Refining the Definitions of Sensing and Intuition as Measured by the MBTI® Instrument

Of the four domains outlined in Isabel Myers's theory of psychological type and measured by the Myers-Briggs Type Indicator® or MBTI® instrument (see Myers, McCaulley, Quenk, & Hammer, 1998), the function pairing of Sensing and Intuition is arguably the most challenging to measure and understand.

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THE FOCUS OF THIS white paper is first to elucidate some of the ways these constructs have been defined, both within the type community and without, and, second, to present data that we hope will help better define what is being conceptualized by type theorists and measured by the MBTI instrument in relationship to these terms.

Intuition. Way back at the source, Carl Jung (from whom Myers's theory and the MBTI instrument itself derive) recognized the inherent challenge of defining the mysterious process of intuition, which "is in the main an unconscious process [and] its nature is very difficult to grasp" (Jung, 1923/1971, p. 366). Intuition operates in a holistic, almost magical fashion: "a content presents itself whole and complete, without our being able to explain or discover how this content came into existence" (p. 453). Though intuition can "appear" in the form of sense perception or feeling, it is "not mere perception, or vision, but an active, creative process that puts into the object just as much as it takes out" (p. 366).

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Respecting intuition's elusive quality, the MBTI instrument attempts a difficult feat: the measurement of an unconscious process by use of a self-report questionnaire, a method which invites conscious deliberation. How well this strategy succeeds is a controversial subject; not surprisingly, both type theory supporters (e.g., Garden, 1991) and critics (e.g., Pittenger, 1993) have criticized the instrument for inadequately capturing the unconscious component so central to psychodynamic psychologists like Freud and Jung.

Whether or not such criticisms are warranted, capturing intuition in its fullest Jungian form presents arguably the MBTI instrument's greatest measurement challenge. The content of MBTI items operationalizes intuition as a preference for extracting patterns from raw data or extrapolating holistic gestalts, future possibilities, or underlying theories from elemental components. "Abstract" is most commonly used as a stand-in for intuition, in contrast to the term "concrete," assigned to the sensing preference. Abstract-Concrete forms the primary facet (out of the five measured by the MBTI Step II™

instrument) of the Sensing–Intuition type domain. That facet name is emblematic of the gap between Jung's rich, nuanced, and elusive take on intuition, which, like sensing, he takes great pains in asserting that BOTH may take either abstract or concrete forms (Jung, 1923/1971).

One response to Jung's (and others') elusive psychological constructs was to ban them from scientific study, and much of 20th century psychology fell under the influence of stimulus-response behaviorism. Humanists and the positive psychology movement have paved the way for a renewed interest in the less overtly behavioral machinations of the human psyche. There is a bit of renaissance in research on intuition. For example, one recent publication, the *Handbook of Intuition Research* (Sinclair, 2011), is an international compendium with contributions by 36 researchers, floating a wide variety of definitions and classifications. Sadly, despite 100 years of Jungian theory on the subject, the MBTI and/or Isabel Myers are cited only three times in the entire book, and not particularly accurately. Fortunately, a few researchers (notably Jean Pretz and her colleagues) have incorporated the MBTI assessment into their attempts to wrestle an understanding from the mystery of intuition.

Jung's writings about the relationships of sensing, intuition, and feeling are nuanced and at times interwoven, reflecting both the complexity of the constructs and the evolution of Jung's concepts over many years.

How do these other researchers define intuition? Definitions vary widely, but one of the most established conceptualizations places intuition within a dual-process model of cognition known as Cognitive-Experiential Self-Theory, or CEST for short (Epstein, 2013). In this theory, intuition is considered "a subset of experiential processing" (Epstein, 2013, p. 111), essentially a sort of automatic, effortless means of cognition resulting from familiarity accumulated through experience. Experiential cognition is distinguished from rational cognition, a logical, rational method of operating that is energy intensive, deliberative, and comparatively slower to move.

There are both similarities and differences between CEST and psychological type theory. The immediate, unconscious operation of intuition is common to both. But experience plays a very different role. It facilitates intuition in Epstein's theory, but in type theory, "for Sensing types, experience speaks louder than words or theory" (Martin, 1997, p. 4) and fosters creation of an experience-based storehouse of "memory that is specific, detailed, literal, and complete" (Quenk, 2000, p. 6).

The basic architecture of the theories differs as well. CEST aligns intuition with emotion and affect; together, intuition, experience, and emotion are the primary components of the larger category of experiential cognition. This in turn is distinguished from rational cognition, arguably more akin to MBTI Thinking. Thus, intuition is aligned with feeling and together these are contrasted to thinking. However, unlike type theory, in which good development necessitates that one pole of contrasting pairs will take precedence, in CEST experiential and rational cognition develop independently, and a person can be adept at both.

Jung's writings about the relationships of sensing, intuition, and feeling are nuanced and at times interwoven, reflecting both

the complexity of the constructs and the evolution of Jung's concepts over many years. For example, he states that Sensing (or, in his original language, sensation) is primarily a sensory perception, but can be an element of ideation (as image) and that sensation also "is an element of feeling, since through the perception of bodily changes it gives feeling the character of an affect" (Jung, 1923/1971, p. 462). On the previous page, though, he is clear to note that "Sensation must be strictly distinguished from feeling" (p. 461). There is a single entry for "emotion" in the index of Collected Works Volume 6; Jung preferred "affect" and obviously used "feeling" frequently, though type theorists are quick to distinguish Feeling, a rational judging function that informs decision making on the basis of values and outcomes, from emotion (see Martin, 1997, p. 5). Jung did in fact note that "the dividing line [between feeling and affect] is fluid, since every feeling, after attaining a certain strength, releases physical innervations, thus becoming affect" (Jung, 1923/1971, p. 411). Empirical evidence clearly associates a preference for MBTI Feeling with emotionality (e.g., Harker, Reynierse, & Komisin, 1998; Thorne & Gough, 1999). Moreover, language used in MBTI TF items refers to "person[s] of real feeling," letting "your heart rule your head," "sentiment," "compassion," and other terms indicative of emotionality. Feeling, then—even if a rational function—seems to more readily encompass emotion within its operation.

A major focus of the research presented in this paper is to gather data from two measures of intuition distinct from the MBTI scales, as well as the measurement of Intuition using the MBTI instrument, and to examine the convergence and divergence of these distinct measures in hopes of elucidating some clarity on these matters.

Sensing. Sensing, presumably Intuition's opposite, presents another set of definitional challenges of a different nature. We believe much confusion arises from treating four similar but discrete terms (sensation, sensing, sensitivity, and sensation-seeking) as though they were synonymous, interchangeable, or necessarily linked—a practice called into question upon closer scrutiny of the evidence.

Let's start with sensation, Jung's original term and simply as "sense perception—perception mediated by the sense organs and 'body senses'" (Jung, 1923/1971, p. 462). The apparent straightforwardness of that definition, however, is deceptive, given his caution that "sensation is not what one usually understands—having sensations of touch, light, etc . . . . it has nothing to do with the functions of the body…the psychological function of sensation is the perception of reality, and the standpoint of the sensation type is simply the standpoint of facts" (Jung, 1984, pp. 613–614).

The latter definition informs the MBTI SN items, which use words such as "fact" to represent Sensing in contrast to words like "possibilities" to represent Intuition. Somewhere along the way, too, the word sensation was replaced by Sensing, which Isabel Myers made to minimize misleading associations with the former term (Geyer, 2014). At the time of Jung's original writings, the term sensation had been in use since the dawn of the age of experimental psychology in the 19th century, when other German-speaking

research pioneers like Weber, Fechner, and Wundt were exploring the psychophysical intersection of measurable physical stimuli (e.g., weight, frequency, heat) translated into psychological sensations.

