The Interstrength™ Cognitive Assessment
Development of a Validated Cognitive Development Psychometric
by Dario Nardi, January 2006

The Interstrength™ Cognitive Assessment is based on Carl Jung's theory of eight cognitive processes ("mental functions") and generates a portrait of a person's overall cognitive development. This portrait is a composite picture of preference, usage, and skill with the eight cognitive processes. Since many people are skilled with and use the cognitive processes that they prefer, a person's cognitive portrait can be used as a data point to help determine his or her best-fit 4-letter personality type code.

Contents:

I. Theoretical Assumptions

Overview of the Eight Cognitive Processes
Swiss psychiatrist Carl Jung identified four mental functions — referred to as cognitive processes. He proposed that we focus our attention and gather information using Sensing (S) and iNtuiting (N), and we organize our experiences and make decisions using Thinking (T) and Feeling (F). Jung described how each of these four processes plays out in a person's "internal world" (I) of thoughts, feelings, memories and imagination; and in the "external world" (E) of actions, people, tools and organizations. Thus, eight cognitive processes total (Se, Si, Ne, Ni, Te, Ti, Fe, Fi). More information on Jung's theory can be found on pages 183-189 of "8 Keys to Self-Leadership" by Dario Nardi.

Sixteen Type Patterns and the 4-Letter Code
Jung observed that everyone has potential access to all eight cognitive processes but we each prefer one as dominant — playing a lead role — with a second process playing a support role. Our two preferred cognitive processes are paired to allow us to do information gathering and decision making, introverting and extraverting. These pairings map to sixteen patterns which are often represented using a 4-letter code. For example, an INFJ prefers introverted Intuiting in a lead role with extraverted Feeling in a support role. Here are the sixteen type patterns and the preferred cognitive processes associated with each:

Type Code	Lead Process	Support Process
ESTP	extraverted Sensing	introverted Thinking
ISTP	introverted Thinking	extraverted Sensing
ESFP	extraverted Sensing	introverted Feeling
ISFP	introverted Feeling	extraverted Sensing
ESTJ	extraverted Thinking	introverted Sensing
ISTJ	introverted Sensing	extraverted Thinking
ESFJ	extraverted Feeling	introverted Sensing
ISFJ	introverted Sensing	extraverted Feeling
ENTJ	extraverted Thinking	introverted Intuiting
INTJ	introverted Intuiting	extraverted Thinking
ENTP	extraverted Intuiting	introverted Thinking
INTP	introverted Thinking	extraverted Intuiting
ENFJ	extraverted Feeling	introverted Intuiting
INFJ	introverted Intuiting	extraverted Feeling
ENFP	extraverted Intuiting	introverted Feeling
INFP	introverted Feeling	extraverted Intuiting

Jung observed that individuals tend to be unconscious of and lack development and use of their non-preferred processes. For example, INFJ would have significantly less access and use of Sensing and Thinking processes.

Basic and Developed Use
Each cognitive process can be engaged in a basic, unsophisticated way reflecting our natural human capabilities. Almost everyone can engage each process in some basic way. Beyond this, individuals will engage some cognitive processes in more sophisticated, developed ways. This is usually the result of preference plus lifelong growth and practice, which equals development.

Perception—how we focus our attention and gather information

Cognitive Process	Basic (Passive) Use	Developed (Active) Use
extraverted Sensing (Se)	Notice sensory data in the environment.	Trust your instincts and take action relevant to the moment and current context.
introverted Sensing (Si)	Recall tangible data and experiences.	Stabilize a situation by comparing it to what is expected, known and reliable.
extraverted Intuiting (Ne)	Notice abstract patterns as they emerge.	Shift a situation's dynamics and explore imaginative potential possibilities.
introverted Intuiting (Ni)	Receive "ah-ha" insights and realizations.	Pursue a greater level of awareness to transform who you are and how you think.

Judgment—how we organize our experiences and make decisions

Cognitive Process	Basic (Passive) Use	Developed (Active) Use
extraverted Thinking (Te)	Follow steps, points and time tables.	Create structure, reason by measures and evidence, and implement complex plans.
introverted Thinking (Ti)	Adhere to definitions and impersonal principles.	Analyze a problem using a framework, and find an angle or leverage by which to solve it.
extraverted Feeling (Fe)	Honor others' needs and preferences.	Connect with people by sharing values and taking on their needs as yours.
introverted Feeling (Fi)	Adhere to personal beliefs about what's important.	Evaluate situations and choose what you believe is congruent with your personal identity.

