ADDITIONAL MATERIAL FOR SECTION B OF INVENTION DISCLOSURE

# IMPLICIT ASSESSMENT OF MULTIFACTOR TRAITS ("Multifactor Trait IAT")

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Abstract: The Multifactor Trait IAT (MFT–IAT) is designed for implicit assessment of traits that are currently assessed in explicit (self-report) form by multi-item personality inventories. The most widely used such inventories include one known popularly as the "Big Five" and the Myers–Briggs Type Indicator (MBTI). The problem in developing Implicit Association Test (IAT) measures of these traits is that, in most such inventories, each distinct major trait involves the contrast of a positive pole (e.g., agreeable) with a negative pole (e.g., disagreeable). When such positive–negative contrasts are used in the IAT, the IAT is effectively converted to an implicit measure of self-esteem rather than an implicit measure of association of self with the more specific target trait. The MFT–IAT's solution to this problem is to provide a test construction strategy that will generally enable contrasting each focal trait of a multifactor collection with the *full set* of other like-valenced traits in the collection.

The problem solved by this invention arises frequently when attempting to construct an implicit measure of personality *traits* using the Implicit Association Test (Greenwald, McGhee, & Schwartz, 1998). Traits are personal characteristics that are assumed (a) to be characteristic of individuals and (b) variable across individuals. Alternately stated, trait names identify *dimensions* along which persons differ. These dimensions are also known as *individual difference dimensions*.

For example, *self-esteem* designates an individual difference dimension, or trait, for which people can differ by having more or less positive attitude toward self. *Explicit* self-esteem is often measured by *self-report* measures (e.g., Rosenberg, 1965), whereas *implicit* self-esteem can be measured by the Implicit Association Test (IAT; Greenwald & