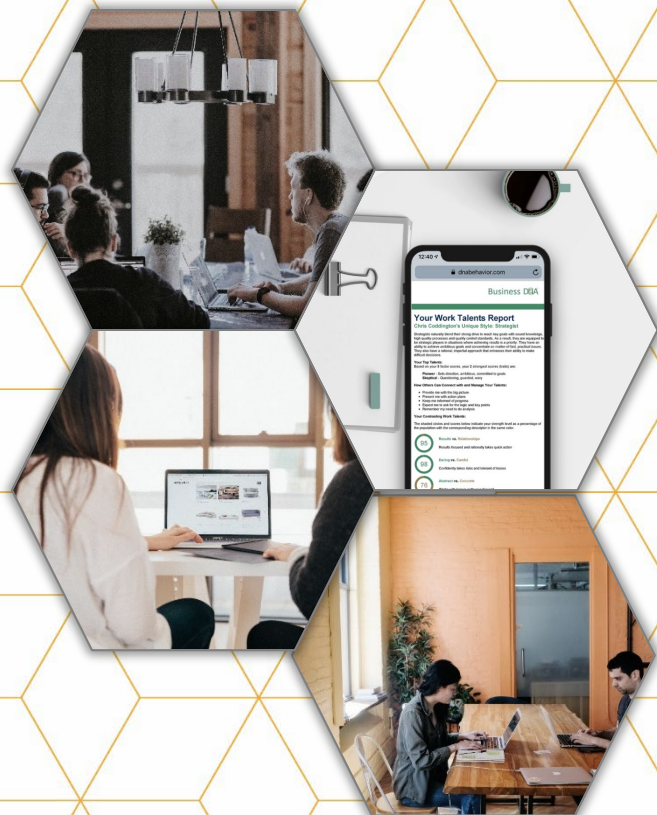


# DNA Behavior® Forced Choice Assessment Model Methodology



DNA Behavior®

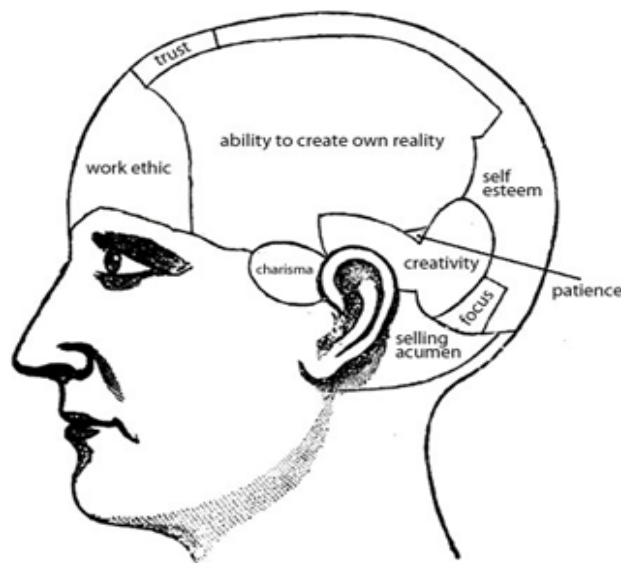
## Introduction

As an international behavioral finance strategist, Hugh Massie<sup>1</sup>, set out to identify why some people make consistently good choices, while others repeatedly make poor decisions. He determined the key was to discover the predictable behaviors in each of us; behaviors that remain the same throughout life.

For a number of years he, together with a highly experienced research team of cutting edge minds, investigated the behavioral dynamics of decision making.

The independent research based on formal psychometric test and re-test procedures showed that a person's Natural DNA “hard-wired” Behavior (default behavior) continuously repeats itself throughout a lifetime, regardless of the nature of life transitions a person experiences, their environment or their financial circumstances.

A significant revelation was that 80% of the basic brain architecture is hard wired by the time a person is age 3<sup>2</sup>; and that Natural DNA behavior is 93% predictable<sup>3</sup>. Then, the Natural DNA behavior is further shaped to 85%<sup>4</sup> by the time the person is five years old. Then by the age of seven 95%<sup>5</sup> of a person's subconscious mind is programmed through ongoing brain development caused by further exposure to the environment and life experiences.



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<sup>1</sup> Hugh Massie <http://www.dnabehavior.com/about/dna-team>

<sup>2</sup> National Research Council and Institute of Medicine.2000, From

Neurons to Neighborhoods: The Science of Early Childhood Development.

<sup>3</sup> Professor of Physics Albert-László Barabási. <http://www.barabasilab.com/>

<sup>4</sup> <https://www.readingfoundation.org/early-learning>

<sup>5</sup> The Biology of Belief by Dr Bruce Lipton, Ph,D published in 2005.

Very often the Natural DNA Behavior sits below the surface; it is not seen because it is masked by the more dynamic (situational) learned behaviors that are shaped by the person's life experiences, education and values that occur between the age of seven and fifteen years old, and then continue to evolve through life. This is why a person's overall personality, at any particular stage of their life, may be seen to change, but their **core Natural DNA Behavior will remain very consistent**. Further, the research team recognized that revealing core natural behavior would also draw out talents, strengths and struggles (blind spots) and communication styles.

The DNA Behavior Discovery Process was designed to holistically uncover, capture and measure all dimensions of a person's natural DNA behavioral style as the core of their personality. How people make decisions, take direction and work with others; how they interact and build relationships, achieve results, handle information, complete tasks, develop trust, set and achieve goals, take and live with risks and their learning styles. This also includes their communication style, financial decision-making style, behavioral (finance) biases and also their response to market movement (as an example).

Following this research period DNA Behavior International determined to build systems powered with reliable "Swiss Watch" predictability and user-friendly "Smart Watch" functionality in terms of how behavioral insights are used on a real-time and scalable basis in all areas of day to day life, financial planning and business activities.

After significant academic research<sup>6</sup> the **Forced Choice Assessment Model** was selected over the more traditionally used Normative (Likert-type) Scaling Model for measuring Natural DNA behavior. This led to the design of the DNA Natural Behavior Discovery Process; a system capable of assessing 8 major behavioral factors as well as 24 related sub-factors.

## What is the Forced Choice Assessment?

The traditional Forced Choice Assessment format is a descriptor used in psychometrics to signify a specific type of measure in which respondents compare two or more desirable options and pick the one that is most preferred. This is contrasted with measures that use Normative/Likert-type scales, in which respondents choose the score (e.g. 1 to 5) which best represents the degree to which they agree with a statement. Source: <https://en.wikipedia.org/wiki/Ipsative>

Personality items constructed with a correctly structured Forced Choice format present the individual with item options that are equal in desirability; this ensures response choices they make will not be influenced by social desirability, circumstances, experiences education or environment. Therefore, the outcomes reveal inherent behaviors, hardwired core traits and strengths and struggles of the person being assessed.

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<sup>6</sup> Morgeson et al. "Reconsidering the use of Personality Tests in Personnel Selection Contexts". by Morgeson et al, 2007 in the "Personnel Psychology" Journal, 60, 683-729 (Blackwell Publishing)

Toth C., Stokes G, Ellis L., Noble B., (1998). "Using Personality to Differentiate Between Holland's Occupational Groups" in the American Psychological Association Magazine on August 14, 1998.

Zavala, Albert (1965). Development of the forced-choice rating scale technique. Psychological Bulletin, Vol 63(2), Feb 1965, 117-124.

Neil D. Christiansen, Gary N. Burns & George E. Montgomery (2005). Reconsidering Forced-Choice Item Formats for Applicant Personality Assessment. Human Performance Volume 18, Issue 3, 2005.

The Forced Choice formats were traditionally Ipsative which while having some strengths of forced choice, have challenges in terms of interpretation. To overcome this and make the Forced Choice Format stronger, the evolution of the Thurstonian Item Response Theory model enabled the development of DNA Behavior's Natural Discovery process based on the use of forced-choice questionnaire formats without the disadvantages of ipsative data.<sup>7</sup>

This construct goes to the core of why the Forced Choice model is difficult to fake<sup>8</sup>. The Five Factor Model<sup>9</sup> (commonly referred to as the Big 5) of personality was developed using the Forced Choice method.<sup>10</sup>

Put simply:

- **The Forced Choice Assessment Model** invites respondents to compare **two or more** desirable options. When there are 2 statements in a block, participants are simply asked to select one statement that better describes them. For blocks of **3, 4 or more statements**, respondents may be asked to rank-order the statements, or to select one statement which is "most like me" and one which is "least like me".<sup>11</sup>
- A Forced Choice item approach is relatively safe-guarded against the problems of normative items, such as social desirability bias. This is assuming that the items themselves are of a high quality and correctly structured. Whereas a traditional personality questionnaire using the Normative/Likert method will ask the individual to rate their agreement to a statement on a scale of 1-5, a well-structured Force Choice format give the applicant a choice of 2-4 equally positive statements, and they must give their preference or agreement to one of them. An example being to choose from: "I enjoy social events" or "I like to keep organized". This format forces the participant to think more about their answer, and answer more truthfully, as there is not one obviously desirable quality to pick from. Also, the Forced Choice format reduces the potential for the participant to agree or disagree.
- A Forced Choice format using blocks of items enables greater insight into the interactions between the items for enabling more specific measurement of the behavioral factors (traits).

