than once by the same person.

To understand if the Emergenetics Youth Report has good test-retest reliability, we conducted a study that included 1631 students, who took the Emeregenetics questionnaire at least two times. The average time between the two test was about 2 years.

1. To compare the test-rest results, we first examined bivariate correlations, which revealed that the scores the two scores were highly related to one another (correlations ranged from $r = .42$ and $r = .55$).

2. After conducting correlations, we then ran a paired samples t-test to examine if the scores from the first-time students took the questionnaire were statistically different from their second time. Overall, we found that all seven factors showed no statistically significant difference in scores.

When looking at the overall sample, we have 1631 students who took the test at least twice, with an average time between the first and second tests being about 2 years (1.7 years). When comparing the entire sample, the test re-test shows no difference in average scores across the attributes. In other words, we have a stable test re-test. Students who took the test within two years remain stable in their characteristics.

Paired T-Test Results (All Ages)

Emergenetics Factor	**t-score**	**df**	**p-value**
Analytical	0.50033	860	0.617
Structural	0.3781	860	0.7054
Conceptual	-0.028386	860	0.9774
Social	-1.3914	860	0.1645
Expressiveness	-0.80951	860	0.4184
Assertiveness	-0.38144	860	0.703
Flexibility	0.39491	860	0.693

If we break this down into our age groups, we see high stability within age groups as well. There is one exception to this, and that is, for 13 to 15-year-olds, assertiveness increases with age and

does not remain stable with test re-test. This may be due to the smaller sample size for the individual age groups (N for 13 to 15 = 114). This does not necessarily indicate an issue and may just be reflective of a small sample more than real differences or instability.

Paired T-Test Results (9 to 12)

Attribute	**t-score**	**df**	**p-value**
Analytical	0.29514	215	0.7682
Structural	-0.99518	215	0.3208
Conceptual	-0.28603	215	0.7751
Social	-1.837	215	0.0676
Expressiveness	0.071899	215	0.9427
Assertiveness	0.28487	215	0.776
Flexibility	-0.035802	215	0.9715

Paired T-Test Results (13 to 15)

Attribute	**t-score**	**df**	**p-value**
Analytical	-1.5257	103	0.1301
Structural	-0.02215	103	0.9824
Conceptual	-0.60582	103	0.546
Social	-0.18354	103	0.8547
Expressiveness	-0.56246	103	0.575
Flexibility	0.79464	103	0.4286
Assertiveness	2.411	103	0.01768

Paired T-Test Results (16 to 18)

Attribute	**t-score**	**df**	**p-value**
Analytical	-0.68001	36	0.5008
Structural	0.63825	36	0.5273
Conceptual	-1.0301	36	0.3098
Social	0.27821	36	0.7824
Expressiveness	-0.27722	36	0.7832
Assertiveness	-0.22241	36	0.9744
Flexibility	-0.032292	36	0.8253

What does all this mean?

The Emergenetics instrument is highly stable with good test-retest reliability. Children can take the survey again in 2 years and would likely get similar results. We know this because we had a group of 1631 children take the survey roughly 2 years apart and they had very similar results.

Validity

Evaluating the validity means evaluating whether the test measures what it is intended to measure. There are many different measures of validity, including:

- Face validity
- Convergent/Discriminate validity
- Predictive and concurrent criterion validity
- Construct validity
- Content validity

Since the Emergenetics Youth Report is a normative nomological instrument, we limit our evaluation of validity to face validity, convergent/discriminate validity, and construct validity.

Face validity

Face validity refers to how effective a survey or test appears to be in terms of its stated aims. The Emergenetics Youth Report aims to capture everyday behaviors and ways of thinking that young people may engage in.

To evaluate face validity, we randomly sampled 21 teachers and other adults who interact with children regularly and asked them, “To what degree do you feel the list of items included reflect everyday behaviors and preferences?” They rated this on a scale from 1 – strongly disagree to 5 – strongly agree. Each list contained a sample of questionnaire items that were related to a specific attribute.

We found that most individuals either agreed or strongly agreed that the attribute accurately described everyday behaviors of children.

These results suggest the thinking and behavioral items are, on their face, valid or representative of everyday behaviors.

Cluster 1

1 – Strongly disagree	4.761905
2 – Disagree	9.52381
3 – Neither agree nor disagree	19.047619
4 – Agree	33.333333
5 – Strongly agree	33.333333

Cluster 2

1 – Strongly disagree	4.761905
2 – Disagree	19.04762
3 – Neither agree nor disagree	4.761905
4 – Agree	47.61905
5 – Strongly agree	23.80952

Cluster 3

1 – Strongly disagree	0
2 – Disagree	4.761905
3 – Neither agree nor disagree	23.80952
4 – Agree	23.80952
5 – Strongly agree	47.61905

Cluster 4

1 – Strongly disagree	0
2 – Disagree	19.04762
3 – Neither agree nor disagree	4.761905
4 – Agree	33.33333
5 – Strongly agree	42.85714

Cluster 5

1 – Strongly disagree	4.761905
2 – Disagree	28.57143
3 – Neither agree nor disagree	0
4 – Agree	38.09524
5 – Strongly agree	28.57143

Cluster 6

1 – Strongly disagree	4.761905
2 – Disagree	9.52381
3 – Neither agree nor disagree	4.761905
4 – Agree	23.80952
5 – Strongly agree	57.14286

Cluster 7

1 – Strongly disagree	0
2 – Disagree	9.52381
3 – Neither agree nor disagree	19.04762
4 – Agree	23.80952
5 – Strongly agree	47.61905

What does all this mean?

The Emergenetics Youth Report is effective in its measurements. We know this because we had 21 individuals rate whether or not they agreed that items in the survey reflected everyday behaviors or ways of thinking for youth and the majority either agreed or strongly agreed.

Contingency

Researchers often use two techniques or statistical analyses to examine the relationship between two variables.

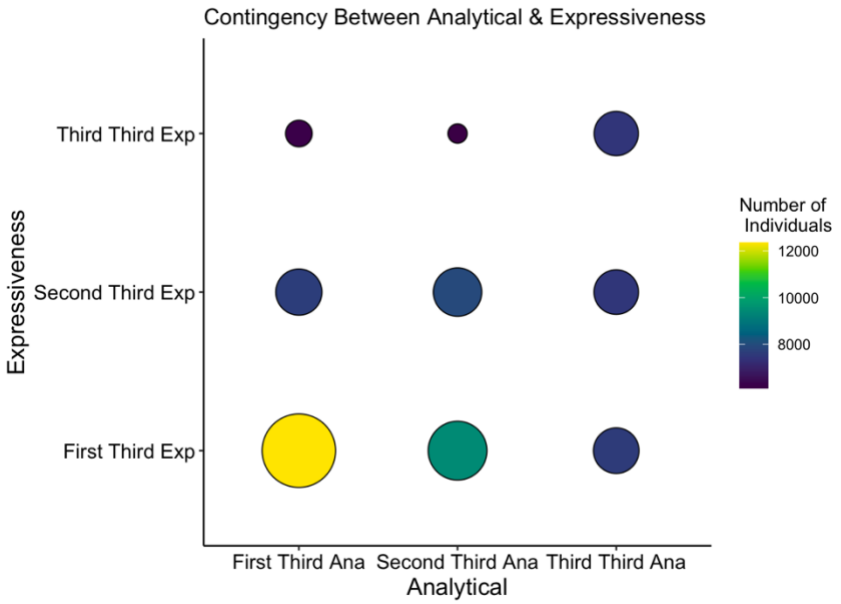
1. Correlation is one popular method to quantify how related or dependent a variable is with another variable. Mathematically, correlations are the process of fitting a line between two or more data points based on their mean and standard deviation.
    - For example, we can quantify the relationship between ice cream sales and shark attacks. ***Most importantly,*** correlations do not represent causal relationships. In other words, just because we find a correlation between ice cream sales and shark attacks ***DOES NOT*** mean that ice cream sales cause shark attacks.
    - Mathematically, we can break down a correlation such that a correlation of r = 0.50 simply tells us that a line can be drawn that minimizes the *plot distances* between roughly 25% of the data points (i.e., .5 squared). The remaining 75% of the data scatter is technically referred to as "unexplained variance."
2. Contingency analysis is another popular method used in survey research to understand the relation between two variables. Pearson suggested that when researchers find that variables are highly commingled, a contingency analysis would better quantify the relations between variables.[26]
    - For example, if we wanted to quantify how closely related paint colors on the same paint chip are, we would want to use contingency analysis. Paint colors on the same paint chips are highly similar to one another and therefore highly correlated, yet it is also sufficiently critical to quantify the differences as these differences may be critical when choosing a color.
    - Similar to correlation, relations quantified through contingency analysis ***DO NOT*** necessarily demonstrate causal relations.

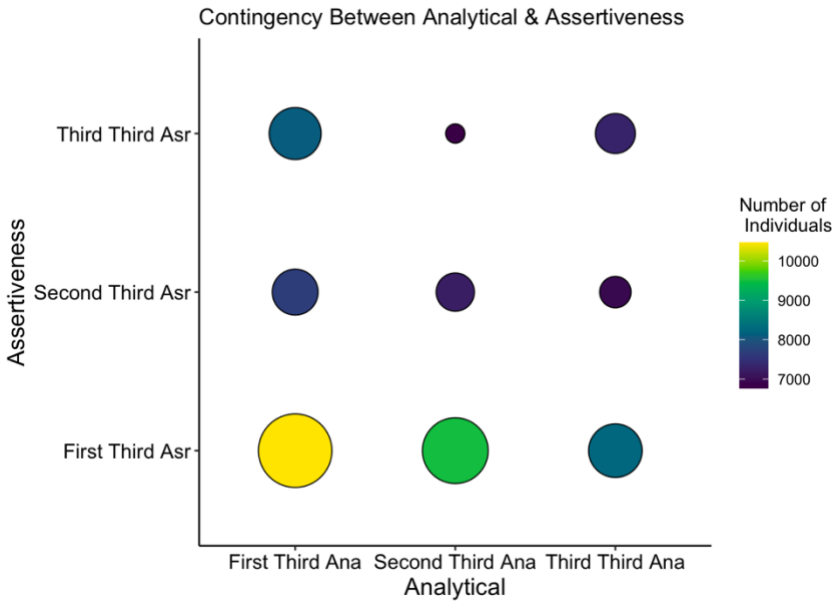
We used contingency analysis to explore differences in thinking preferences and behaviors. We believe that contingency analyses represent a better understanding of the nomological relationship between a thinking preference and a specific behavior because it allows for the exploration of small yet meaningful differences that may exist.

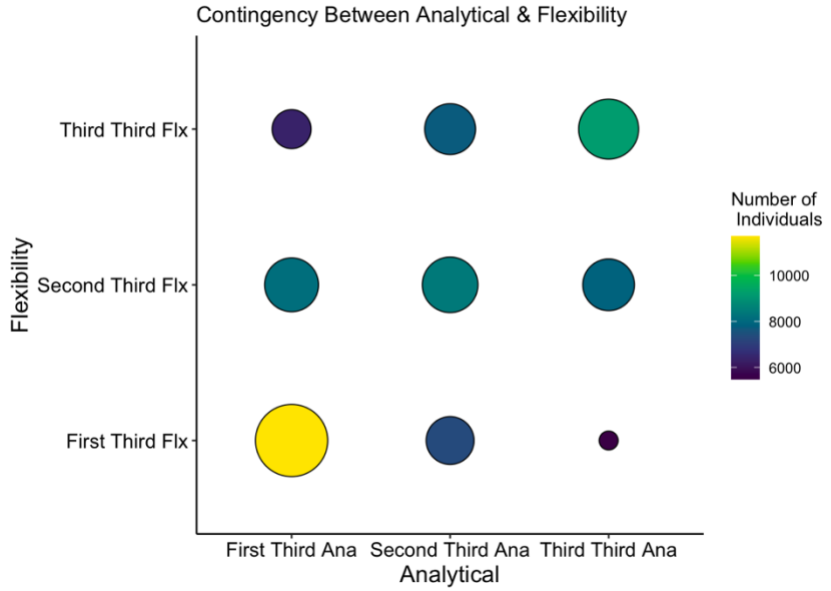
Using a sample of 72,216 individuals, the below tables demonstrate contingencies for the Emergenetics thinking preferences and behaviors. To facilitate comparisons, we first z-scored the raw data to normalize and scale each factor, then divided each factor into bins of equal thirds based on percentiles.

The contingencies reveal that while each of the factors may be related using correlations, there are, in fact, important differences between factors. For example, it may seem that Analytical thinkers may be more likely to fit a stereotypical behavior of peacekeeping, yet the contingency table reveals that those in the top third of Analytical thinking were more likely to rate themselves in the top third of Assertiveness as opposed to the bottom third. Overall,

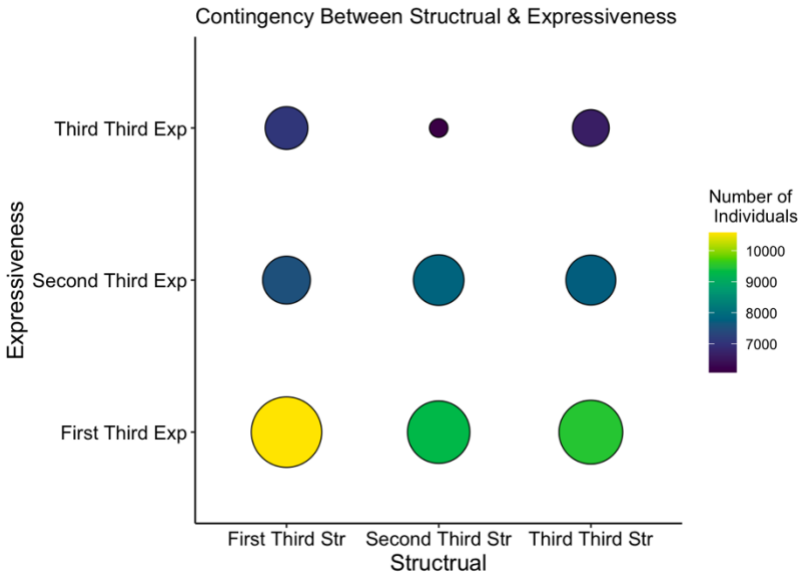
contingencies demonstrate the need for participants to hesitate to form conclusions about how people behave simply because they express a specific thinking preference.