Jung in fact cited Wundt in his definition of sensation, but took it at least one major step further by distinguishing it (and the other three Jungian functions) as having two possible expressions, either introverted (inward focused) or extraverted (outward). These two orientations differ in the extreme; per Jung, "no other type can equal the extraverted sensation type in realism" (Jung, 1923/1971, p. 363), whereas introverted sensation involves a "reality-alienating subjectivity" such that "no proportional relation exists between object and sensation" (pp. 396-397). One is objectively realistic and one is divorced from reality by its subjective nature.

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Sensitivity. Similar to Sensing but potentially very different is the concept of sensitivity. Elaine Aron, a Jungian-trained clinical psychologist, has devoted the bulk of her career to the measurement and study of highly sensitive persons, those whose nervous systems have a sensitive threshold for stimulation and exhibit high reactivity and may be overstimulated by external or internal events. Aron and her psychologist husband have developed and validated the Highly Sensitive Person (HSP) scale (Aron & Aron, 1997).

Aron too finds Jung's theories relevant, but she is clear that sensitivity is a phenomenon distinct from sensation or Sensing. Instead, she believes Jung's initial ideas about innate hypersensitivity grew into his conception of introversion. "The idea of 'sensitiveness' remains as the basic physiological characteristic of sensitivity to stimuli," (Aron, 2004, p. 349) even as Jung's language evolved from sensitivity to introversion. Jung never explicitly defined sensitiveness, but he did associate "congenital sensitiveness" (Jung, 1961, p. 249) with "exaggerated nervous reactions" (p. 249) and "unnecessary excitement" (p. 183), which could be observed as early as the first weeks of an infant's life.

Since sensitivity might also be understood as a heightened awareness of and/or attention to concrete stimuli—characteristics which the type literature frequently attributes to those with an MBTI Sensing preference—it makes some sense to consider possible links between sensitivity and Sensing. Some type theorist explicitly affirm a Sensing type's unusually accurate visual perception (Haas & Hunziker, 2006), better perceptual discrimination (Hartzler & Hartzler, 2005), or a more refined sense of visual hue, auditory pitch, or taste (Loomis, 1991). These assertions are commonly made of types that theoretically extravert their Sensing, but the type literature does regularly attribute such characteristics *broadly* to those with a Sensing preference. *The MBTI® Manual*, for example, associates a Sensing preference with especially "acute powers of observation" and "focus[ing] on the immediate experiences available to the five senses" (Myers et al., 1998, p. 24).

If Myers had labeled the SN scale with an appropriate but different sounding name like "Facts-Possibilities," linking the MBTI measure to sensitivity might

never have occurred. Is there a true relationship among these diverse constructs, or is the similarity of terminology driving theorists to draw connections that do not exist? Our goal in this paper is to investigate two such questions:

1) Does MBTI Sensing = greater sensory acuity? Despite frequent claims of such a relationship, there is very little research that has tested the relationship of MBTI Sensing to sensory acuity. There is a 39-year old master's thesis (Boyce, 1976) that compared the perceptual discrimination accuracy (the ability to distinguish two close pressure points on the skin as separate rather than singular, and the ability to sort handheld weights into a light-to-heavy order) of SJs, SPs, NJs, and NPs. She reported some evidence that Sensing types and SPs in particular were better at discriminating 5 gram differences in weights, but tactile sensitivity as measured by a Van Frey Aesthesiometer did not differ for S and N (instead, Ps proved more discriminating than Js).

   An even older study (Corlis, Splaver, Wisecup, & Fischer, 1967) found that MBTI Intuitives were *more* sensitive to tasting quinine than MBTI Sensing types, the exact opposite of a Sensing-senses-better relationship.

   These studies provide a mixed picture about some of the claims made about Sensing. There is even less research testing claims made about the two different attitudes of MBTI Sensing. Thompson (1996), for example, makes "a heightened sensitivity of the senses" (p. 52) the province of the extraverted Sensing type in particular. When Sensing takes an introverted expression, such heightened sensitivity is directed towards a greater awareness of "our kinesthetic and proprioceptive bodily sensations" (Loomis, 1991, p. 80).

2) Does MBTI Sensing = greater sensitivity of the sort studied by Elaine Aron? This question presumes that such sensitivity can be distinguished from sensory acuity as discussed above. Aron's definition of sensitivity incorporates a lower sensory threshold (more mechanical than emotional), but her definition also incorporates a heightened reactivity (more emotional) component. Some research (Smolewska, McCabe, & Woody, 2006) has identified three subfactors of Aron's Highly Sensitive Person (HSP) scale, two of which (Low Sensory Threshold and Ease of Excitation) correspond to this very distinction. (The third is a heightened Aesthetic Sensitivity.)

   Thus, Aron's scale and the Smolewska subscales offer the potential to distinguish these relationships and the depth of the relationship of Sensing (if any) to sensitivity. Evidence collected to date appears to again offer little support for an association of sensitivity with MBTI Sensing; instead, there is more of a relationship with MBTI Intuition. For example, in one study 31 of 35 people who self-identified as highly sensitive, tested as Intuitives on the MBTI assessment (Aron & Aron, 1997). Even more consistent is the association of HSP with MBTI Introversion has been (across many studies and measures, the median correlation was .29). Aron (2011) has since claimed that 70% of HSPs (Highly Sensitive Persons) are Introverts and 30% are

Extraverts. The sensitive Extravert may develop when "being around people is not so arousing, and sometimes even soothing" (Aron, 2011, p. 1), possibly a result of a person being raised in safe, secure social environments.

Research Goals and Questions

GIVEN THE GAP between type theorists' provocative claims and the empirical record, the present research was undertaken to further explore the relationships of MBTI Sensing and Intuition (and sometimes other preference pairs as well) to perceptual acuity of external stimuli, sensitivity to internal somatic states (often called interoception), scores on Aron's HSP measure, and scores on two alternative measures of intuition developed by researchers outside the type community.

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Intuition.

1) *The relationship of different measures of intuition*. We administered three measures of intuition:

   a. The MBTI assessment, Form M (Myers et al., 1998). There are 26 items that force a choice between two responses, one associated with Intuition and one associated with Sensing.

   b. The Rational-Experiential Inventory, modified version m (REI-m for short; Norris & Epstein, 2011). This is a 42-item (Likert-type responses) inventory that measures Rational cognition and three facets of Experiential cognition, Emotionality, Imagination, and Intuition.

   c. The Types of Intuition Scale, or TIntS (Pretz, Brookings, Carlson, Humbert, Roy, Jones, & Memmert, 2014), which assesses three varieties of intuition: Affective, Inferential, and Holistic-Abstract, with Holistic-Big Picture a possible fourth. The latter subscale was not as clearly emergent as the other three from Pretz et al.'s research.

2) *The relationship of different measures of intuition to a measure of word association*, the Dyads of Triads test (Bowers, Regehr, Balthazard, & Parker 1990), which is often cited as a test of intuition. The DOT assessment is described in the section entitled *Subjects, Method, and Instruments* presented later in this paper.

Sensing.

1) *The relationship of MBTI Sensing to the Highly Sensitive Person scale* (Aron & Aron, 1997) and its subscales (Smolewska et al., 2006). We administered both the MBTI and HSP instruments to a pool of subjects. The HSP scale is described in more detail later in the *Subjects, Method, and Instrument* section of this paper.

2) *The relationship of MBTI Sensing to an independent paper-and-pencil measure* of *interoception* (perception of internal

body states), the 32-item Multidimensional Assessment of Interoceptive Awareness, or MAIA (Mehling, Price, Daubenmier, Acree, Bartmess, & Stewart, 2012).