In her paper titled Personality Assessment, Forced-Choice Professor Anna Brown PhD. states the following advantages of the Forced Choice Formats:

1. *Comparative judgments employed in forced-choice questionnaires can have substantial advantages over absolute judgments. Firstly, forced choice makes it impossible to endorse all*

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<sup>7</sup> Louis Leon Thurstone Thurstonian Item Response Theory 2009 and an Application to Attitude Items

<sup>8</sup> Don't people fake their test results by Guido Makransky and Mads Rung Master Management and Jackson, D. N., Wroblewski, V. R., & Ashton, M. C. (2000). The Impact of Faking on Employment Tests: Does Forced Choice Offer a Solution? Human Performance, Vol. 13, No. 4, Pages 371-388.

<sup>9</sup> Costa, P.T., Jr. & McCrae, R.R. (1992). *Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI) manual*. Odessa, FL: Psychological Assessment Resources.

<sup>10</sup> The Five-Factor Model, forced-choice personality inventories and performance: A comprehensive meta-analysis of academic and occupational validity studies. 10.1080/1359432X.2012.716198 Jesús F. Salgado\* & Gabriel Táuriz\* pages 3-30

<sup>11</sup> Brown A and Maydeu-Olivares (2011). How Item Response Theory Can Solve the Problems of Ipsative Data. University of Cambridge Psychometrics Centre.



*items indiscriminately (so-called “acquiescence” bias). It is also impossible to elevate or reduce ratings across all items (“leniency / severity” effects), or provide uniformly extreme or middle ground ratings (“extremity / central tendency” responding). Overall, the forced-choice formats eliminate any systematic response sets that apply uniformly across items (Cheung and Chan, 2002).*

- 2. Secondly, forced choice tackles the problem with lack of differentiation in ratings (so-called “halo” effects). Halo effects are particularly problematic in personality assessments involving external raters (such as spouses, colleagues or bosses) who often have overgeneralized perceptions of different characteristics of the assessment target based on one important dimension. Forcing choice between various characteristics of the assessment target facilitates finer nuances of judgment and reduces halo effects, enhancing the quality of data.*
- 3. Thirdly, binary preferences do not require any rating scales since items are compared directly. This is an advantage since test takers do interpret verbal and non-verbal anchors provided with the rating scale differently. Furthermore, Maydeu-Olivares and Böckenholt (2008) argue that comparing items directly may be cognitively simpler than rating them, particularly when there are many rating categories with few or poor verbal anchors.*
- 4. Finally, the use of forced-choice formats in personality assessments has been largely motivated by attempts to reduce socially desirable responding. It has been thought from conception of forced-choice personality measures that combining equally desirable items in the same block would reduce socially desirable responding compared to single-stimulus formats, where all desirable items can be easily endorsed and all undesirable ones can be rejected. Extreme forms of socially desirable responding often referred to as “faking good”, are particularly concerning in high stakes personality assessments, where interest in the use of forced-choice questionnaires has been growing.*

*Over the years, evidence for superiority of forced choice in high stakes (e.g. Christiansen et al., 2005; Jackson et al., 2000) as well as against it (Feldman and Corah, 1960; Heggstad et al. 2006) has been published. Findings are inconclusive for many reasons; including lack of control for differences in questionnaire designs and testing contexts as well as technical challenges in modelling forced-choice data (see Section 3). Good methodology is essential to move this research forward, but most importantly, good understanding of test takers’ cognitions when completing personality assessments in high stakes. While test takers’ cognitions have been studied with single-stimulus measures (e.g. Robie et al., 2007), there is a clear gap in our understanding of such cognitions in forced-choice assessments.<sup>12</sup>*

In conclusion, the research highlights that to achieve a higher degree of success with a Forced Choice Scoring format, the assessment needs to be correctly structured with the right methodology. The outcome is extremely sensitive to the specific design of the assessment.

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<sup>12</sup> International Encyclopedia of the Social and Behavioral Sciences, 2nd edition; Anna Brown, School of Psychology, University of Kent, Canterbury, Kent

## Ideal Structure of the Forced Choice Assessment

In her paper titled - Personality Assessment, Forced-Choice, Anna Brown PhD states the following:

*The potential reduction in response biases that forced-choice measures can provide, while maintaining interpersonal comparability of trait scores, is an exciting prospect for many applications in personality assessment. For instance, cross-cultural personality research, where culturally specific response sets present a challenge for score comparability, could benefit from the use of direct comparative judgments. Assessments by external raters, whether in workplace, health or education, could also benefit from the use of carefully designed forced-choice questionnaires to enhance validity by reducing rater effects such as halo and leniency/severity. Provided that appropriate methods are used to design and score such assessments, the forced-choice formats can be a viable alternative to the single-stimulus formats.*<sup>13</sup>

The benefit of a correctly structured Forced Choice Assessment Model does not allow a person to rate themselves high on all desirable traits, and low on all undesirable traits (for reasons of self-promotion or situational bias; intentional or unintentional).

More specifically, the structure of the Forced Choice Assessment Model should ideally be as follows to minimize the impact from social desirability, situational, educational and perception biases of the participant:

1. Each item (word or statement) to be narrowly framed in a short phrase with words which are not situationally expressed and are not preference based. Further, the words in the item should be easy to understand, avoid double negatives and the overall meaning not be ambiguous. This will assist in forcing the participant to respond more instinctively with minimum scope for interpretation.
2. The choices between the statements should be clear and balanced alternatives which will enable consistency in response on a test re-test basis.<sup>14</sup>
3. The use of 3 items (blocks of 3 or triads) is preferred over 2 items as it creates a genuine forced choice of leaving only one item out. Further, the triad format means that all 3 items are being correlated leading to a more specific analysis.
4. Further, blocks of 4 or more items (quads) is less preferred as a format over a triad of 3 items because it is more complex to evaluate, and the quality of data can be considerably worse in populations with lower education or in non-native speakers. The quad format means 2 (or more) statements get left out making the selection process potentially more variable on a re-test basis. However, the quad format could offer more information because there is an increase in the number of word relationships from 4 to 5.

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<sup>13</sup> International Encyclopedia of the Social and Behavioral Sciences, 2nd edition Personality Assessment, Forced-Choice Anna Brown, School of Psychology, University of Kent, Canterbury, Kent, CT2 7NP, UK

<sup>14</sup> The Stability of Responses to Forced-Choice Questions: Philip Gendall, Eric Assendelft, Janet Hoek Massey University [http://marketing-bulletin.massey.ac.nz/V2/MB\\_V2\\_A5\\_Gendall.pdf](http://marketing-bulletin.massey.ac.nz/V2/MB_V2_A5_Gendall.pdf)

5. The items to choose from in each question should be correctly ordered so as to minimize bias. Depending on the behavioral factors being measured there should be an equal number of items positively correlating to each factor being measured. There should not be 2 or more items in the same block measuring the same factor. Further, there should be an equal number of items across all of the blocks relating to each factor placed first, middle and last.<sup>15</sup> In addition, no item should be used (contribute) twice to measure different factors.
6. Ideally, five or more primary factors (behavioral trait) of behavior should be measured which are distinct from each other. The more primary factors that are measured adds more meaning to the assessment as responding positively to one item is not necessarily positively contributing to another factor. The distortion impact in measuring another factor is reduced. Put another way, depending on the scoring methods, Forced Choice formats measuring less than 5 factors can practically be circular in nature.
7. There should be enough items measuring each primary factor to achieve a sufficient level of reliability. Statistically, more than 20 items relating to each primary factor is adequate.

While a correctly structured Forced Choice Assessment is more ideal, it is also far more difficult and costly to develop the items which will meet the tests of a rigorous validation process to measure factor reliability. The Forced Choice Assessment format is a naturally more complex model because of the higher levels of interaction between the rating items. Further, the Forced Choice Assessment is more suitable for global use across different cultures and languages.