Development as a whole is more than basic or developed use of a single process. Excellent use of a process involves basic and advanced use as appropriate and ability to deploy other processes in its service.

Comparison with Existing Instruments
Other instruments draw on Jung's theory. References for these instruments can be found at the end of this document. The Interstrength™ Cognitive Assessment differs in purpose, design, and theoretical assumptions. Specifically:
- The Singer-Loomis and Grey-Wheelwright instruments are based on old definitions of the cognitive processes, its results often do not match a person's type code, and neither instrument accounts for key theoretical points.
- The Management Team Roles-indicator® (MTR-i®) assesses contextual use in teams rather than general development or best-fit 4-letter type code.
- The Function Skill Development Assessment (FSDA) does not suggest a respondent's best-fit 4-letter type code and does not normalize results.
- The Myers-Briggs Type Indicator (MBTI®) and derivative instruments mimicking it do not assess 8 cognitive processes or report development.

II. Development of the Assessment

Pilot Study Results
In spring 2004 an Internet-based pilot study allowed respondents to rate 120 phrases (15 phrases for each of the eight cognitive processes) on a three-point scale ("don't do" "do somewhat," and "do a lot.") Phrases were brainstormed based on conversations with other experts and from a review of the literature. Respondents were allowed to enter comments (feedback). Most respondents were individuals of "verified type." The results of this promising pilot study are reported on pages 192 to 195 of *8 Keys to Self-Leadership* by Dario Nardi.

Design Choices and Assumptions

Following the pilot study, the Interstrength™ Cognitive Assessment was developed with 48 items. The following design decisions were made:

- There are six items for each of the eight cognitive processes.
- Among the six items for each process, two assess "basic use" and two assess "advanced use." Basic items were constructed using passive terms like "notice, follow, perceive, stay with, hold to" while advanced items were constructed using active terms like "construct, engage, play with, manage."
- Among the six items for each process, two assess usage with a supporting (auxiliary) process. For example, extraverted Sensing with introverted Feeling has a different "look" than extraverted Sensing with introverted Thinking. The result is 16 items that directly tap the 16 personality types.
- Respondents are asked to rate each item on its own rather than in comparison to other items. This design minimizes theoretical assumptions, such as which processes might be oppositional to each other, and allows the widest range of possible results.
- A five-point scale from "not me" to "exactly me" is used.
- In addition to the standard directions, respondents are informed that understanding the items is part of the assessment process and they should rate as "not me" items they do not understand.

The items were designed for psychological appeal. For example, at least one item contains the word "always." Even through "always" might not be logically possible, the word often appeals to individuals with a preference for introverted Feeling. Also, some phrasing allows for multiple meanings. An individual's response to multiple meanings is one aspect of cognition that is assessed. Finally, like most assessments, the items are presented out of context. People often respond contextually when presented with specific/ example situations, giving skewed results.

Data Gathered to Date

There were some ten iterations of the assessment. As of January 2006, 2085 people took iteration 2.0 of the assessment, 814 people took iteration 1.9, and so on back to 2004. The online format forces respondents to reply to all items. Sometimes a person might submit more than once. The presence of duplicate records has been determined using a formula based on demographic data and final result. Duplicates are discarded. (In an online environment with multiple people taking the assessment at once, duplicate records do not necessarily appear in linear order. And since the assessment is optional and unmonitored, individuals do not indicate unique IDs.) Information of 4-letter type code (if known) and how the respondent learned his or her code also has been gathered. Among individuals who report a type code, a majority have indicated the MBTI® as the source of knowledge of their code.

Scoring

Various scoring schemes were considered and tried during the data analysis phase. The following two criteria were used to assess efficacy:

1. Best match with respondents' reported 4-letter type codes (when known). Thresholds were set for a minimum match of 70 percent and maximum match of 85 percent (since results from other instruments may also be faulty and not do represent benchmark standards.)
2. Best match with theoretical assumptions (for each respondent, lowest scoring processes are "opposite" to the highest scoring processes.) For example, respondents who rate introverted Intuiting highest should also rate low the two Sensing processes.

Ultimately, the scoring process described in Section IV was chosen for best effect.

Statistical Analysis

Statistical analysis used inter-item correlation (factor analysis) to pick out the best performing items from the 120-item pilot study and to evaluate later iterations of the 48-item Interstrength™ Cognitive Assessment. For pair-wise item-to-item comparisons, the Pearson statistic was used. A minimum threshold of $r = 0.20$ was set for correlation between items assessing the same cognitive process, with a goal of $r = 0.40$ to $r = 0.60$ correlation, which was eventually achieved for all items. Except, it was understood that mixed-items (which appeal to multiple cognitive processes at once) might only have $r = 0.20$ to $r = 0.40$. Items which did not meet the criteria, or which correlated with other cognitive processes above $r = 0.20$, were modified or replaced with new items over several iterations of the instrument. Each iteration is noted in 0.1 increments beginning at 1.0. Thus, version 2.1 is the 11th iteration of the assessment.