3) *The relationship of MBTI Sensing to thresholds of visual perception.* The task required identification of a different colored letter in a rapid stream of visually presented (RSVP) letters. We provided an online test that flashed a rapid sequence of alphabet letters, one at a time and asked subjects to identify the one letter which was colored red.

4) The relationship of MBTI Sensing to visual hue discrimination.

5) *The relationship of MBTI Sensing to auditory pitch discrimination*.

6) *The relationship of MBTI Sensing to visual memory.* Many type theorists assert that Sensing preference types have superior visual memory. (This skill is especially attributed to Introverted Sensing—see Haas & Hunziker, 2006; Hartzler, McAlpine, & Haas, 2005; Thompson, 1996; also, in a survey, type experts specifically and uniquely associated the description "photographic memory" with Introverted Sensing; McPeek & Martin, 2012a. It is difficult to reconcile the idea of Si eidetic memory with Jung's description of this type's "reality-alienating subjectivity.") The test we used was the well-known Corsi block tapping test (Corsi, 1972). This is a simple test of visual memory, recall of the order in which different blocks shown on the screen illuminate. The number of steps in the sequence increases until the test subject makes a recall error.

We were interested not only in the degree to which independent ratings might deviate from a pattern of opposition, but also whether some preference pairs (Sensing–Intuition in particular) might exhibit less opposition than others when rated independently.

Sensing-Intuition in combination.

1) *Stroop test: informational conflict.* Type theory asserts that a person with a Sensing preference attends to raw sensory data, whereas a person who prefers Intuition is more attentive to symbolism and hidden meaning. To explore these ideas, we used two variations of the Stroop test (e.g., Stroop, 1935). The Stroop is a well-established paradigm for studying the effects of cognitive interference. More details are presented in the *Subjects, Method, and Instrument* section.

2) *The opposition of MBTI Sensing and Intuition*. Jungian theory and the MBTI instrument are rooted in the construct of opposition. Jung clearly states that "sensation and intuition represent a pair of opposites, or two mutually compensating functions" (Jung 1923/1971, p. 463). MBTI items are constructed with this underlying opposition/dichotomy in mind, requiring a forced-choice selection of two alternatives, each representing one pole. Some studies (e.g., Loomis & Singer, 1980) have found that removing this forced-choice construction produces more independent scores for opposing preferences, e.g., a person can score high on both Sensing and Intuition.

To test this opposition, we provided descriptions of each of the eight type preferences to our subjects in two different formats. One required four ratings of paired preferences on the same rating scales with each preference at opposite ends of the scale, such that only one preference could be rated as more self-descriptive. The second

format required independent ratings of similarity to self for each of the eight type preferences independently. We were interested not only in the degree to which independent ratings might deviate from a pattern of opposition (operationalized by a lack or reduction of negative correlations of ratings), but also whether some preference pairs (Sensing–Intuition in particular) might exhibit less opposition than others when rated independently. Note that other type theorists have previously singled out SN as particularly problematic: "the intuitive function and the feeling function may be harder to measure (than their MBTI counterparts) with a dichotomous instrument" (Cowan, 1989)

Subjects, Methods, and Instruments

SUBJECTS WERE RECRUITED from attendees to ongoing and previous MBTI certification courses offered by the Center for Applications of Psychological Type (CAPT), located in Gainesville, Florida. Pilot testing was conducted onsite among volunteer attendees over their 4-day training. Subjects were not paid, but were offered a free lunch on the last day of training as compensation for their efforts. There were 30 subjects who participated from five different course offerings, from June through November 2014. Their participation consisted of completed exercises using time outside of the training sessions.

Per Epstein, rational cognition is logical, operates consciously using reason rather than emotion, and thus demands effort. The experiential form of cognition is less demanding of cognitive resources and operates unconsciously, automatically, and holistically.

Note that these subjects did not complete as many assessments as did the group recruited via a subsequent e-mail solicitation, which formed the bulk of our subject pool. The e-mail was sent to past CAPT certification course attendees over the previous three years. There were three e-mail recruiting efforts, one in December 2014 and the others in early 2015. Volunteer participants earned up to $30 for completing some or all of the assessments involved in the research. Two hundred forty-five subjects volunteered, a healthy 10.7% response rate (2,292 emails were sent).

Questionnaires. The following questionnaires were completed. Other than the MBTI assessment, which was completed by all participants as part of their certification course work, only the e-mail subjects filled in the other measures. Results were written to a database for scoring by CAPT. All participants agreed to allow CAPT to access MBTI results from existing data.

MBTI Form Q (Quenk, Hammer, & Majors, 2001). Form Q, otherwise known as MBTI Step II, is a 144-item forced-choice response questionnaire. The Step II instrument provides not only the standard 4-letter type results (including preference clarity scores) as MBTI Form M, but also results for twenty facets (five in each of the four type domains).

Rational-Experiential Inventory, expanded form (REI-m) (Norris & Epstein, 2011). This is a more recent 42-item version of the standard REI assessment (Epstein, 2013) developed

as part of Cognitive-Experiential Self Theory (Epstein, 2013). The REI-m provides four scores: Rational, Emotional, Imagination, and Intuition. The latter three represent more recent theoretical developments which breaks Experiential cognition into three components measured by the scale. Per Epstein, rational cognition is logical, operates consciously using reason rather than emotion, and thus demands effort. The experiential form of cognition is less demanding of cognitive resources and operates unconsciously, automatically, and holistically. Epstein considers intuition a "subset" of experiential processing "by procedures that occur outside of awareness" (Epstein, 2013, p. 111).

Types of Intuition Scales (TIntS; Pretz, Brookings, Carlson, Humbert, Roy, Jones, & Memmert, 2014). Pretz and her colleagues have been researching intuition for at least a decade, leading them to conclude that intuition has multiple facets, reflected in the development of the TIntS. (Note that "types" of intuition does not have the same meaning as in "psychological types.") The four types of intuition these researchers identify, and which they attempt to measure with the TIntS, are:

1) Holistic Intuition, the integration of diverse source of information (Pretz et al., 2014), seems closest to MBTI Intuition. The researchers identify two forms of Holistic Intuition, one called Holistic-Abstract and the other Holistic-Big Picture. The former proved to be more reliably measurable, as the authors consider the Big Picture scale provisional pending further research.

2) Inferential Intuition, an experiential-based cognitive mode that emerges when experience in a subject area is sufficient to facilitate automatic decision making and evaluation. In essence, cognition that once required analysis and reason becomes automatic and less effortful with the accumulation of practice.

3) Affective Intuition, by which intuitive feelings or emotions rather than analysis and logic serve as the basis for making decisions or dealing with problems.

Multidimensional Assessment of Interoceptive Awareness, or MAIA (Mehling, Price, Daubenmier, Acree, Bartmess, & Stewart, 2012). This 32-item scale is the culmination of research examining a variety of scales intended to measure interoception, or awareness of and sensitivity to events occurring inside one's body. The MAIA breaks down into eight subscales:

1) Noticing, the awareness of uncomfortable, comfortable, and neutral body sensations.

2) Not-Distracting, the tendency not to ignore or distract oneself from sensations of pain or discomfort.

3) Not-Worrying, the tendency not to worry or experience emotional distress with sensations of pain or discomfort.

4) Attention Regulation: Ability to sustain and control attention to body sensations.

5) Emotional Awareness: Awareness of the connection between body sensations and emotional states.

6) Self-Regulation: Ability to regulate distress by attention to body sensations.

7) Body Listening: Active listening to the body for insight.

8) Trusting: Experience of one's body

as safe and trustworthy.