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<sup>15</sup> The Stability of Responses to Forced-Choice Questions: Philip Gendall, Eric Assendelft, Janet Hoek Massey University [http://marketing-bulletin.massey.ac.nz/V2/MB\\_V2\\_A5\\_Gendall.pdf](http://marketing-bulletin.massey.ac.nz/V2/MB_V2_A5_Gendall.pdf)

# DNA Behavior®

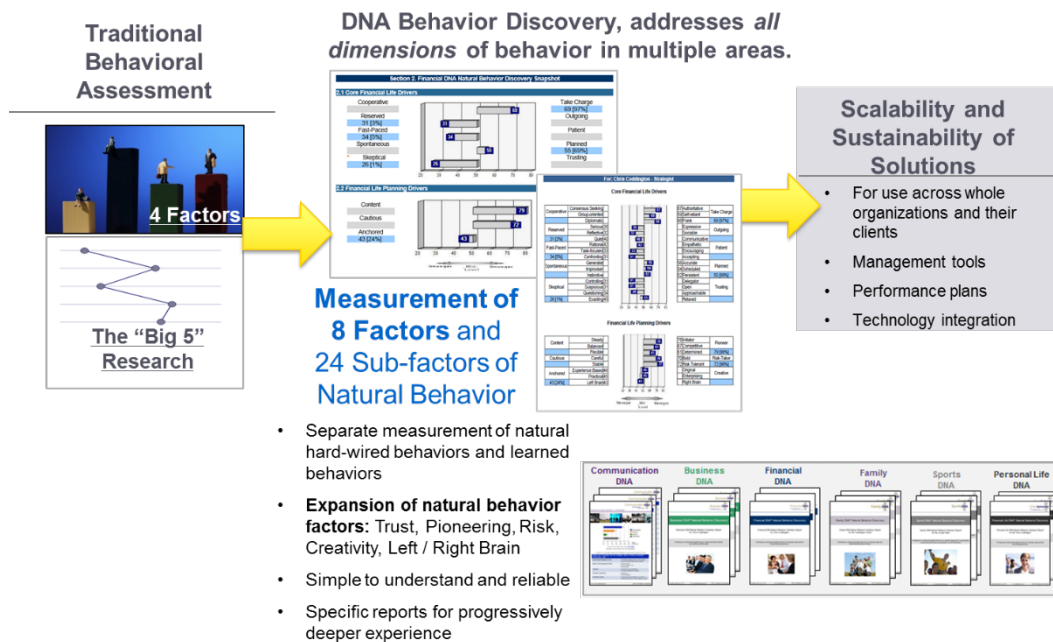
Choose “**Most Like**” you and “**Least Like**” you from each triad of words

<input type="checkbox"/> <b>Attentive</b> Pays careful attention to what is said; makes effort to listen well	<input type="checkbox"/> <b>Confidently faces danger</b> Bold, brave, valiant, fearless	<input type="checkbox"/> <b>Decision Maker</b> Conclusive, decisive, comfortable in decision making or problem solving
<input type="checkbox"/> <b>Thinks quickly</b> Intelligent, mentally alert and sharp	<input type="checkbox"/> <b>Interactive</b> Sociable, wants to interact with others, seeks communication	<input type="checkbox"/> <b>Generates new ideas</b> Inventive, imaginative, characterized by originality and expressiveness
<input type="checkbox"/> <b>Follows routines</b> Likes habit, prefers to perform in a routine manner	<input type="checkbox"/> <b>Self-assured</b> Full of assurance and certainty, bold, confident	<input type="checkbox"/> <b>Determined</b> Follows through on goals, focused on outcomes

Measurement strengths for long term reliability and predictability:

1. Non-situational phrases that consistently measure specific ingrained behaviors and automatic biases over long periods
2. Easy to understand
3. Very difficult to “game” the assessment

The depth of the DNA Behavior Discovery Process, using the Forced Choice Assessment, enables all dimensions of behavior to be addressed in multiple areas.





- The Normative (Likert-type) Scaling Model is referred to as the Single-stimulus response format where respondents are asked to rate each item according to the extent it describes their personality. The distinct feature of the single-stimulus format is that each item is rated separately, therefore absolute judgments are made. Item responses can be given by selecting one of several categories ranging, for example, from “strongly disagree” to “strongly agree”, or from “never” to “always”, or from “very inaccurate” to “very accurate” etc.<sup>16</sup>

Likert-type Scale and True/False Models allow respondents to self-promote leading to distorted results. Further, with these traditional models the results could be repeatedly slanted over long time periods if the assessment is re-taken. Thus - the Likert-type Scale and True/False Models and similar models lead to the following problems:

- a. Capability of being more easily “faked” by the participant to not admit the truth
- b. A person’s current emotions, feelings, experiences dominating the choice
- c. The choices may be influenced by different levels of education or knowledge about the situation in the assessment statements or the overall purpose of the assessment
- d. The statements in the assessment are much more open to interpretation or misunderstanding by the participant

<p><input type="checkbox"/> <b>I want to use my money to become an important person in the community.</b> How strongly do you agree?</p> <p><input type="checkbox"/> Strongly agree <input type="checkbox"/> Agree somewhat <input type="checkbox"/> Disagree somewhat <input type="checkbox"/> Disagree strongly</p>	<p><input type="checkbox"/> <b>I am willing to take significant risk in order to increase my returns.</b> Does this describe your attitude toward risk?</p> <p><input type="checkbox"/> Not at all <input type="checkbox"/> To a small extent <input type="checkbox"/> To a moderate extent <input type="checkbox"/> To a great extent <input type="checkbox"/> To a very great extent</p>	<p><input type="checkbox"/> <b>To what extent does ensuring your financial future is protected</b> occupy your time, thoughts and energy?</p> <p><input type="checkbox"/> Not at all <input type="checkbox"/> To a small extent <input type="checkbox"/> To a moderate extent <input type="checkbox"/> To a great extent <input type="checkbox"/> To a very great extent</p>
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Long term predictability and reliability issues:

1. Responses change depending on situation and market events
2. Difficult to interpret and requires education
3. Strengths likely to be over stated and struggles understated by 1 standard deviation

<sup>16</sup> Brown A and Maydeu-Olivares (2011). How Item Response Theory Can Solve the Problems of Ipsative Data. University of Cambridge Psychometrics Centre.

A series of different academic research studies show that “faking” can take place under both the Forced Choice and Normative questionnaire formats. However, the faking is far more likely to take place, and to a greater degree, under the traditional questionnaire Normative/Likert formats. The research shows that respondents score **one standard deviation higher** under a traditional questionnaire format.<sup>17</sup> Further, techniques to control faking have proven not to be valid, such as introducing lying scales, consistency scales and limiting completion time. Overall, a tightly structured Forced Choice questionnaire will be less susceptible to faking coupled with structured behavioral interviews.

A recent survey of practitioners who work in the area of selection and assessment found that approximately 70% expressed preference for using a personality inventory that includes a method to deal with applicant distortion, the Forced Choice method.<sup>18</sup>

Many organizations use a Likert scoring model. Our view is that this doesn’t provide predictors of behavior over a long term period. Some of the Likert models may be reliable *today* but over a time period their reliability is reduced. Forced Choice does not allow room for self-promotion and will provide a more accurate reflection of a person’s strengths and struggles over *longer time* periods. Therefore, we believe that this approach is preferred for any process that is used for human behavioral discovery.

Further, academic research indicates that the Forced Choice Assessment Model can be equally applied to personality and motivation, interests, beliefs and attitudes in a wide range of areas. Therefore, we believe that there is a strong academic basis to use the Forced Choice Assessment Model for assessments administered for employment, financial planning and other purposes.<sup>19</sup>

The design of DNA Behavior International’s Forced Choice Format for measuring 8 primary behavioral factors and 24 sub-factors on the left and right hand side (64 traits in total) is intended to be more specific than Costa and McCrae’s (1985) measure of the “Big Five”<sup>20</sup> and most other personality inventories in the market<sup>21 22</sup>. This required depth in measurement can only be achieved using a **Forced Choice Assessment Format** because its calculation model inherently provides greater levels of behavioral insight. Further, the Forced Choice Model is also by its inherent nature preferred for measuring a person’s natural instinctive style rather than their situational bias in a particular area of personality.

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<sup>17</sup> Douglas N. Jackson, Victor R. Wroblewski & Michael C. Ashton (2000). The Impact of Faking on Employment Tests: Does Forced Choice Offer a Solution? Human Performance Volume 13, Issue 4, 2000.