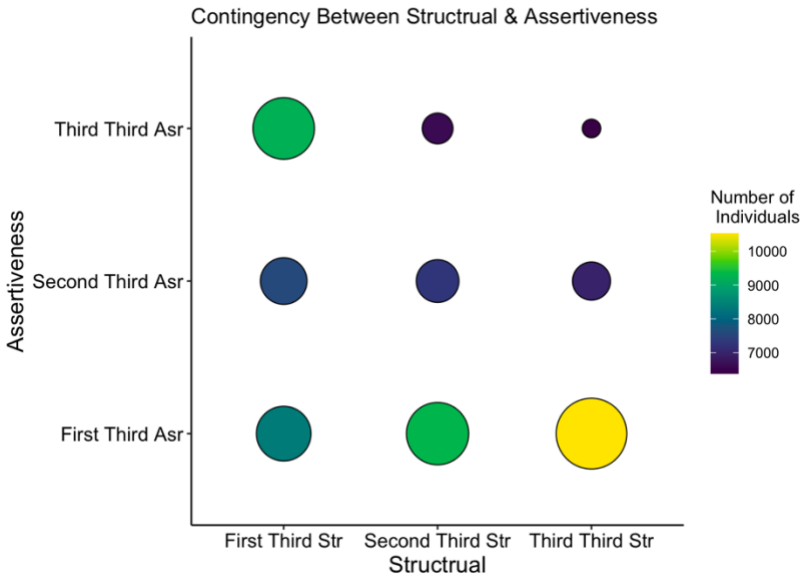


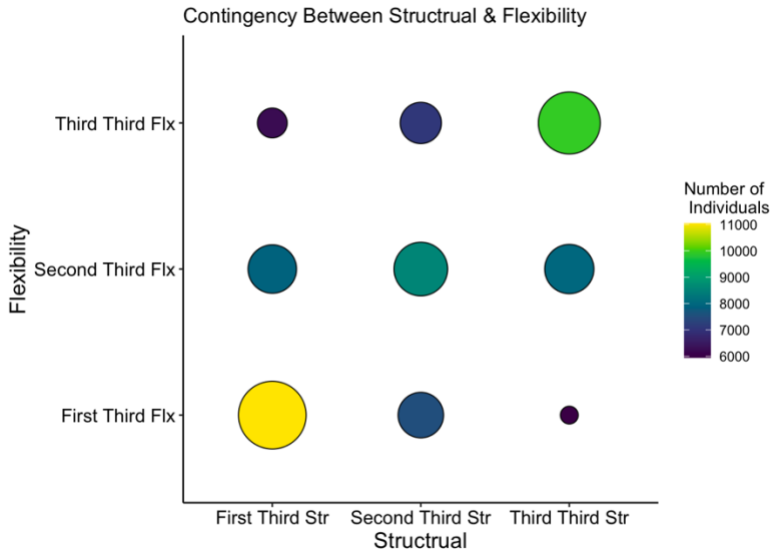




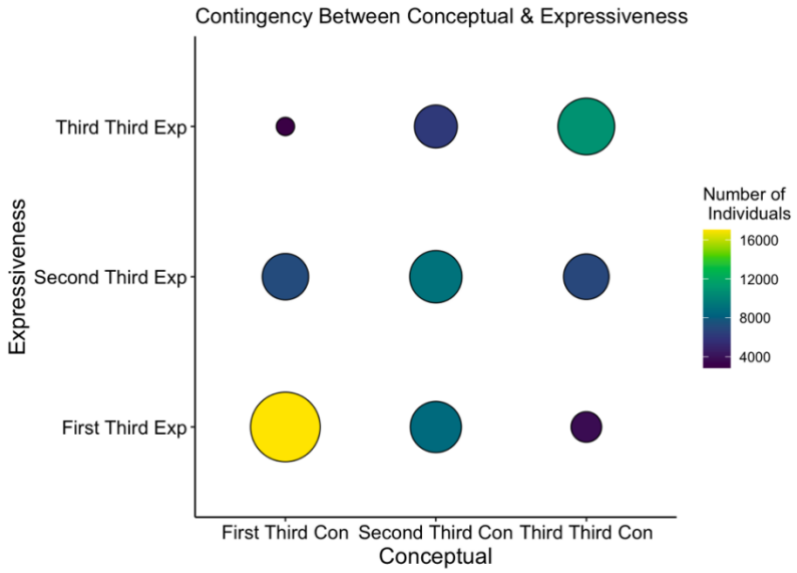
Each of these graphs shows the crosstabs between Analytical thinking and the three behavioral Attributes. The size and color correspond to how many individuals fall into that category, with larger circles indicating more individuals. Additionally, the more yellow a circle, the more individuals are contained in that category; as the color becomes greener and then blue, the number of individuals in that category decreases. For example, in the top right graph, we can see a medium green circle representing the number of individuals who are both third-third Analytical and third-third Expressive. Critically, we see that in each graph, there are individuals in all categories. Also, the size and color of the circles are randomly distributed throughout, such that there are no significant patterns.