Highly Sensitive Person Scale. This is a 27-item assessment designed to measure an individual's reactivity to stimuli (Aron & Aron, 1997). Some follow up research (Smolewska et al., 2006) has suggested that 25 of the 27 items fit a 3-factor model:

1) Ease of Excitation (EOE), consisting of 12 items.

2) Aesthetic Sensitivity (AS), consisting of 7 items.

3) Low Sensory Threshold (LST), consisting of 6 items.

These are often construed as "facets" of high sensitivity that are positively intercorrelated and "consistent with a general, higher order construct" (Smolewska et al., 2006, p. 1276).

Independent Type Preference Rating Scale. This unpublished scale was developed internally at CAPT by Charles Martin, Ph.D. It consists of two parts:

1) Detailed descriptions of the four bipolar domains of type theory (Extraversion–Introversion, Sensing–Intuition, Thinking–Feeling, and Judging–Perceiving). Subjects rate themselves on four 9-point scales with the endpoints representing the purest expressions of each pole. Scoring is done using the convention of higher scores representing a clearer preference for Introversion, Intuition, Feeling, or Perceiving, and lower scores representing the four opposite poles. A rating of 5 would indicate a self-rating of equivalence of tendencies towards the two poles.

2) The same descriptions in eight separate presentations, asking for self-ratings for each preference independently. This format allows individuals to endorse the characteristics of presumably opposite preferences separately.

Online tests. In addition to the questionnaires, subjects completed six online exercises. Four of these were tests designed using the Inquisit platform (www.millisecond.com):

1) The Corsi block tapping test (Corsi, 1972). This test measures a person's ability to remember a visual sequence displayed on a computer monitor. The screen shows a pattern of square block shapes that light up in an order, starting with two blocks that illuminate and increasing in length by one block at a time. The subject is asked to click on the blocks in the order in which they were illuminated. This continues until the subject is no longer able to reproduce the sequence by clicking on the blocks in the correct order.

There are two trials for each number of blocks. This produces three summary statistics: the number of correct sequences reproduced, the "span" or the number of blocks in the longest sequence recalled, and the product of these two numbers, the total score. Thus, if someone correctly reproduced all sequences involving 2, 3, 4, 5, and 6 blocks, got one of the two trials for a 7-block sequence correct, but could not reproduce either 8-block sequence, the number of correct sequences would be 11 (5 x 2 plus 1), the span would be 7, and the total score would be 77.

2) A variation of the Dyads of Triads (DOT) test (Bowers, Regehr, Balthazard, & Parker 1990). This exercise presents a series of two sets of three words. Only one set has a common association or

"solution" (e.g., the solution for steam, ice, and clear is water); the second set is composed of three words that have no common association. The task is to identify which of the two sets can be solved (and, in the original and follow up studies, to provide the actual solution). Bowers et al. found that even when an actual solution proved elusive, their test subjects were able to pick which of the two sets of words could be solved at a greater than chance level, presumably by intuition.

We introduced some modifications to the scoring of the DOT, based on extensive pretesting, in an effort to measure a person's sense ("intuition") of which dyad could be solved even if they were unable to solve it. There were 25 trials and 5 possible responses for each. The object was to pick which of two sets of three words has a common association to a fourth word. Subjects were given 20 seconds to choose one of five possible answers: (1) "I know it's Set A," (2) "I have a feeling it's Set A," (3) "I have a feeling it's Set B," (4) "I know it's Set B," or (5)"I don't know." Pilot testing established 20 seconds as an appropriate length of time. Each trial was scored as +2 points for a correct "I know" choice (i.e., if Set A had a solution, choice #1 was scored as +2; for Set B, choice #4 was scored as +2), +1 point for a correct "I have a feeling" choice, 0 for "I don't know" or no response (due to 20 seconds expiring), -1 for an incorrect "I have a feeling" choice, and -2 for an incorrect "I know" response. Points were totaled over the 25 trials. I also counted the number of correct "I know" and "I feel" choices separately and summed, and the number of incorrect "I know" and "I feel" choices, separately and summed.

We speculated that choosing the actual font color (and ignoring the word) would be easier for the less-verbal, more raw sense orientation of someone with a Sensing preference, and that choosing the word and ignoring the actual font color would be easier for the symbolism, verbally oriented person with a preference for Intuition.

3) Two variations of the venerable Stroop test (Stroop, 1935). The test visually presents a series of words that label colors (e.g., the words red, green, black, and blue) which may appear in a font that is either the same color (e.g., blue) or in an inconsistent color (e.g., blue). When asked to identify the word, subjects take longer to respond when the label and the font are not the same. Our two variations involved the criterion used to choose the "correct" color when word and font color differed. We speculated that choosing the actual font color (and ignoring the word) would be easier for the less-verbal, more raw sense orientation of someone with a Sensing preference, and that choosing the word and ignoring the actual font color would be easier for the symbolism, verbally oriented person with a preference for Intuition.

   There were two Stroop measures: the percentage of times in all trials that a correct choice was made and the mean latency (reaction times, in milliseconds) of each response. We used percent correct rather than absolute number correct because some of the early Stroop trials used a different number of trials than later subjects were given.

4) Rapid stream of visually presented letters test. This was a visual perceptual threshold test, programmed by CAPT staff, a modified version of the Attentional Blink test (Raymond, Shapiro, & Arnell, 1992) offered with the

Inquisit program (Millisecond Software, www.millisecond.com). This exercise required identification of the single red letter in a rapid stream of visually presented (RSVP) letters, all but one of which were black. The position of the red letter occurred at either the fifth or tenth position in a stream of 32 letters.

We also used two measures of Stroop results: the number of correct identifications of the red letter (out of 32 trials) and the mean latency of responses.

For the above four exercises, data were automatically written to a database as the exercises were completed. The two remaining online tests, one testing hue discrimination and one pitch discrimination, utilized existing websites:

5) The visual perception test (Farnsworth-Munsell 100 Hue Test; see http://en.wikipedia.org/wiki/Farnsworth-Munsell_100_hue_test) involved arranging four rows of color tiles of varying Pantone hues. The end points of the rows represented two different colors, with the intervening color tiles different blends of the two end tile hues. The task was to arrange the intervening tiles in a gradated sequence from one endpoint color to the other. The scoring was done automatically at the website, with lower scores indicative of better performance. Scores ranges from 0 to 1052. (http://www.xrite.com/online-color-test-challenge).

6) The auditory perception test (www.musicianbrain.com) involved listening to two tones in sequence, and correctly identifying whether the second pitch, often only slightly different from the first, was higher or lower in frequency. Scoring was performed automatically at the website and consisted of two numbers: the number of Hertz (cycles per second) that could be reliably distinguished in pitch, and the percentile of the result among other testees of similar age.

Results for these tests were delivered to the subjects by the original test sites. CAPT provided detailed instructions and a user-friendly interface that allowed the results to be forwarded to CAPT.

Results

NOTES ON DATA ANALYSES. This paper reports a wide range of results, though not all of the analyses done, using Pearson correlations primarily, but also t-tests and analyses of variance when appropriate.
The t-tests typically compared one preference opposite (e.g., Sensing, or S) to another (e.g., intuition, or N), using verified rather than indicated types. Repeating the analyses using indicated type preferences did not materially change any patterns.

Although we were very interested in comparing dominant introverted or extraverted Sensing types to each other, to their Intuition counterparts,

or to all other types, such analyses are difficult to interpret clearly. The first problem with this approach stems from the confounding of different function-attitude combinations with other preferences that is built into the framework of type theory (for more detailed explanation, see McPeek & Martin, 2012b). For example, a group of dominant introverted Sensing types is comprised exclusively of Introverts. Thus, results for this group might be due to the influence of Introversion, Sensing, Introverted Sensing, or any combination of the above.

A second limitation was the small number of dominant extraverted Sensing types, represented by only four people in the entire sample in the best case scenario, and often fewer (when some measures had missing data). These tests generally yielded nonsignificant results, though such tests are inconclusive due to their low power and confounding of preference types with function-attitudes.

For these reasons, most of these function-attitude combination analyses are not reported.

Type table. We collected both indicated and verified type data for 208 subjects. Of these, 37 (17.8%) verified a type different than indicated, 32 who verified one different letter, four who verified two different letters, and one who verified three. The verified type distribution is shown in the table to the left.

Verified Type Distribution

ISTJ n = 19 (6.9%)	ISFJ n = 11 (4.0%)	INFJ n = 22 (7.9%)	INTJ n = 16 (5.8%)
ISTP n = 4 (1.4%)	ISFP n = 2 (0.7%)	INFP n = 22 (7.9%)	INTP n = 12 (4.3%)
ESTP n = 1 (0.4%)	ESFP n = 3 (1.1%)	ENFP n = 35 (12.6%)	ENTP n = 5 (1.8%)
ESTJ n = 12 (4.3%)	ESFJ n = 14 (5.1%)	ENFJ n = 21 (7.6%)	ENTJ n = 9 (3.2%)

The type distribution of our subjects differed in one clear way from the US national representative type table (Myers et al., 1998), with a frequency of preference for Intuition over Sensing more than two and a half times as likely in our group, a highly significant difference. We have observed similar clear high incidence of Ns in other studies of MBTI trainees, so this was not surprising.

Paper assessment reliabilities. We did not have access to the MBTI item data, so it was not possible to calculate internal consistency (alpha reliabilities) for any of the individual MBTI domain or facet scales. These reliabilities, however, have long been well-established as robust (see Myers et al., 1998; Quenk, Hammer, & Majors, 2001).

We did collect item data for the TIntS, REI-m, HSP, and MAIA scales, which allowed us to calculate coefficient alpha reliability (internal consistency) scores for each scale and subscale. All of the results indicated high reliability.

The TIntS alphas were .870 for Affective (N = 220, 8 items), .676 for Inferential (N = 221, 8 items), .881 for Holistic-Abstract (N = 221, 3 items), and .884 for Holistic-Big Picture (N = 221, 4 items). Notably, the Big Picture scale results indicated more reliability than Pretz et al. (2014) found.

The REI-m alphas were .893 for the 12 items of the Rationality scale (N = 228), .762 for Emotionality (N = 228, 10 items), .773 for Imagination (N = 227, 10 items), and .789 for Intuition (N = 229, 10 items).

Overall alpha for all 27 HSP items was .898 (N = 221). The Ease of Excitation subscale alpha was .816 (12 items, N = 221); for Aesthetic Sensitivity .716 (7 items, N = 221); and for Low Sensory Threshold .802 (6 items, N = 221).

MAIA alphas for six subscales were .84 or higher (Ns ranged from 223 to 227). The two remaining scales, Not-Distracting (alpha = .725) and Not-Worrying (alpha = .762), showed sufficient reliability even though each has only three items (alpha is positively affected by high item counts). The alpha reliability for all 32 MAIA items was .928 (N = 223).

Correlations of intuition measures. Note first that we used modified preference clarity index (pci) continuous scores for all MBTI results. These scores can range from 1 to 30 for each preference in each of the four pairs of MBTI letter results. In order to distinguish one letter result from its opposite, we converted all pci scores for Extraversion, Sensing, Thinking, and Judging preferences to negative values. Thus, for example, a pci score of 27 for a Sensing preference became -27, whereas an Intuition preference score of 13 remained 13. Scores converted this way are mathematically equivalent to the theta scores as described in Myers et al. (1998; see p. 146).

In regards to the MBTI domains, both SN and TF (primarily the latter) correlate with affective intuition, but SN is more strongly correlated to holistic (which is unrelated to TF).

As expected, MBTI Intuition correlated very highly with TIntS Abstract and Big Picture scales (.77 and .72 respectively, N = 174, p < .001 in both cases), consistent with the definition of MBTI Intuition, which emphasizes both of those conceptualizations. MBTI Intuition also correlated significantly with the other two "types" of intuition, TIntS Affective (r = .34, N = 174, p < .001) and Inferential (r = .32, N = 174, p < .001), though at a significantly lower level.

MBTI Feeling correlated highly with the TIntS Affective scale (r = .74, N = 174, p < .001), moderately with TIntS Holistic-Abstract (r = .16, N = 174, p = .03), and nonsignificantly with TIntS Big Picture (r = .11) and Inferential (r = .01).

For the Rational-Experiential Inventory, MBTI Intuition correlated more strongly with REI Imagination and Intuition (r = .42 and .53, respectively; N = 178, p < .001 for both) than with REI Emotionality (r = .21, N = 178, p = .005) or Rationality (r = –.16, N = 177, p = .04). The REI Intuition scale correlated more highly with MBTI Feeling (r = .56, N = 178, p < .001) than with MBTI Intuition, however. Rationality and Emotionality correlated with opposing poles of the MBTI TF scale (Rationality with Thinking, r = .60, N = 177, p < .001) and Emotionality with Feeling, r = .48, N = 178, p < .001).

These results are similar to past results from Pretz (e.g., Pretz & Totz, 2007; Pretz, 2011; Pretz et al., 2014) and consistent with her construction (and that of others such as Epstein) that intuition involves an affective component, which is more strongly reflected in the Feeling side of the TF preference than in the SN scale. Thus, intuition as defined by TIntS and REI-m is related to both MBTI SN and TF, but only in its affective components for TF. SN is also related to Affective intuition, but much more strongly to Abstract and Big Picture forms of intuition.

Thus, the holistic and affective aspects of intuition are most convergent (correlate with each other

the highest), with TIntS inferential still related but less strongly. It may be that, among the types of intuition, affective and holistic are more cohesive and identifiable. In regards to the MBTI domains, both SN and TF (primarily the latter) correlate with affective intuition, but SN is more strongly correlated to holistic (which is unrelated to TF).

Intuition and Dyads of Triads. Note that scores for 11 subjects were discarded on this measure for one of two reasons: an indication made by the subject in an optional comment field that they either did not understand the instructions or that they were not native English speakers, a potential detriment in making word associations.

Our primary hypothesis was that MBTI Ns would score higher than Ss, i.e., be better at picking (or solving) the correct set of words. The N mean total score (11.38) was in fact higher than the S mean (9.45), but nonsignificantly so ($p = .26$). Two differences were marginally significant. N scores were higher than S scores for number of correct "I know" choices ($M = 5.53$ and 4.28 respectively, $t(135) = 1.69$, $p = .09$) and for the total number of "I know" choices (both correct and incorrect, suggestive of a greater willingness to claim a solution; $M = 6.86$ and 5.23 respectively, $t(135) = 1.66$, $p = .10$). S preferences were more likely to choose "I don't know" or not respond at all compared to N preferences, but this difference was also not significant ($p = .17$).

Finally, the correlation of Sensing with Low Sensory Threshold was close to zero, clear evidence suggesting that Sensing and sensory sensitivity are independent constructs.

Other measures (TIntS, REI-m) of intuition failed to show any relationship to DOT performance as well. REI Rationality scores did correlate with total DOT scores, $r = .16$, $N = 152$, $p = .054$).

In sum, we found no confirmation that any measure of intuition predicted DOT performance.

MBTI Sensing and Highly Sensitive Persons. The correlation of Sensing with overall HSP scale scores was nonsignificant ($r = .10$, $N = 174$, $p = .21$). Consistent with Aron's interpretation that Jung distinguished sensitivity from sensation and instead associated it with introversion, HSP scores did correlate significantly with MBTI Introversion ($r = .18$, $N = 174$, $p = .015$).

The subscales of the HSP, however, revealed an interesting pattern. MBTI Sensing correlated marginally significantly with Ease of Excitation ($r = .15$, $N = 174$, $p = .056$), but MBTI Intuition correlated significantly with Aesthetic Sensitivity ($r = .24$, $N = 175$, $p = .001$). Finally, the correlation of Sensing with Low Sensory Threshold was close to zero, clear evidence suggesting that Sensing and sensory sensitivity are independent constructs.

MBTI Introversion correlated significantly with all three HSP subscales, most strongly with Ease of Excitation ($r = .35$, $N = 174$, $p < .001$), moderately with Low Sensory Threshold ($r = .26$, $N = 174$, $p < .001$), and least with Aesthetic Sensitivity ($r = .16$, $N = 175$, $p = .039$).

MBTI Feeling correlated significantly with Aesthetic Sensitivity ($r = .28$, $N = 175$, $p < .001$) and Low Sensory Threshold ($r = .15$, $N = 174$, $p = .047$). MBTI Judging correlated with Ease of Excitation ($r = .21$, $N = 174$, $p = .006$) and MBTI Perceiving with Aesthetic Sensitivity ($r = .15$, $N = 175$, $p = .049$).

T-tests comparing MBTI preference opposites produced results very similar to the Pearson correlations, as would be expected. We also used t-tests to compare dominant introverted Sensing (dom Si), comprised of ISTJ and ISFJ types, to all other types. The Si means were higher on both overall HSP scores (dom Si mean 5.27 versus 3.76 for non-dominant Si subjects, p = .005) and EOE subscale scores (dom Si mean 4.35 versus 3.69, p = .001).

This EOE mean for dominant introverted Sensing types was marginally significantly higher than the mean for the four subjects with a verified dominant extraverted Sensing preference (mean = 3.25, p = .065). This is a good illustration of the difficulty of interpreting such a result. Dom Si types (ISTJ and ISFJ) are all Introverts and Judging preference types, whereas dominant Se types (ESTP and ESFP) are Extravert/Perceiving types. Given the stronger relationship of HSP and EOE with MBTI Introversion than MBTI Sensing, this difference is more parsimoniously attributed to the former MBTI preference.

Thus, not only did MBTI Sensing show either no relationship or a negative relationship to MAIA measures of interoception, but dominant introverted Sensing did not differ, or scored lower, than dominant extraverted Sensing.

Multidimensional Assessment of Interoceptive Awareness (MAIA) and psychological type. All of the correlations of the MBTI SN continuous scores with MAIA subscales (except Not Distracting) were positive; in other words, in the direction of MBTI Intuition. Only two correlations, however, were significant, both in the direction of a positive relationship with MBTI Intuition (Self-Regulation, r = .20, N = 174, p = .008 and Body Listening, r = .16, N = 175, p = .036). The mean on Self-Regulation was also significantly higher for Ns than Ss (p = .039).

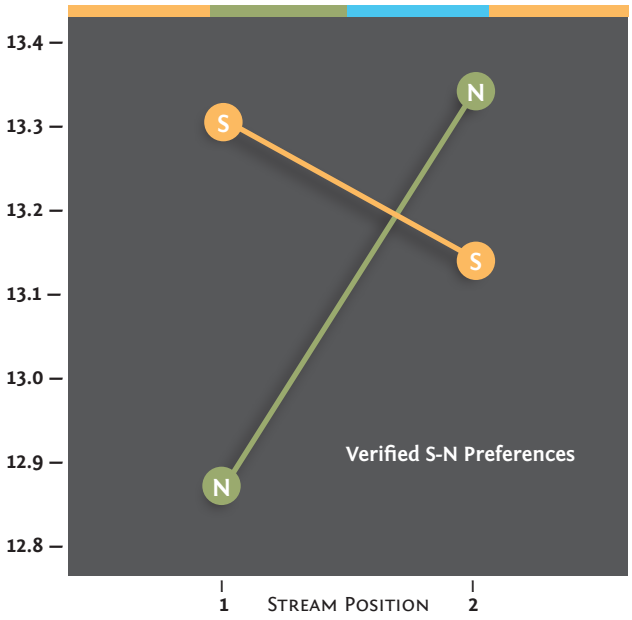
We also compared the means for our four dominant extraverted Sensing participants (i.e., those who preferred E, S, and P) to 23 dominant introverted Sensing (ISJs) subjects. Only one subscale comparison was significant (p = .029), with a higher mean for ESPs (3.86) than for ISJs (2.77) on the Attention Regulation scale. This scale is defined as the ability to sustain and control attention to body sensations, and the finding that dominant extraverted Sensing scores were higher directly contradicts predictions. Thus, not only did MBTI Sensing show either no relationship or a negative relationship to MAIA measures of interoception, but dominant introverted Sensing did not differ, or scored lower, than dominant extraverted Sensing.

Instead, MBTI Feeling was most strongly associated with MAIA scores, with six of eight correlations significant at alpha = .05 or more. The strongest correlation was with MBTI Feeling and Emotional Awareness (r = .27, N = 174, p < .001).

MBTI Introversion was negatively correlated with MAIA Trust in one's body (r = -.185, N = 175, p = .014). None of the other seven MAIA subscales correlated significantly with MBTI EI continuous scores, though all were negative, suggestive of less interoception for Introverts.

One MAIA subscale, Not Distracting, approached significance with MBTI Judging (r = .14, N = 176, p = .064), and subjects who verified a J preference in fact had significantly higher scores on this scale than verified Ps (t = 2.02, df = 174, p = .045).

Visual Sensory Threshold (Rapid Stream of Visual Presentation test). T-tests comparing the performance (number correct and speed of responding) of verified Sensing and Intuition preferences showed no significant differences on the RSVP task (all p's > .12). There were no significant differences when comparing other type pairs either.



Mean number of correct red letters identified as a function of position of red letter in the stream.

There was an interesting SN phenomenon, however, involving an interaction of SN with stream position, (F (1, 170) = 4.59, p = .034) as shown in the figure above.

The SN x stream position interaction is also significant for latency, (F (1, 170) = 4.59, p = .034). S subjects are more accurate and faster than N subjects at the first stream position (5th letter presented), but the effect is reversed for the second stream position. These are moderately strong effects (partial eta squared = .026 for correct and .028 for latency). Perhaps this suggests that Ss are more sensitive to visual stimuli but their greater vigilance erodes with time. That's a challenging argument to make, however, given the very short time gap (less than half a second) between the 5th and 10th stream positions.

Visual memory (Corsi Block tapping test). There were no significant differences on any of the three Corsi measures between verified MBTI S and N subjects, as shown in the table below.

The TF domain, however, did show significant differences, with Ts outperforming Fs on all three measures.

Js outperformed Ps on the number of correct sequences recalled (M= 9.10 for Js and 8.60 for Ps, t = 2.08, df = 175, p = .039). The span difference also favored Js, though not significantly (p = .13), and the total score approached significance for Js over Ps (p = .06).

There were no significant EI differences.