Assessment Validity

Getting accurate results is an important measure of an assessment's performance. As of version 2.0 (ended December 31, 2005), 44 of 48 items performed at the $r=0.40$ or higher level with other items of their kind, and under $r=0.20$ for items tapping other processes (usually $r=0.0$ to $r = -0.20$.) The remaining 4 items were modified or replaced for testing in version 2.1, now in progress. Overall, analysis suggests the assessment taps eight distinct processes.

The results strongly support theoretical points as well, including: the importance of functional pairs (Se + Fi, Ne + Ti, etc), basic versus advanced use, and low scores for non-preferred processes (for example, a typical INFP will score high Fi and Ne and low for the Sensing and Thinking processes.)

In terms of match with reported type, results matched individuals' reported 4-letter type code 75 percent of the time (compared to 6.25 percent by chance alone.) This is similar to other well-regarded instruments of this kind such as the MBTI® instrument.

III. Administering the Assessment

Appropriate Audience
The assessment is best used with adult English speakers who have completed a high school (12 year) education. The assessment items are written at an 8th grade reading level, the standard for public-use documents although many type assessments are at an even lower grade level. Reading level was determined using several common measures. The assessment contains colloquial phrases and is most suited for native English speakers and non-native speakers who have fluent use of the English language. The assessment is generally not appropriate for those under the age of 15 due to reading level, developmental issues, the degree of self-reflection and self-knowledge required, and complexity of concepts.

Assessment Instructions
Respondents are asked to set aside prior knowledge or notions they may have about Jungian psychology, cognitive science, and models of development. They should read carefully and rate on a scale of "not like me" to "exactly like me" each of the 48 phrases presented. If unsure, respondents are asked to:
- Indicate how often you do skillfully what the phrase describes.
- Use dictionary definitions and proceed with the overall meaning of the item most comfortable to them.
- Mark as "not me" any phrases they don't understand (if the individual does not understand a phrase, it was likely not meant for him or her.)

Common Experiences Taking the Assessment
The assessment taps into cognitive (internal, mental) processes as opposed to outward surface behavior or self-image. Thus, it is not a purely self-reflective questionnaire with easy-to-answer items such as, "Do you play sports often?" or "Are you logical?" Instead, this is a "cognitive" assessment. A typical item is, "Easily get in sync physically with people and things around you" (item 48.) A respondent's ability to understand items is assessed along with his or her self-rating. This is based on Jung's theory, which proposes that non-preferred cognitive processes may be outside a person's awareness or experience.

Feedback during the assessment's develop supports this approach. Respondents sometimes volunteered which items were easy or difficult (for them) to understand. Items labeled as difficult varied with their reported type. For example, a self-reported ENTP (who had a cognitive profile typical of ENTP) stated several of the extraverted Sensing items were "very unclear," particularly item 48 mentioned above (designed as an "ESFP" item).

Because the items require self-reflection and are context independent, one might think that respondents with a Sensing-preference would have a harder time with this survey. This is not the case. Instead, individuals who have the most questions about the assessment report a preference for introverted Thinking (INTP, ENTP, ISTP, ESTP). Perhaps this is because words used in the items do not have precise definitions, or because introverted Thinking is the cognitive process naturally associated with clarifying and critiquing.

Some individuals take issue with spelling and grammar. There are no spelling or grammar errors in the assessment. However, there may be alternative spellings in the assessment literature, such as "extraverted" for "extroverted," because these are terms used in Jung's theory. Also, what many people colloquially refer to as "grammar" is actually "usage," which is subjective.

IV. Scoring and Presentation of Results

Scoring Procedure

Items which assess basic use are worth one point. Items which assess advanced use are worth three points. Items which asses mixed usage assign 2.1 points to the lead process and 1.1 points to the supporting process. The purpose of decimal values is to prevent ties. A respondent's rating for an item is converted to a five-point scale (0, 1, 2, 3 or 4 points) and multiplied by the worth of the item (1, 3, or 1.1 and 2.1 points). The result is a score from 0.0 to 57.6. for each cognitive process. Because of the different weights, an individual may feel he or she is often giving a high rating to a particular process but the final result may only show average or even low rating.