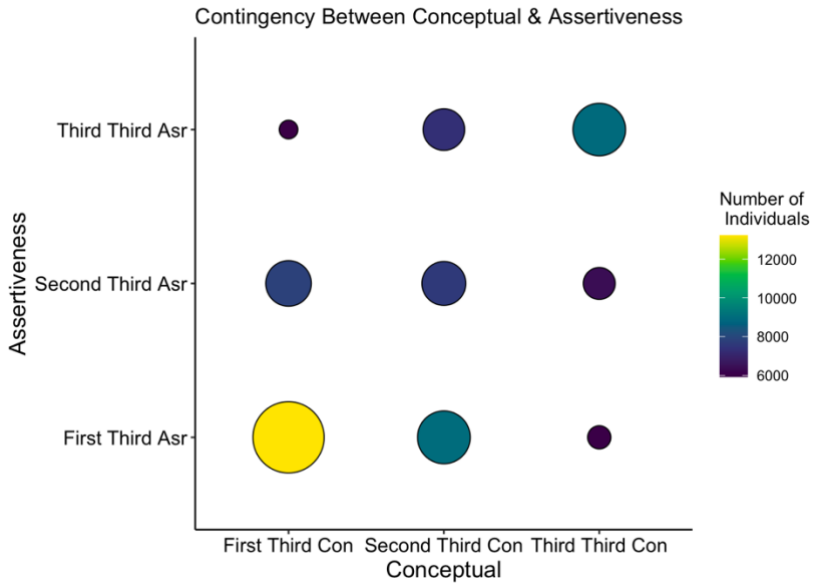


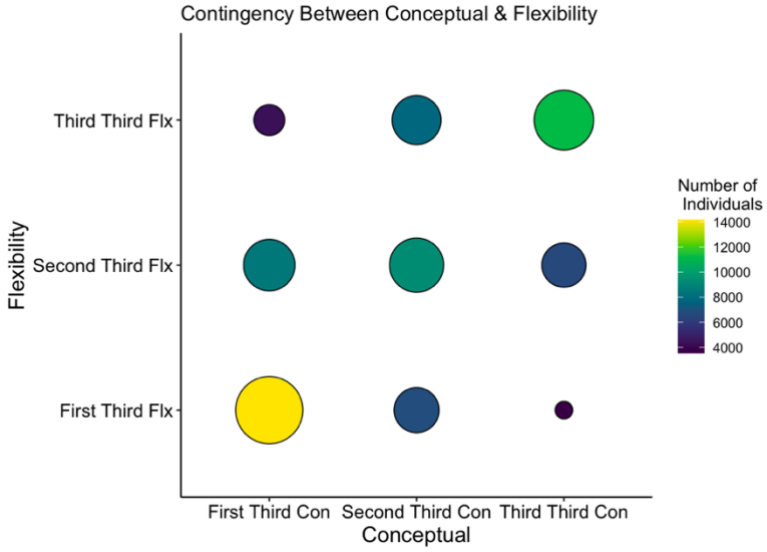




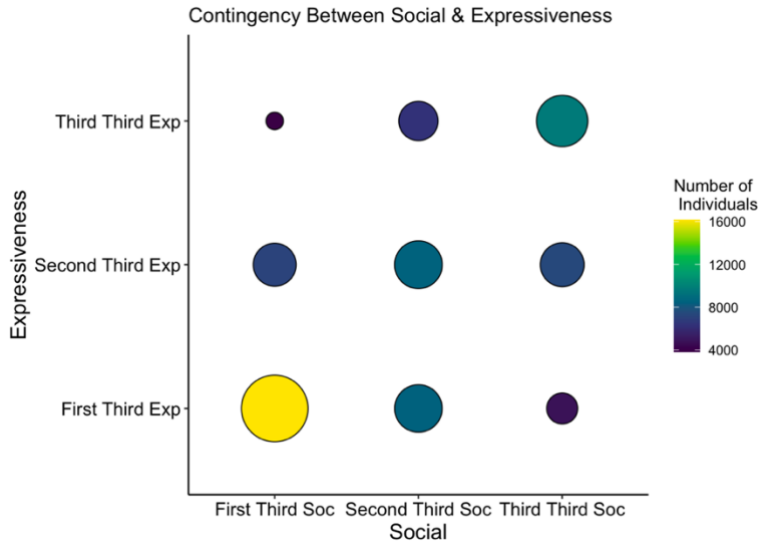
Each of these graphs shows the crosstabs between Structural thinking and the three behavioral Attributes. The size and color correspond to how many individuals fall into that category, with larger circles indicating more individuals. Additionally, the more yellow a circle, the more individuals are contained in that category; as the color becomes greener and then blue, the number of individuals in that category decreases. For example, in the top left graph, we can see a large yellow circle representing the number of individuals who are third-third Expressive and first-third Structural. Critically, we see that in each graph, there are individuals in all categories. Also, the size and color of the circles are randomly distributed throughout, such that there are no significant patterns.