Sensing and Intuition Results for Corsi Block Tapping Test

	S–N pref	N	Mean	Std. Deviation	T-test value	df	p
Corsi Block Number of correct sequences recalled	S N	57 120	9.05 8.81	1.68 1.54	0.96	175	0.34
Corsi Block span	S N	57 120	6.04 5.96	1 0.98	0.48	175	0.63
Corsi Block total score	S N	57 120	56.23 53.78	19.72 17.87	0.83	175	0.41

Thinking and Feeling Results for Corsi Block Tapping Test

	S–N pref	N	Mean	Std. Deviation	T-test value	df	p
Corsi Block Number of correct sequences recalled	T F	67 110	9.27 8.65	1.66 1.51	2.53	175	0.01
Corsi Block span	T F	67 110	6.19 5.85	0.96 0.99	2.25	175	0.03
Corsi Block total score	T F	67 110	58.85 51.95	19.13 17.62	2.44	175	0.16

Hue and pitch discrimination. Simple t-tests comparing preference opposites yielded no significant differences for any of the four type domains (all $p > .11$; for SN, $p > .20$). SN results were not changed when age (with its possible deleterious effects on vision and hearing) was used as a covariate.

Stroop tests. We began with simple t-test comparisons of Stroop results (on incongruent trials, when information was contradictory) for the four sets of preference opposites. The only SN finding was a marginally significant faster response time ($p = .064$) for Ss ($M = 1639.82$ milliseconds) compared to Ns ($M = 1817.04$ milliseconds) in the name-the-color incongruent trials. Neither the word—incongruent nor either of the congruent combinations (word or color) produced significant SN differences.

There were no significant EI differences on any of the eight measures (# correct and latency for word congruent, word incongruent, color congruent, or color incongruent). F subjects got more correct answers on both the color-congruent ($p = .03$) and color-incongruent ($p = .064$) blocks as well as the word-incongruent trials ($p =$

Correlations of Preferences in Unified and Independent Self-rating Scales

Overall domain scores or scale ratings	Left pole (E,S,T,J) independent ratings	Right pole (I,N,F,P) independent ratings		Independent pole (E with I, S with N, etc.) ratings correlations
EI pci correlates with...	E r = -.80, N = 172	I r = .82, N = 172		r = -.79, N = 216
SN pci correlates with...	S r = -.66, N = 172	N r = .75, N = 172		r = -.71, N = 217
TF pci correlates with...	T r = -.66, N = 172	F r = .71, N = 172		r = -.66, N = 217
JP pci correlates with...	J r = -.78, N = 172	P r = .85, N = 172		r = .-78, N = 216
				Pci-domain ratings correlations
EI rating correlates with...	E r = -.85, N = 217	I r = .87, N = 216		.87, N = 173
SN rating correlates with...	S r = -.74, N = 217	N r = .85, N = 217		.76, N = 173
TF rating correlates with...	T r = -.80, N = 216	F r = .83, N = 216		.75, N = 173
JP rating correlates with...	J r = -.83, N = 217	P r = .90, N = 216		.84, N = 173

.043). Ts, however, responded faster, marginally for color-incongruent response times (p = .09), but significantly for word-congruent (p = .022) and word-incongruent (p = .03) trials. Js consistently responded significantly more quickly than Ps on three of four latency measures: color-congruent (p = .024), color-incongruent (p = .02), and word-incongruent (p = .012) blocks.

Expanding to various mixed model ANOVAs (preference opposites x congruent-incongruent and preference opposite x Stroop variety repeated measures plus the Stroop x congruence x preference three way analysis) showed no interaction or main effect involving SN. (We predicted an interaction in which Ns performed better in the word task and Ss better in the color task.) Results did indicate better performance for the Stroop task requiring correct naming of the word than correct naming of the color. Additionally, as would be expected, performance was faster and better when the task involved congruent stimuli rather than incongruent. A significant TF x congruency interaction (p = .014) indicated that Ts were more adversely affected by incongruency than Fs were (significant for number correct but not latency). A significant JP x Stroop variety interaction (p = .023) indicated that Js did worse than Ps on the color-incongruent trials, but Ps did worse on the word-incongruent trials.

In short, incongruence impaired Stroop performance, especially when the job is to name the color in which the word is written. The word itself is thus a more salient influence than the font color. MBTI Sensing and Intuition, however, had little effect. Effects, in fact, were more linked to the TF preference.

Self-ratings of type descriptions, unified or independent scales. The type preference/domain questionnaire designed by Charles Martin included two major sections. The first presented four sets of two styles of behavior as opposite ends of a scale with a 9-point scale (from E to I, S to N, T to F, or J to P) for self-rating. The second presented the two previously opposite style descriptions as single dimensions, allowing individuals to rate themselves low or high on either, neither, or both, independently. The latter potentially allowed people to rate themselves as facile with behavioral styles/preferences that are otherwise predictable from knowing only half of a forced-choice equation.

The correlations of these measures with one another can indicate how independently a person can construe the two preferences in their self-image. If the single dimension/opposite pole model is most influential in self-perception (as captured by our self-ratings), the magnitudes of correlations of the single score with its two separated elements rated independently should be similar but opposite in sign. If one of the type domains contains two preferences that are less polar opposites than those of another domain, the two correlations (e.g., SN with S-independent versus SN with N-independent) should diverge more.

The table on page 18 (Correlations of Preferences in Unified and Independent Self-rating Scale) suggests that the polar opposite model fits the data very well. The high negative correlation (shown in the last column) of the E and I independent ratings, for example, is -.79. In other words, knowing one score is on average a good predictor of the other, and subjects in this study very rarely rated themselves as

either low or high on both opposing preference poles. Similarly, the overall domain result (pci score) and the overall scale ratings both correlate at similar magnitude with their two associated independent scales, but in opposite directions. Pci scores and overall domain ratings (right column, bottom four rows) correlate very well, about as much as test-retest correlations of the same assessment.

Conclusions

THE PATTERN OF RESULTS suggests that both Intuition and Sensing as measured by the MBTI assessment are best interpreted more narrowly than some of the verbal descriptions provided for understanding of what the MBTI instrument measures.

Intuition. The good news is that MBTI Intuition does show a robust relationship to other measures of intuition, notably in the high correlations of MBTI pci scores with TIntS Holistic-Abstract (.77) and Big Picture (.72) Intuition. These results are consistent with findings by Pretz et al. (2014) as well as with the focus of language in the items used to measure Intuition on the MBTI instrument. However, these alternative measures incorporate an affective component of intuition that is more closely correlated to the MBTI Thinking–Feeling scale. In short, other measures that have arisen outside of the MBTI community incorporate emotion into their definitions of intuition. This is consistent with lay parlance that associates intuition with having "feelings" about a person or a situation. These emotional components of intuition as measured by other scales are reflected in the MBTI TF scale. Thus, MBTI Intuition is a more specific kind of intuition that emphasizes the ability to conceptualize the world in abstractions.

The pattern of results suggests that both Intuition and Sensing as measured by the MBTI assessment are best interpreted more narrowly than some of the verbal descriptions provided for understanding of what the MBTI instrument measures.

A fruitful area of type research would involve studying the effects of Feeling and Intuition in situations where intuition takes a less abstract and more decision-making form, as in making judgments with limited information. In type theory of course, Intuition is deemed a perceiving function rather than a judging function such as Feeling. MBTI Feeling is also considered to be a rational function, whereas both Intuition and Sensing are irrational. Making a decision on the basis of intuitive affect, however, at least superficially has the earmarks of irrationality. Thus, there are contradictions strewn across such a path that will require clever research to resolve.

Regardless of the measure of intuition used in this study, we found no relationship to performance on the Dyads of Triads measure, though it has been related to intuition in past research (e.g., Bowers et al., 1990). Our DOT task may have presented too many obstacles to be a sensitive measure. Comments from subjects suggest that the salient quality of the DOT task was the difficulty of understanding and complying with the instructions rather than its word-game aspect. Past use of the DOT has employed computer-delivery of word triads, as we did, but unlike

our research, these studies were conducted in the laboratory with an administrator present to guide the process and answer questions. Because we automated the process entirely and administered it via an Internet connection, we created a situation with strong potential for misunderstanding. Our design team found creating an ideal online DOT very challenging, requiring constant modification during our pretesting. The DOT is better administered in face-to-face research.