<sup>18</sup> Reconsidering Forced-Choice Item Formats for Applicant Personality Assessment Neil D. Christiansen, Gary N. Burns, and George E. Montgomery *Department of Psychology Central Michigan University* [http://www.researchgate.net/profile/Gary\\_Burns/publication/231180332\\_Reconsidering\\_Forced\\_Choice\\_Item\\_Formats\\_for\\_Applicant\\_Personality\\_Assessment/links/0912f50645a9e7825c000000.pdf](http://www.researchgate.net/profile/Gary_Burns/publication/231180332_Reconsidering_Forced_Choice_Item_Formats_for_Applicant_Personality_Assessment/links/0912f50645a9e7825c000000.pdf)

<sup>19</sup> Hogan J., Barrett P., Hogan R., Personality Measurement, Faking and Employment Selection. Journal of Applied Psychology, 2007, Vol. 92, No 5, 1270-1285.

Martin B.A., Bowen, C.C. & Hunt, S.T (2002). How Effective are People at Faking on Occupational Personality Questionnaires? Personality and Individual Differences, 32 (2002) 247-256.

<sup>20</sup> [https://en.wikipedia.org/wiki/Big\\_Five\\_personality\\_traits](https://en.wikipedia.org/wiki/Big_Five_personality_traits)

<sup>21</sup> Costa, P.T. Jr. & McCrae, R.R. - “*The NEO Personality Inventor*” (1985). Odessa, FL: Psychological Assessment Resources

<sup>22</sup> The Faking Dilemma: Examining Competing Motivations in the Decision to Fake Personality Tests for Personnel Selection by Jennifer Anne Komar University of Waterloo, Ontario, Canada 2013

## The History of Personality Discovery

All human beings behavior is hardwired<sup>23</sup>: that personality is ingrained from birth is not news to any parent with more than one child, as they can repeatedly see the differences between their children from birth. Put another way children can be brought up in the same home with many of the same opportunities, experiences and education, yet they will function in life very differently. This knowledge has been around for at least 2,400 years. There have only been a few notable scholars who have contributed to the development of this concept.<sup>24</sup>

Nigel Nicholson, Professor of Organizational Behavior at London Business School observes: *Yes, you can train people, teach them about different ideas, and exhort them to change their attitudes. But evolutionary psychology asserts that there is a limit to how much the human mind can be remolded. Proponents of evolutionary psychology assert that, because of natural selection, human beings living and working in today's modern civilization **retain the hardwired mentality—that is, the needs, drives, and biases—of Stone Age hunter-gatherers.*** Source: <https://hbr.org/1998/07/how-hardwired-is-human-behavior>

The Old Testament Bible records the following in terms of how intricately individual beings were designed before birth: 2000-1800<sub>BC</sub> the book of Job reveals that ALL are fashioned in the womb<sup>25</sup> 1000-300<sub>BC</sub> the Psalmist David talks about the intricacies and wonder of having been designed in the womb<sup>26</sup> 586<sub>BC</sub> the prophet Jeremiah records, not only the formation in the womb, but at the point of creation there was also a plan for lives 1000-300<sub>BC</sub><sup>27 28</sup>.

From the beginning of time many have tried to offer explanations as to why people are different. What makes them different and why; how to understand the intricacies of their wiring; how to uncover core behaviors; what is their life purpose. Hippocrates (470 -360 BC) believed that the answer to the differences in behavior and temperament lay inside man. He believed that behavior was determined by the presence of an excessive amount of one of four fluids or humors. These four humors were thought to be related to the four elements of earth, air, fire and water.<sup>29</sup> Hippocrates, and other early Greeks, thought that an excess of one of the four humors produced a particular temperament and behavior.

*The word temperament derives from the Latin word temperamentum and means right blending. The Greeks thought that a person's temperament was therefore made up of a blending of these four fluids. Source: Journey of the Mind, Journey of the Soul: By Michael H. Likey, Dr Michael H. Likey Ph. D. D. D.*

Each of the four types of humors corresponded in ancient times to a different personality type. These were associated with a domination of various biological functions. Bernardus Lievegoed a Dutch medical doctor, psychiatrist and author suggested that the temperaments come to clearest manifestation in

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<sup>23</sup> Harvard Business Review:How Hardwired is Human Behavior Professor Nigel Nicholson 1998

<sup>24</sup> [https://en.wikipedia.org/wiki/Big\\_Five\\_personality\\_traits](https://en.wikipedia.org/wiki/Big_Five_personality_traits)

<sup>25</sup> Job 31:15AMP

<sup>26</sup> Psalm 139: 13-16 NLT

<sup>27</sup> Jeremiah 1:5 NASB

<sup>28</sup> Jeremiah 29:New American Standard Bible (NASB)

<sup>29</sup> Boeree, C. George. "[Early Medicine and Physiology](#)". Retrieved 21 February 2013.

childhood, between approximately 6 and 14 years of age, after which they become subordinate (though still influential) factors in personality.<sup>30</sup> Source: [https://en.wikipedia.org/wiki/Four\\_temperaments](https://en.wikipedia.org/wiki/Four_temperaments)

So it is worthy to note that this concept of *temperament*, i.e. *each person is born with natural tendencies which affect behavior*, has been steadily developing for thousands of years. Terms may have changed, but the thought process has remained consistent. Each successive study validated the research before it, bringing us to a point of accuracy today.

See Appendix 1: The History and Chronology of Personality Discovery

## The Process

The primary objective in developing the DNA Natural Behavior Discovery Process, was to make revealing a person's natural DNA behavior the critical first step in identifying the core of who they are; their core behavior and communication style; how they make life, financial and business decisions; their talents for work and sustainable life time performance.

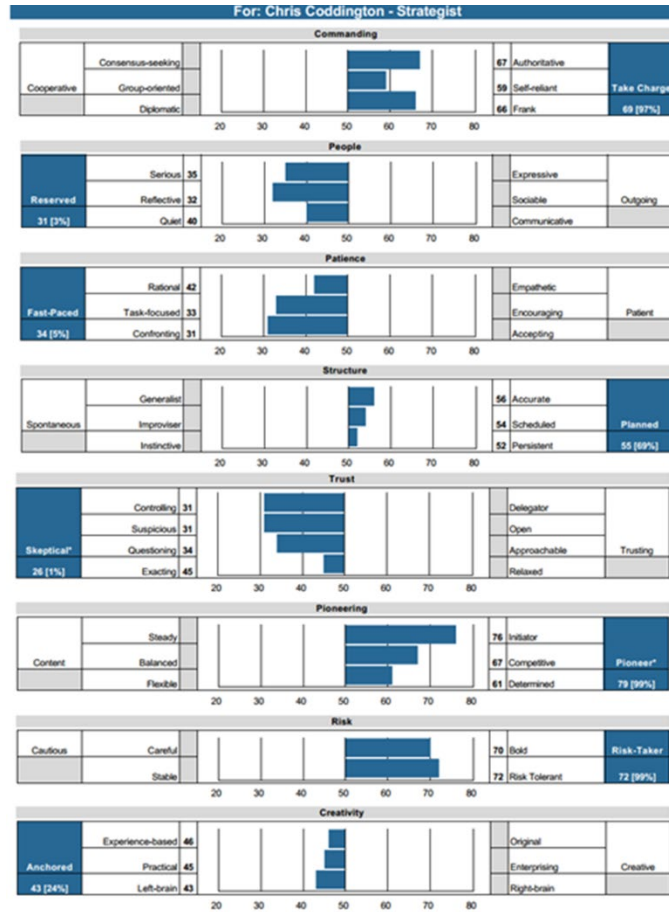
The differentiation of the DNA Natural Behavior Discovery Process approach is that it begins with uncovering a person's natural instinctive behavioral traits at a greater level of depth and accuracy using a Forced Choice Assessment Model. This method delivers a more reliable predictor of talents and decision-making styles for long term performance.

The DNA Natural Behavior Discovery Process also uncovers the sub-factors that form a part of the primary Factors of inherent behavior. These are a more specific set of behavioral insights that are each separately measured. They provide an additional level of depth in terms of revealing the core of a person. Having this additional level of information is a critical starting point to understanding a person's strengths and predicting with more pin-pointed accuracy the areas in which they will perform well. For instance, two people could have the same Structured primary factor score but one could be more Organized and the other more Precise. If you are looking for someone to write research papers for you, it may be best that they are Precise. However, if reliability in delivery is more important, then revealing the Organized sub-factor score would be more appropriate to identify.