In addition to a profile of the eight processes, the assessment results can be used to determine the 4-letter type code most associated with that profile. To determine which 4-letter type code matches best, the sum of scores for the four introverted processes is compared to the sum of scores for the four extraverted processes. The dimension with the highest score determines "E" or "I" for the result. This fits with Jung's assertion that individuals are fundamentally introverted or extraverted regardless of cognitive processes in use. Next, scores for cognitive processes are summed pair-wise (extraverted Intuiting + introverted Feeling, etc) to determine STP, SFP, STJ, SFJ, NTJ, NTP, NFJ and NFP. The pair with the highest score determines the rest of the 4-letter type code. The runner-up pair is also noted. Respondents are shown this type code result along with two other type codes to consider, for three type codes total (out of 16 possible.) One extra code reverses "E" and "I." The other extra code is based on the runner-up pair. For example, if Se+Ne+Te+Fe summed greater than Si+Ni+Ti+Fi, and NFJ scored highest and SFJ scored second highest, then the following type codes would be offered: ENFJ, INFJ, and ESFJ.

Presentation of Results

Respondents are shown a graph of each cognitive process based on their responses to the items. The results are reported for each of the eight cognitive processes, beginning with extraverted Sensing, then introverted Sensing, and then extraverted and introverted for Intuiting, Thinking, and Feeling. This order is useful when discussing a respondent's results in terms of 4-letter type code, when the facilitator is discussing S and N, followed by T and F. Respondents are also shown the 3 type codes most associated with their pattern of responses.

Statistical analysis shows that certain personality types tend to rate items higher overall compared to other types. These types are ENTP, ENFJ, ISTP and ISFP. Other types consistently rate items lower overall compared to other types. These types are ISTJ and ISFJ. Also, some individuals may rate themselves high or low across all eight processes for personal or contextual reasons.

To present a less-biased picture of results to respondents, the eight raw scores are normalized so that the average of all the scores is 30.0. The number 30.0 was chosen because it was the average score for all eight processes for all 16 personality types. The bar graph presented to clients includes a numeric equivalent of the score and a developmental category for each process. The developmental categories are determined as follows:

Numeric Score	Categorical Result
0 to 16	Unused
> 16 and <= 24	Limited use
> 24 and <= 30	Average use
> 30 and <= 36	Good use
> 36	Excellent use

Thirty was set as the upper-end of "average use" because out of the eight cognitive processes, individuals prefer two (rather than half, or four.) Because the scores are normalized, no individual will have "excellent use" in all eight processes. Nor will any individual have "limited" or "unused" in all eight processes. The individual who reports similar use in all eight will get "average use" for all processes instead. Thus, the assessment does not differentiate between individuals with "poor" or "exceptional" overall development. Rather, development of a cognitive process is presented as relative to other processes. This fits with Jung's theory that the use of processes involves a balance of psychological energy (which he termed "libido" and which might now be understood as neurochemical balance.)

Performance with Respect to Reported Type
Determination of "E" and "I" has been somewhat less reliable than in the pilot study, and the general preference for basic usage over advanced usage does not show as strongly, perhaps because the number of items was reduced from 120 to 48. Thus, if a type result does not match for the individual, the first alternative is to explore the same type code but with the first letter, E or I, reversed.

There is some variation in performance by type. Results suggest the assessment is likely to be more accurate with people who don't know about psychological type (or their 4-letter type code) compared to people who do. Also, results for individuals with "N" and "J" in their 4-letter type code are more likely to respond strongly to items not indicative of their type compared to individuals reporting other types.

Results support the influence of four governing temperament categories as proposed by Linda V. Berens et. al. There is a clear negative correlation between extraverted Sensing items and introverted Sensing items for individuals who rated either type of item highly. Also, there are clear positive correlations for Intuiting and Thinking processes, and Intuiting and Feeling processes, as two distinct categories. The result is four over-arching categories. For individuals who have reported a type code, assessment results have matched the temperament corresponding to the reported code over 90 percent of the time (compared to 25 percent by chance alone.)

Sex, Age, and other Demographic Correlations
Age and sex relate to development. Men and women rated certain items higher or lower regardless of their final results. These variations are statistically significant and consistent with results from other instruments. Specifically, men tended to rate introverted Thinking items higher than women did, even men who otherwise have a preference for Feeling processes. Similarly, women tended to rate extraverted Feeling items higher than men did, even women who otherwise have a preference for Thinking processes. Response patterns also tended to vary with age regardless of a person's results. Men were more likely to identify strongly with their preferred processes and much less so with their non-preferred processes, particularly in their 30s and 40s; while women tended to rate preferred and non-preferred processes more closely, particularly in their 30s and 40s.