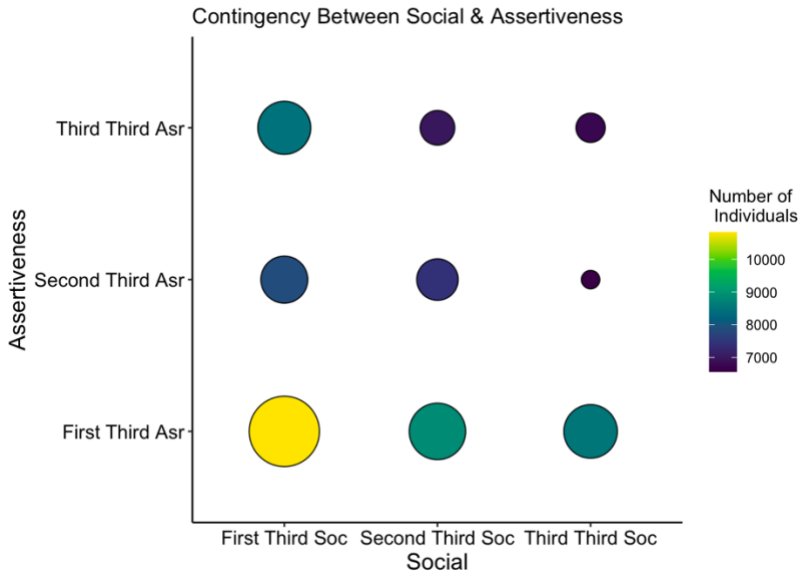


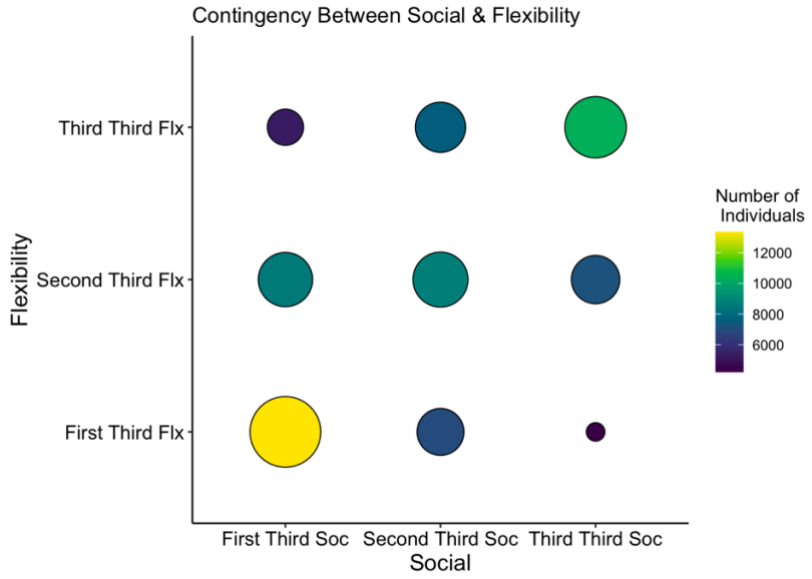




Each of these graphs shows the crosstabs between Conceptual thinking and the three behavioral Attributes. The size and color correspond to how many individuals fall into that category, with larger circles indicating more individuals. Additionally, the more yellow a circle, the more individuals are contained in that category; as the color becomes greener and then blue, the number of individuals in that category decreases. For example, in the bottom left graph, we can see a that there are many green and yellow circles representing the number of individuals who are in each pairing. Critically, we see that in each graph, there are individuals in all categories. Also, the size and color of the circles are randomly distributed throughout, such that there are no significant patterns.