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<sup>30</sup> Lievegoed, Bernard. *Man on the Threshold*. Hawthorn Press. pp. 80–81. [ISBN 0950706264](https://www.amazon.com/dp/0950706264).

# DNA Behavior®



The DNA Natural Behavior Assessment is comprised of 46 sets of three non-situational items (pairs of phrases) that relate to one of the 8 factors using a forced choice rating (most like, least like) methodology. A total of 138 rating items. The responses to the 46 questions (138 rating items) produce 2,349,060 scoring combinations. The number of unique report T Score<sup>31</sup> combinations is: 3,704,945,600,000,000,512,144,136.

Independent validation work requiring more than 60 man years of time, using established psychometric methodologies, performed by industrial psychologists from Georgia Tech University, and other independent psychologists with a total of more than 100 years relevant experience, authenticates this approach.

This DNA Natural Behavior Discovery Process differentiator is important for the following reasons:

- It overcomes the problem of “who someone says they are”, or “wants to be” versus “who they actually are”. While many people can learn to mask their true behavior for temporary periods or navigate around unpleasant situations, they still have a central reference point in their personal approach to which they revert to in times of extreme stress.

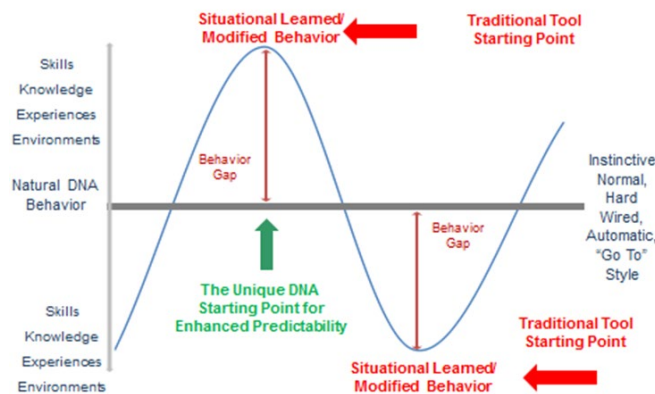
<sup>31</sup> T-scores are standardized scores on each dimension for each type. A score of 50 represents the mean. A difference of 10 from the mean indicates a difference of one standard deviation. Thus, a score of 60 is one standard deviation above the mean, while a score of 30 is two standard deviations below the mean.



# DNA Behavior®

- It creates a framework to communicate with and serve people on a consistent basis based on who they are.
- It delivers a more reliable prediction of how a person will behave across different life, business and financial events, to assist them make better longer term decisions.
- It enables talent development to start from the center of a person's natural strength and struggles, rather than who they have learned to become, or a misconception of who they think they are.
- It provides crucial insight into the hiring process, to be able to hire people into the right role based on their natural talents rather than the situational exhibited behavior.
- It enables the matching of people for long term personal and business relationships.

Further, the DNA Natural Behavior Discovery Process leads to a greater understanding of the importance in identifying the learned situational behaviors which a person exhibits. This knowledge provides insight into their current actions, motivations and needs and how they have been shaped by influences of environment, experiences education and values. Further, this information guides understanding into learned behaviors in order to measure current human performance and levels of personal alignment for development purposes. Therefore, these natural DNA behaviors need to be revealed separately with an appropriately structured instrument. Revealing natural DNA behaviors can greatly assist in understanding how individuals make decisions.



One key behavior that needs to be uncovered and managed is that of bias.

1. Each behavioral bias is instinctive and therefore measurable by the DNA Natural Behavior Discovery Process
2. However, each behavioral bias can be learned through experiences, values and education.

3. Further, each behavioral bias whether natural or learned can be overcome with behavioral management.
4. Every person has a different level of each bias naturally ingrained in them.
5. When applied (for example) to financial decision making; the Financial DNA® Natural Behavior Discovery reporting reflects the predominant behavioral factor which is applicable in measuring each behavioral bias.
6. The extent to which each bias prevails in decision-making will be determined by the strength of the person's behavior in one or more factors. Further, some behavioral factors may apply at some level to more than one bias.

Using a Likert style response is one example of a type of survey that can be **highly vulnerable** to the effects of response bias<sup>32</sup>; the participant's responses can have a large impact on the validity of the questionnaire or survey to which the participant is responding. The Forced Choice method of assessment, compared to other tests, is **more resistant** to the effects of participant response bias.<sup>33</sup> Research undertaken at the University of Texas observed that the Forced Choice process can reduce systematic response bias which exists between groups in a study.<sup>34</sup>

Psychologists Daniel Kahneman (Nobel Prize Winner in Economic Sciences) and Amos Tversky' write in their book Thinking, Fast and Slow:

*.....there are two routes to persuasion, based on two basic modes of thinking.*

*"System 1" thinking is intuitive thinking – fast, automatic and emotional – and based on simple mental rules of thumb ("heuristics") and thinking bias (cognitive bias) that result in impressions, feelings and inclinations.*

*"System 2" thinking is rational thinking – slow, deliberate and systematic – and based on considered evaluation that result in logical conclusions.* ISBN-13: 978-0374533557

The bell curve graph below shows the degree to which scores on the right, left or in the middle uncover extremes of behavior relative to the population and the degree to which they are strengths or struggles. The closer the scores move toward 20 and 80 respectively, the stronger the behavior. Put another way, the strengths will be greater as will be the corresponding struggles. Strengths overused without behavioral awareness can become blind spots.

Strengths – Behaviors that come naturally and should be used.

Struggles – Behaviors that can be managed with greater awareness of a person's natural behaviors. Struggles not managed can become weaknesses.

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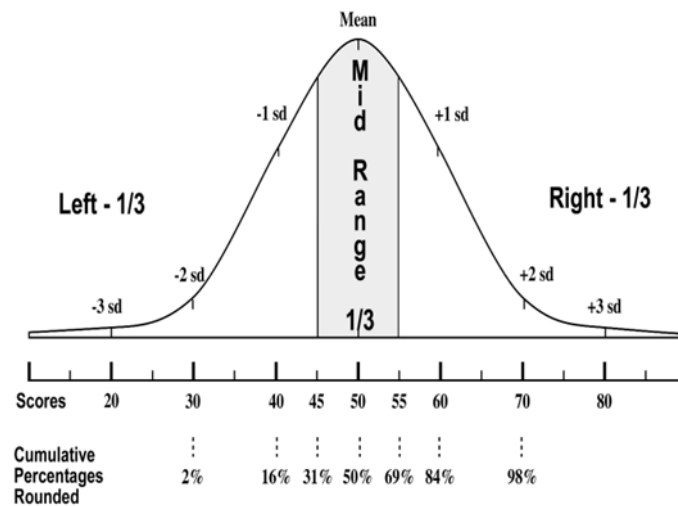
<sup>32</sup> Furnham, A (1986). Response bias, social desirability and dissimulation. *Personality and individual differences* 7. 385-400; Nederhof, A (1985). Methods of coping with social desirability bias: a review. *European Journal of Social Psychology* 15. 263-280

<sup>33</sup> Zavala, Albert (1965). Development of the forced-choice rating scale technique. *Psychological Bulletin*, Vol 63(2), Feb 1965, 117-124.

<sup>34</sup> The Ipsative Process to Reduce Response Set Bias WILLIAM H. CUNNINGHAM, Associate Professor of Marketing Administration, ISABELLA C. M. CUNNINGHAM, Associate Professor of Advertising and ROBERT T. GREEN, Associate Professor of Marketing Administration

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Mid-Range Scores – Tend to be more flexible in these factors and are easier to move left or right.



## Primary Markets

In business, managers are taking the findings of evolutionary psychology seriously to develop a more “natural way of managing” that goes *with* our inherited predispositions, rather than *against* them. For example, in the past, businesses wanted employees to check their emotions in at the door. It is now clear that due to our evolutionary past we are more driven by our emotions than by logic or reason. Through the process of natural selection our ancestors were “programmed” with their “emotional radar – call it instinct – turned on.”<sup>35</sup> Source: <http://www.21learn.org/archive/review-how-hardwired-is-human-behavior/>

In considering the primary markets where the use of the DNA Natural Behavior Discovery Process (Forced Choice) is applied to reveal hardwired behavior; the following list (not exhaustive) of industries and businesses is offered, where the target population for any person is over 15 years old, regardless of gender or culture:

- Financial Advisory Business
- Relationship Management
- Customer Relations

<sup>35</sup> Review of How Hardwired is Human Behavior, by Nigel Nicholson appeared in the July-August 1998 Harvard Business Review. Prepared by Terence Ryan for the 21st Century Learning Initiative.