V. Facilitating Client Understanding of Results

General Frame of Mind
All assessments, particularly those that rely on self-report, are inherently limited in their ability to capture a person's personality. In light of this ethical point, the Interstrength™ Cognitive Assessment reports three best-match types rather than other instruments which report one. The cognitive profile is also important to helping individuals sort out their development and perhaps why they responded to the assessment items the way they did.

Commonly Observed Response Patterns
There are several common types of cognitive profiles. *The most common kind of profile shows a smooth progression from several highly-rated processes to several low-rated processes*. This typical report might look like this:

Cognitive Process	Level of Development (Preference, Skill and Frequency of Use)
extraverted Sensing (Se)	************************ (26.9) average use
introverted Sensing (Si)	********* (9.9) unused
extraverted Intuiting (Ne)	*********************** (25.9) average use
introverted Intuiting (Ni)	************************************** (40.9) excellent use
extraverted Thinking (Te)	** (48.9) excellent use
introverted Thinking (Ti)	************************************ (37.9) excellent use
extraverted Feeling (Fe)	******** (8.9) unused
introverted Feeling (Fi)	************************************** (40.9) excellent use

Cognitive processes that score as "limited" or "unused" can be improved through the careful exploration of "basic use" of those processes. For processes that score as "average use", consider ways to reinforce satisfying basic use while encouraging exploration of developed use. Processes that score as "excellent use" may sometimes be over-used, to reflect a reaction to the demands of the environment. Check these possibilities by exploring and confirming satisfying developed use.

Some individuals show other patterns, mentioned below. Suggestions are included for how to interpret and facilitate these results.

Undifferentiated Cognitive Pattern
All processes clustered around "average use." This individual would likely benefit from a 360-degree type of evaluation to get feedback from others on what their strengths and challenges areas are as observed by others.

Results Strongly Contrary to Reported Type
The processes associated with the individual's report type score low in the profile. For example, a self-declared INFJ scores highly on extraverted Sensing and introverted Feeling with a best-match type pattern of ISFP. Introverted Sensing also rates highly while introverted Intuiting and extraverted Feeling rate low. This mismatch might happen because the respondent was in an unusual frame of mind while taking the assessment, or because their reported type is not a best-fit. Inquire about any special life situation and suggest alternate type descriptions to consider. Some individuals who are familiar with type theory may resist thinking of themselves as another type. Since the assessment items are clearly related to specific processes, you might ask the individual why they rated highly items like they did.

Highly Rated Non-preferred Process
The highest-scoring process is unrelated to the best-fit type pattern. For example, the report suggests INTJ as the best-match type code but the highest scoring process is introverted Thinking, followed by extraverted Thinking, extraverted Intuiting and introverted Intuiting. The suggested best-match is INTJ because the sum of Ni + Te is greater than the sum of Ne + Ti. Yet, Ti is the highest rated process. This can occur because of job requirements or educational background, or because of self-image. This INTJ might be a scientist for example, trained to be objective and analytical and officially eschew intuition. Yet this training does not negate the use of Intuiting processes. You can explore the respondent's contextual demands. Fortunately, three type codes are offered not just one, so the client will have ENTJ and INTP to explore as options in case one of these types is in fact a better fit.

Nearly Opposite Results
In this situation, the best-match type and runner-up type are nearly opposite types. For example, INFJ, ENFJ and ISTP. These 4-letter code system might suggest that ENFJ and ISTP are "opposite" types. But this is not the case. Jung proposed that people develop their non-preferred processes beginning at mid-life. John Beebe and Linda V. Berens have proposed that certain processes such as Ni and Se, and Ti and Fe, work in tandem.

Thus, a person might rate highly Ni, Fe, Ti and Se, with lower scores for the remaining processes. The respondent can be encouraged to consider all three type options with the understanding that the 4-letter code does not convey development.

Temperament-Related Pattern
It is not unusual for individuals with an Intuiting preference to rate highly those processes commonly associated with their temperament. For example, an INFP or other "NF" type might rate highly introverted Feeling, extraverted Feeling, introverted Intuiting and extraverted Intuiting. Similar, an "NT" type might rate highly all four Intuiting and Thinking processes. In contrast, this pattern is rarely observed for individuals with a Sensing preference, who tend to either rate highly extraverted Sensing (the "SP" types) or introverted Sensing (the "SJ" types) but not both. In these situations, the individual may responding in terms of what meets his or her temperament needs and values.

VI. References

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