Each of these graphs shows the crosstabs between Social thinking and the three behavioral Attributes. The size and color correspond to how many individuals fall into that category, with larger circles indicating more individuals. Additionally, the more yellow a circle, the more individuals are contained in that category; as the color becomes greener and then blue, the number of individuals in that category decreases. For example, in the top right graph, we can see a large yellow circle representing the number of individuals who are both first-third Assertive and first-third Social. Critically, we see that in each graph, there are individuals in all categories. Also, the size and color of the circles are randomly distributed throughout, such that there are no significant patterns.

What does all this mean?

The results of these contingency analyses demonstrate that only knowing an individual's thinking preferences does not guarantee that you can predict their behavioral preferences or vice versa. We know this because in each of these graphs we see a variety of circle sizes in all position rather than a diagonal line of large circles.

Norming

Emergenetics International will regularly conduct a re-norming of our survey items. This process is a data-driven way to evaluate and ensure clarity for each of the seven Attributes. Importantly, the re-norming process allows us to account for how the manifestation of Attributes may adapt with societal changes.

For example, the evolution of technology has significantly influenced how humans interact with one another professionally and personally. In the last few years, we have seen transformations in the access and usability of technology. Broader access and ease of technology use have made it more efficient for most people to gain quick access to information. Historically access to this level of information was often limited to printed materials, television or radio. However, with increased access to the internet, social media, software applications and personal devices, information can now be easily accessed in a variety of ways, from podcasts to video tutorials to blog posts.

Norms for the Emergenetics Youth Report are also calculated by developmental stage. These groups represent children at different developmental stages. Given the rapid development of children's cognition and behavior patterns, it may be that behavioral preferences may change across developmental periods. For youth report norming, we use three different developmental stages 9 to 12 years old, 13 to 15 years old, and 16 to 18 years old.

Conclusion

The Emergenetics Youth Report indicates how children aged 10 – 18 years old prefer to think, learn, problem solve and communicate through seven Attributes. The seven Attributes are integrated and taken wholistically to display an individual's unique ways of thinking and behaving. The development of the Emergenetics Youth Report is supported by Emergenetics theory, which proposes humans have a combination of genetic tendencies to think and act in certain ways that have been influenced through socialization (Browning, 2007).

In both adults and young people, the data suggests the Emergenetics nomological approach to personality differences cuts across multiple lexical personality theory factors; shows construct validity, convergent/discriminate validity, and independent observer validity. Critically, individuals report that Emergenetics has robust utility in real-world applications. The unique and novel separation of thought preferences and behaviors provides a simple way for all youth to better understand interpersonal and intrapersonal differences in the way they may interact with the world. Emergenetics can help youth become more self-aware they will develop positive advocacy and agency skills necessary to navigate the 21st century world to become contributing and productive global citizens.

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Appendix A: Glossary of Terms

Construct validity: evidence that the test corresponds to other tests that measure the identified constructs

Content validity: evidence that the content of a test corresponds to the content of the construct it was designed to measure

Contingency analysis: a table representing the cross-classification of two or more categorical variables

Convergent validity: evidence that the test correlates with other measures of similar constructs

Discriminate validity: evidence that the test shows patterns of interrelationships with other variables

Face validity: evidence that the test items look like they measure the identified constructs

Inter item reliability: evidence of consistency that items measure the same construct

Nomological: a representation of concepts or constructs of interest in a study, their observable manifestations, and their interrelationships

Reliability: the ability of a measure to produce consistent results when the same entities are measured under different conditions

Test-retest reliability: evidence that the results of a test will remain stable over time

Validity: evidence that a test measures what it was set out to measure conceptually