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- Behavioral Marketing
- Behavioral Economics
- Communication Styles
- Customer and Employee Engagement
- Human Capital Management to improve business performance
- Employee-Customer Matching
- Family Succession Planning

One version of the reports (known as Financial DNA®) is specifically designed for financial services and insurance businesses by addressing the financial personality of – advisors, investors and their family members. Specifically, it is suitable for the advisor client setting in the context of the goal setting, financial planning and/or the investment portfolio development process.

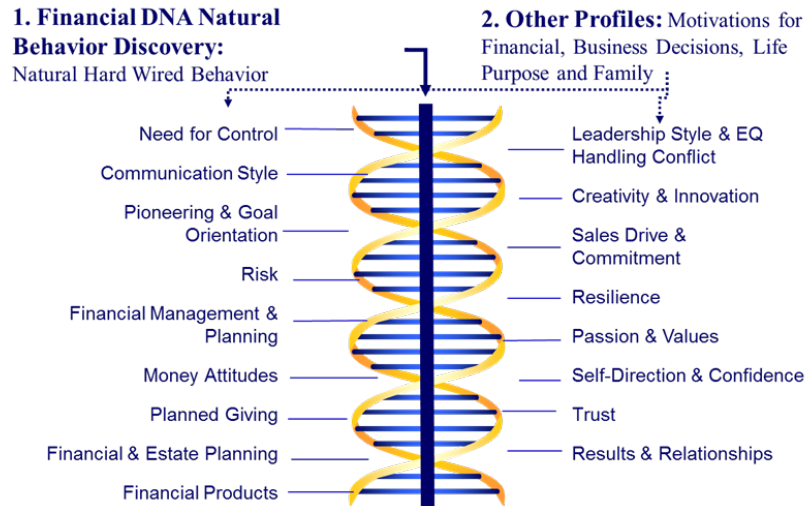
We have users of our Business DNA® branded reports in a wide range of business disciplines, including accounting, law, health care, sports, retail, manufacturing service industry, armed forces, human resources and more. Specifically, the reports are used for hiring, onboarding, talent management, team development, leadership development and career development.

Regardless of the industry, the demand by business users is for a system that is highly accurate and reliable; hence their use of the unique construct of DNA Behavior International's "Forced Choice Scoring" Model. The user-friendly and non-facilitator dependent nature of reports, the ability to obtain customized reports, the ability to obtain customized branding, the extensive nature of the reporting for "hire to retire" uses, and the ability for not only employees to participate but also clients or customers and other third party stakeholders.

1. In addition, the power of the DNA Behavior technology systems enables the behavioral insights to be integrated to the business systems and processes of a company on a real time basis.
2. The Financial DNA Discovery version of the reports is unique in the market place. There is no other Discovery process and customized reporting for understanding the "financial personality" of a client. In particular, the reporting provides the advisor and investor user with unique insights on:
  - Risk propensity and risk tolerance
  - 8 Financial Behavior and Relationship Behavior Risks
  - 16 Behavioral Finance biases
  - Investment Portfolio Allocation Grouping
  - Advisor Client compatibility
  - Quality Life Insights for setting goals

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- Financial Decision-making style insights
- Communication Keys for relating to different clients





## Applications

The DNA Natural Behavior Discovery personality inventory is designed to provide insight into the instincts, needs, motivations and temperament of an individual (often reflected as the “will do” aspect) as evidenced in their natural behaviors related to life, work place, business and financial decision making. Specifically, the Discovery is used as the foundation:

- Financial DNA Natural Behavior
- Business DNA Natural Behavior
- Communication DNA Natural Behavior
- Family DNA Natural Behavior
- Sports DNA Natural Behavior
- Personal Life DNA Discovery Processes.

It's primary application is focused on relationship management; believing that that the key to moving from transactional service to long term client relationship requires a fundamental shift in thinking. The foundation of the DNA Behavior Discovery process is to enable businesses to “know, engage and grow” their clients, customers and employees to provide customized life-long experiences that increase sustainable performance.

An additional application is the ability to uncover bias and provide a pathway to managing it. In the choices people make bias surfaces based on hidden agendas of emotion, loss aversion, over-confidence, categorical thinking, and social intuition. In any relationship it is important to have a clear view of inherent bias that might surface in order that trust is built and integrity maintained.

## IN SUMMARY

The DNA Behavior Discovery process was developed to answer the question who am I? What are my hard wired core behaviors and talents? How do I make decisions? What do I fear? How would I lead? How do I respond under pressure? How do I communicate? How do I want others to communicate with me?

In determining that the use of Forced Choice was the most reliable approach to uncovering inherent hard wired behaviors and talents in April 2001, DNA Behavior International (unlike other Personality Profile developers and users) has never needed to re-evaluate their methodology by moving from the Normative (Likert) test to the more reliable Forced Choice process.



However, some established organizations whose primary approach was to use the Normative/Likert model have moved this offering to a lower cost option to the marketplace, whilst investing the substantial time and resources to develop a more robust Forced Choice model.

At the outset, DNA Behavior International undertook extensive, rigorous research and was resolute in using only the Forced Choice model. This foundational decision places the DNA Natural Behavior Discovery Process in a very significant and well respect position in the market place.

## The History and Chronology of Personality Discovery Appendix 1

Date	Founder	Extroverted, Task Oriented Commanding, Dominance, Choleric, Leader, Controlling, Driving
2200 BC	The Chinese	The Chinese used oral examinations to hire and retain civil servants. Believing their responses to certain questions would reveal personality, character and behavior of prospects. By 1370 the test includes writing essays and poems, a three-day exam and a final test in Peking. The system was not abandoned until 1906 AD.
c. 450 BC	Classical elements. Hippocrates' four humors	Hippocrates – Four Temperaments Theory – Humorism. <b>Hippocrates</b> of Kos a Greek physician systematically described the four temperaments of people as "humors" (moods). Each was based on the four elements of fire, air, water, and earth and was believed to be responsible for a different type of behavior.
c. 340 BC	Plato	Plato a Greek philosopher described the four temperaments as philosopher, guardian, artisan and scientist.
c. 190	Galen's four temperaments	Temperaments: Sanguine Phlegmatic Choleric Melancholic
c. 1025	Avicenna's four primary temperaments	loss of vigor, deficient energy, insomnia, wakefulness, high pulse rate, lassitude, acquired habit
c. 1798	Immanuel Kant	Explained the relationship between reason and human experience. According to Kant, human beings occupy a special place in creation, and morality can be summed up in an imperative or ultimate commandment of reason, from which all duties and obligations derive. He defined an imperative as any proposition declaring a certain action (or inaction) to be necessary.
1869	Sir Francis Galton - statistical concept of correlation	First to apply statistical methods to the study of human differences and inheritance on intelligence; introduced questionnaires and surveys for

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		first scientists to apply the Lexical Hypothesis to the study of personality
1879	Wilhelm Wundt	Believed that all four temperaments were basic dimensions of the human personality and that the temperaments formed the basis of "changeability" and of "emotionality". He theorized that four temperaments—sanguine, phlegm, cholera and melancholy—were actually four dimensions of the human personality and no individual was completely of one temperament; rather that everyone typically has varying proportions of two or more.
1900	Sigmund Freud - Interpretation of Dream	Introduced ego and free association into the personality/behavior debate.
1905	Erich Adicke: Four World Views	Dogmatic (or Doctrinaire), Agnostic (or skeptical), Traditional, and Innovative, which would help shape personality theory in the 20th century.
1905	Eduard Spranger	Contribution to the personality theory book <i>Types of Men</i> . Theoretical: A passion to discover, systemize and analyze; a search for knowledge. Utilitarian: A passion to gain a return on all investments involving time, money and resources. Aesthetic: A passion to experience impressions of the world and achieve form and harmony in life; self-actualization. Social: A passion to invest myself, my time, and my resources into helping others achieve their potential. Individualistic: A passion to achieve position and to use that position to affect and influence others. Traditional: A passion to seek out and pursue the highest meaning in life, in the divine or the ideal, and achieve a system for living.
1907	Carl Jung	Developed the concepts of the collective unconscious, archetypes and extraversion and introversion. , founder of analytical psychology met and collaborated with Sigmund Freud, founder of the discipline of psychoanalysis elected with Freud's support. Jung and Freud influenced each other during the intellectually formative years of Jung's life. In 1921 after a long period of self-imposed isolation Carl Jung in his book <i>Personality Types</i> was the first to theorize that people always prefer certain identifiable behaviors