Sensing. We found little if any support for any associations of MBTI Sensing with greater sensitivity to internal or external stimuli or better memory for visual stimuli. Self-report, paper-and-pencil assessment results on the Highly Sensitive Person scale or Multidimensional Assessment of Interoceptive Awareness scale or subscales bore few significant relationships to MBTI Sensing. On the HSP, there was a marginally significant correlation of Ease of Excitation with Sensing and a negative correlation (i.e., positive correlation with MBTI Intuition) with Aesthetic Sensitivity. But HSP was much more clearly related to MBTI Introversion, consistent with Aron's claims that Jung's early writings about highly sensitive individuals evolved into his conception of Introversion, not Sensing. HSP scores also correlated significantly with MBTI Feeling. Of particular note is the fact that Feeling and (to a greater extent) Introversion—but not Sensing—correlated with the Low Sensory Threshold scores from the HSP. The Introversion finding is consistent with an abundance of past evidence that Introverts are more sensitive to stimuli (e.g., Paine, Kishor, Worthen, Gregory, & Aziz, 2009; Paine, Worthen, Gregory, Thompson, & Aziz, 2009; Stelmack, Achorn, & Michaud, 1977). Thus, type theorists' speculations that Sensing is associated with more sensitive perceptual acuteness was unsupported by this research, though Introversion may well be.

HSP was much more clearly related to MBTI Introversion, consistent with Aron's claims that Jung's early writings about highly sensitive individuals evolved into his conception of Introversion, not Sensing.

MAIA scores also showed no evidence of greater self-reported interoception among Sensing types. In fact, if anything, the opposite was true. But, again, another MBTI domain, Thinking–Feeling, took precedence over SN. Feeling types scored significantly higher than Thinking types on six of the carefully vetted eight MAIA subscales. In any event, there is no evidence at all to tie enhanced interoception to Sensing. It's important to understand that the attribution of enhanced interoception of bodily events to Introverted Sensing is a concept that has emerged in MBTI and recent type literature, but is not an attribution that Jung made.

Sensing was associated with a superior ability to discriminate the one red letter embedded within a rapidly presented stream of black letters, but only when the letter occurred about 450 milliseconds (less than half a second) earlier than the other position. At the second, later position, Ns performed better than Ss. Given the short time difference in the two positions, this finding is difficult to interpret and at best weak evidence that persons with a preference for Sensing have more acute visual perception.

Mean scores on the Corsi Block tapping test, a measure of the ability to store and recall a visual memory, were in fact higher for Sensing preference subjects than

Intuitives, but the differences were far from significant. Once more, the action took place along another type dimension, this time with Thinking types outperforming Feeling types, and, to a lesser extent, Judging types outperforming Perceiving types. These results are consistent with the competitive focus of the Thinking preference and the conscientious desire to do well of the Judging preference. Perhaps the Corsi test, unlike the others, is a simple enough task to allow motivation to have more effect; in more complex or difficult tasks, motivation might be ineffective if not a handicap. Perhaps too, this task draws on the natural analytical predisposition of Thinking types and their tendency to have a linear orientation to time (Myers et al, 1998), qualities which may support attention to block sequences.

. . . there is little evidence that has emerged from this research to support the strong assertions in the literature on psychological type that Sensing types—at least broadly—have superior sense modalities or better visual memories. The state of the evidence strongly underscores the need for additional research to support assertions about Sensing beyond a simple preference for factual, straightforward information over more abstract, inferential cognition.

Results on the hue and pitch discrimination tasks produced no significant differences for any of the preference pair comparisons. Thus, our data showed no evidence of superior hearing or vision for Sensing types. We consider this mild evidence against the idea that the Sensing preference is associated with superior sense modalities. Our tentativeness reflects the fact that we relied on external websites to administer and score the tests, and for our test subjects to accurately relay the results to CAPT. The data did contain some obvious mistakes in data transcription (such as supplying the hearing test results for the vision test); nonobvious mistakes could have easily escaped detection. Another concern is that subjects scoring poorly might be embarrassed by their performance and report a higher score, or refrain from reporting such a score at all.

Since typology reflects a psychology of consciousness (and by corollary, what one attends to), we might not find physiological differences in threshold once Ss and Ns are instructed to give attention to the physical phenomenon. Thus, another possible explanation of our findings is that we chose tests that missed the essential functional quality of Sensing. For example, our focus on thresholds of perception tells us little about whether persons with a Sensing preference might remember more details about an environment, or whether they attend more to colors, sounds, and odors in a room than persons who prefer Intuition do. Type preferences may more define what rises into consciousness, is attended to, and remembered, in the midst of everyday life, a possibility we did not test. Future research should expand testing to address these other modes of perceptual acuteness—for example, by placing both Ss and Ns in a stimulus-rich environment and then asking them to recall details later.

In any event, there is little evidence that has emerged from this research to support the strong assertions in the literature on psychological type that Sensing types—at least broadly—have superior sense modalities or better visual memories. The state of the evidence strongly underscores the need for additional research to support assertions about Sensing beyond a simple preference for factual, straightforward information over more abstract, inferential cognition.

Sensing–Intuition combined. We created two varieties of the Stroop test to explore whether a preference

for Sensing or Intuition might affect what kind of information is attended to when symbolic (in this case, the word "red" naming the color red, for example) and physical (sensory) color information (the word "red" written in green letters) is incongruent. We found a marginally significant faster reaction time ($p = .064$) for Ss compared to Ns when font and word disagreed and the criterion was to correctly pick the font color. Ss did not correctly pick the font color more often than Ns, however, nor was there an SN difference for reaction time picking the word rather than font color incongruent conditions. We also found that Js responded more quickly than Ps regardless of word or font color criteria, but without any significant advantages in accuracy. Ts responded faster than Fs for either criterion, but Fs tended to be more accurate. Thus, there was little evidence to support a consistent or type theory-affirming Sensing or Intuitive advantage on the Stroop tests.

The clearest confirmation of type theory occurred with our independent preference self-ratings. Even when given the opportunity to rate themselves independently on preferences that type theory claims are in opposition to one another, our subjects' ratings still generally fell into an either/or pattern with strongly significant negative correlations.

We did find that picking the word rather than the font color was easier and more accurate, as well as some other minor differences unrelated to the focus of this paper.

The clearest confirmation of type theory occurred with our independent preference self-ratings. Even when given the opportunity to rate themselves independently on preferences that type theory claims are in opposition to one another, our subjects' ratings still generally fell into an either/or pattern with strongly significant negative correlations. This is encouraging support for type theory; however, one major caveat is that these subjects had all gone through four days of type training that explained the theoretical opposition of preferences. Given the transparent nature of the descriptions and self-ratings, it is not only possible but likely that our subjects were positively influenced by the training and favorable to the theoretical model. Thus, a much more stringent test of these independent ratings would involve administering the same questionnaire to subjects unfamiliar with type theory.

It's worth noting that results for SN self-ratings were similar to those of other domains, offering little evidence that Sensing and Intuition as measured by the MBTI instrument are any less in opposition than the other polar domains, one of our speculative hypotheses.

We close with a call for more research and the hope that type theory advances through a combination of insight and evidence, with careful attention to detail and meaning of the complex constructs involved. As Jung and many others have noted, human behavior is complex and motivated by invisible motives and forces, many of them unknown even to ourselves. Intuition is indeed difficult to grasp, but so are the rich meanings of the other type preferences. It is tempting to assert claims that outstrip the evidence, but when evidence confirms theory, we can proceed with greater confidence to a greater understanding.

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