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		if they are given a free choice. He proposed four main functions of consciousness: Sensation, Intuition, Thinking, and Feeling.
1913	Hugo Munsterberg	The first to apply psychological principles to the legal field, creating forensic psychology.
1917	Robert Woodworth	Developed the Woodworth Personal Data Sheet (considered to be the first personality test)
1919	Henry C Link	Employment Psychology testing ability to perform certain work.
1920	Ernst Kretschmer	Association of body types with personality traits
1921	Hermann Rorschach: The Ink Blot Test	A way to determine personality by the interpretation of abstract inkblots. The subject's perceptions of inkblots are recorded and then analyzed using psychological interpretation and very complex algorithms. Some psychologists use this test to examine a person's personality characteristics and emotional functioning
1928	William M Marston DISC	His research into emotions in humans was published in his book titled <i>The Emotions of Normal People</i> , the basis of which explained that people show their emotions using four behavior types: Dominance, Inducement, Submission and Compliance hence DISC. In addition he suggested that these types came from a person's sense of self and interaction with their environment. His work became the foundation of the DISC assessment was first introduced in 1972.
1928	Louis Thurstone – the Law of Comparative Judgement	The Thurstone Scale. U.S. pioneer in the fields of psychometrics and psychophysics noted that a list of 60 adjectives on an assessment he developed could be reduced to five meaningful factors. Little was done to advance this concept. His approach led to the measurement known as the law of comparative judgment; he further contributed to the area of factor analysis.
1943	Myers-Briggs Type Indicator	First questionnaire published. Isabel Myers (1897-1980) and her mother, Katharine Cook Briggs (1875-1968), Using the ideas of Carl Jung's psychological types; Sensing, Intuitive, Feeling and Thinking; Myers further developed Jung's ideas into a system to provide understanding of the Jungian types.



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1943	Allport and Odbert - Lexical Hypothesis	4500 adjectives, describing nonphysical differences, which could be considered to describe observable and relatively permanent traits. Allport and Odbert. Allport and Odbert (1936) combed through the English language and found over 4,500 adjectives that are used to describe personality, and formed the primary starting point for Raymond Cattell psychologist and creator of the 16PF assessment in 1946.
1946	Raymond Cattrell	See above: creator of the 16PF assessment. <u>used</u> technology of computers to analyze the Allport-Odbert adjective list. He computerized personality testing using an IBM sorter and the Illiac computer (Illinois Automatic <i>Computer</i> ), to perform factor analysis on 4,500 personality-related words at the University of Illinois. His 16 Personality Factors test as the name implies, accounted for the majority of trait terms used to describe personality. Through factor analysis, Cattell identified what he referred to as surface and source traits. The big Five Factor tests are derivatives of Cattell's work.
1963	Ernest Tupes and Raymond Christal	Building on Cattell's work established the five factors of personality testing. The Big Five
1963	Warren T. Norman	Using the work of Tupes and Christal's work replicated their study and confirmed the Five-factor structure for trait taxonomy.
1981	A number of groups (Goldberg 1993), Digman (1996), John, Angleitner & Ostendorf (1988) and McCrae (1992) review.	Review of available personality tests decided that most of the tests supported Warrant T Normans's claims and seemed to measure a subset of five common factors. The Big Five personality traits (Big Five) became widely used in business.
2001	Hugh Massie DNA Behavior International	In 1999, Hugh commenced research on the structuring of a financial personality discovery model based on behavioral finance principles and identified the Forced Choice Assessment Model as being the most reliable predictor of long term behavior. He established DNA Behavior International in 2001 as an international people analytics firm that helps organizations become client centered using validated behavioral insights. The firm provides organizations worldwide with a single technology platform which delivers practical and scalable behavioral intelligence solutions to

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		“Know, Engage and Grow” every employee, advisor and client online for the building of a client-centered business. Today, DNA Behavior International is the global leader of the behavioral management revolution for enhancing advisor client relationships and unlocking human potential.
2002	Daniel Kahneman Ph.D	Psychological research into economic science concerning human judgment and decision-making under uncertainty. He established a cognitive basis for common human errors that arise from heuristics and biases. Heuristics are simple, efficient rules, learned or hard-coded by evolutionary processes, that has been proposed to explain how people make decisions, come to judgments, and solve problems typically when facing complex problems or incomplete information.

The current DNA Behavior Profiling Systems have been independently validated with research performed by the Institute and a team of independent consultants who are psychologists from Georgia Tech University in Atlanta, Georgia, USA, as well as other psychologists and behavioral specialists experienced in psychometric test development.

In their paper titled The Impact of Faking on Employment Tests: Does Forced Choice offer a Solution D.N Jackson, V.R Wroblewski and M.C Ashton observe .....*the research that has compared forced choice and normative questionnaire formats is clear. **The studies in this area consistently found that forced choice tests are less susceptible to faking than their normative counterparts.*** (The Impact of Faking on Employment Tests: Does Forced Choice offer a Solution? 2000 Human Performance, Vol. 13, No.4, Pages 371-388 D.N Jackson, V.R Wroblewski and M.C Ashton)

In his study Albert Zavala noted the following:

*This study on the Forced Choice method of personality testing did some reliability and validity study of FC methods compared to other methods of personality testing and discovered that **FC method is more resistant than others to effects of bias.** Formats using 4 favorable items, from which the rater chooses the items most characteristic of the person rated, prove superior to other formats. Also combining FC scores with other scale scores yielded better results than using either instrument alone. (Zavala, Albert (1965). Development of the forced-choice rating scale technique. Psychological Bulletin, Vol 63(2), Feb 1965, 117-124.)*

The psychology postgraduate's collaborative project: The University of Warwick, Durham University, and The University of Southampton

***A forced-choice scale is a measure mainly used in personality questionnaires. It is a way to assess a candidate's personality traits or behavior, and is relatively safe-guarded against the problems of normative items, such as social desirability bias .Whereas a traditional personality questionnaire will ask the individual to rate their agreement to a statement on a scale of 1-5, Forced Choice forms give the applicant a choice of 2-4 equally positive statements, and they must give their preference or agreement to one of them. An example being to choose from: "I enjoy social events" or "I like to keep organized". This forces the person think more about their answer, and hopefully answer more truthfully, as there is not one obviously desirable quality to pick from.*** <http://www.psychometrictest.org.uk/ipsative-items/>

We have summarized in the table below the necessary features of a correctly structured **Forced Choice Assessment Model** based on academic research. DNA Behavior's approach to norming our assessment tools adheres to the professional and technical benchmarks established in the Standards for Educational and Psychological Testing.

<i>Validation Feature</i>	<i>Why It Is Regarded as a Strong Indicator</i>	<i>DNA Natural Behavior Discovery Process</i>
<b>Psychometric Scoring Model</b>	Forced Choice Scoring (Choosing from a Triad Most Like and Least Like)	Forced Choice Scoring (Choosing from a Triad Most Like and Least Like)
<b>Question Structure</b>	Non-Situational Phrases measuring different traits to force instinctive choice	Non-Situational Phrases measuring different traits to force instinctive choice
<b>Number of Items/Statements to Measure a Factor</b>	20+	46 triads (138 Rating Items) measuring 8 Factors using 24 items each, resulting in 2,349,060 scoring combinations
<b>Development of Phrases</b>	Independent, Experienced Subject Matter Experts	Yes, 100+ years combined test usage and development experience
<b>Primary Factors Measured</b>	Additional depth of behavioral discovery beyond 4 normal personality insights and the singular measure of risk	8 Factors measured on left and right side (16 Traits)
<b>Sub-Factors Measured</b>	Greater distinction of behaviors that make up a primary factor that would otherwise be generalized	24 Sub-factors measured on left and right side (48 Traits)
<b>Report Combinations</b>	Measurement of a person's unique DNA versus generalization into categories	3,704,945,600,000,000,512,144,136.
<b>Independent Peer Review</b>	Academic and Relevant Industry Experience	Professors at Georgia Tech University, Experienced Industrial Psychologist, Business consultants each with 10+ years relevant business and financial services industry expertise
<b>Testing of Phrases</b>	Plain English	Yes
	Grammar	Yes
	Consumer	Yes

	Professional User	Yes
<b>Internal Consistency Analysis</b>	Confirmatory Factor Analysis Performed	Yes, on both primary factors and sub-factors
	Statistical Software used	M-Plus to compute Polyserial correlations and maximum likelihood estimation to determine the standardized estimates of path co-efficients for the items
<b>Internal Consistency Measurement</b>	Greater than 80%	97.10% (134 out of 138 items had a positive correlation to the Major Factors and Sub-Factors)
<b>Factor Relationship Determination</b>	Exploratory Factor Analysis	Yes, on both Major and Sub-Factors
	Statistical Software Used	M-Plus to compute Polyserial correlations to determine the items relating to the Major Factors and Sub-Factors. All EFA's were (obliquely) Varimax rotated to maximize the structure of the factors
<b>Validation and Reliability Sample</b>	Minimum of 200 and ideally 2 times the number of rating items	270 sample size meets sample requirements based on 138 rating items. Additional review using 10,000 sample size. Annual monitoring of data reliability across the whole data base.
<b>Benchmarking of the Sample</b>	Completion of a comparative validated assessment	Yes, Path 6 which had over 250,000 uses at December 31, 2007 and a more than 10 year development and usage history in both business, hiring, career, financial planning and personal development.
<b>Make up of Sample</b>	Equal number of male and female participants	Yes
	Over 16 years of age	Yes
	Language	English



	Test, re-Test Period to gather longitudinal data	3 to 8 years (to gain a deeper insight into consistency over long time periods and life and economic events)
<b>Convergent Validity Measurement</b>	Pearson Correlation Methodology with an absolute value over .70 indicates statistical significance, meaning that there is a 95% chance that correlation is accurate and not random	Pearson Correlation Methodology was used indicating .70 to .87 correlation with the corresponding Path factor.
<b>Internal Consistency to Measure Factor Reliability</b>	Cronbach Alpha Co-efficient over .70 is considered favorable and alpha co-efficients above .80 are considered excellent	All alpha co-efficients for each Factor exceeded .80, except Pioneer which was .62
<b>Testing Period</b>	>3 years	>14 years
<b>Time Current Model Commercially Used</b>	>3 years	6 years (at December 2014)
<b>Usages of Natural Behavior and Communication DNA</b>	100,000+	700,000++ (Natural Behavior at 475,000++ and Communication DNA at 275,000++)
<b>Individual Completion of Assessment</b>	Instructions for participant to personally complete without assistance or coaching	Yes
<b>Couples and teams</b>	Separate Assessment and Measurement	Yes
<b>Statistical Review for Consistency of Test Results</b>	Every 3 years	Every year – with regular monitoring, and changes made to population weighted scores as necessary
<b>Participant “Gaming” Review</b>	Identification of Inconsistent Answers	Yes
<b>Academic Usage</b>	Uses in university training courses	Yes
	Academic training materials	Yes

The Leaders of the DNA Behavior International Behavioral Research Team are:

### **Justin A. DeSimone PHD, University of Nebraska-Lincoln**

Justin serves as a consultant to DNA Behavior International, with a focus on behavioral research and content development. He is a non-executive member of the DNA Behavior International Advisory Board for Behavioral Research. Justin has a B.A. in Psychology from Duke University and an M.S. and Ph.D. in Industrial and Organizational Psychology from the Georgia Institute of Technology. He is currently working as a post-doctoral research associate at the University of Nebraska-Lincoln. Justin has extensive experience in psychometric analysis, test development, and test validation. He has worked with many multi-national and Fortune 500 clients in the field of test development, evaluation, and validation—including the Coca-Cola Company, AON Talent Solutions, the Ramsay Corporation, the U.S. Army, Personnel Development & Hiring, the Human Resources Research Organization, the American Society for Training and Development, and the U.S. Marshal's Service. Justin's research has appeared in Organizational Research Methods, Industrial and Organizational Psychology: Perspectives on Science and Practice, and The Journal of Business Research. In addition, Justin has taken twelve graduate-level courses in research methodology and statistics, and he has served as a teaching assistant at Georgia Tech for six graduate level statistics courses since 2006. He also has experience working with training and organizational development for The Coca-Cola Company and CJC International.

### **Bill Newbolt PHD, Newbolt & Associates**

Bill currently serves as a consultant to DNA Behavior International, with a focus on behavioral research and content development. He is a non-executive member of the DNA Behavior International Advisory Board for Behavioral Research. Bill has a PHD in Industrial and Organizational Psychology from the University of Georgia. He has worked for The Coca-Cola Company and other Fortune Companies for over twenty years, leading the development and validation of personality measures and conducting behavioral statistical analysis. For the past eight years he has provided independent consulting services to companies on behavioral research and human performance issues.

### **Lee Ellis, Leadership Freedom, LLC**

Lee serves as a consultant to DNA Behavior International, focusing on behavioral research and content development. He is a non-executive member of the DNA Behavior International Advisory Board for Behavioral Research. Lee has a B.A. in History and an M.S. in Counseling and Human Development. He is the president of Leadership Freedom, LLC. Lee has over twenty years of experience in psychometric research and use of behavioral systems. For twelve years he led the pioneering research and development of behavioral assessment systems for career counseling, working collaboratively with a research team from the Industrial-Organizational Psychology Department of the University of Georgia.

In particular, Lee was a pioneer in the use of the Forced Choice Scoring Model. He led the team that researched and developed the Career Direct Personality Inventory (Career Direct® assessment system) and the RightPATH® 4 and 6 (Financial DNA) Profile Assessments that have been used internationally by more than 251,000 individuals as of December 31, 2007. Lee has twenty years of experience in leadership training and education as well as eight years of experience in financial and career guidance counseling. Lee is the author of *Leading with Honor: Leadership Lessons from the Hanoi Hilton* and *Leading Talents, Leading Teams* and the co-author of three books on career planning.

## **Carol Pocklington, Consultant**

Carol serves as a consultant to DNA Behavior International, focusing on behavioral research and content development. She is a non-executive member of the DNA Behavior International Advisory Board for Behavioral Research. Prior to consulting with DNA Behavior International, Carol worked for Thomas International in the United Kingdom, the developer of the original DISC inventory. She has over forty years of technical and practical experience in the development and use of personality systems for Government Departments, the Banking Sector, the Airline Industry and many multi-national corporations undergoing significant internal re-structuring. She is a world authority on how personality insights can be used in human development, and she specializes in their application within the workplace. Carol conducted an independent research study for DNA Behavior International in 2001 on all of the major personality profiling systems being utilized in business, with a view to assess their strengths and limitations. The findings formed the foundation for establishing the criterion required in the development of new personality assessment tools for use in personal development, career, financial and business consulting services. She led the development of the DNA Discovery Processes which are currently applied to more than twenty specific applications worldwide, applied under three primary DNA brands with twelve different assessment processes.

## **Hugh Massie, DNA Behavior International**

Hugh is a human behavior strategist and serves as the President of DNA Behavior International. He is the company's executive, leading the packaging of the company's behavioral research into commercial programs that can be distributed worldwide. In particular, he is a specialist in making the field of behavioral finance practical on a scalable basis, using human behavior discovery systems. Hugh has a Bachelor's of Commerce, is a Chartered Accountant in Australia, and has a diploma in Financial Planning. He has twenty-nine years of international business experience in human behavior, accountancy, wealth management and as a portfolio investor. Hugh has more than twelve years of technical and practical international experience in developing and using personality systems for a wide range of business applications. His expertise is the packaging of technical behavioral concepts that can be applied daily in both personal and business arenas, on a mass scale with a worldwide platform—using technology systems. Since September 1999, he envisioned and led a team of behavioral experts from Australia, the United States, and Europe to develop the DNA Discovery Processes. They are currently under three primary DNA brands with twelve different assessment processes. Hugh is a pioneer in the development and use of the Forced Choice Scoring Model in behavioral discovery processes. In particular, he has focused on the development of the DNA Discovery Processes to be both client and employee-centered.



Hugh is a world authority on the connection of natural DNA behaviors to life and to financial and business decisions. He also provides consulting and training services to international corporations, Fortune 500 Companies and financial service firms. Hugh has written numerous whitepapers on behavioral topics, and he is the author of Financial DNA – Discovering Your Financial Personality for a Quality Life, published by John Wiley and Sons.

**Ryan Scott, DNA Behavior International**

Ryan serves as the Product Development Manager at DNA Behavior International and is assisting with the management of the company's behavioral research and content development. Ryan has a Bachelor of Science degree in Management from the Georgia Institute of Technology. He has worked closely with Hugh Massie and the non-executive consultants during the development and commercialization of the DNA Discovery Processes, particularly utilizing his mathematical and statistical analysis skills.

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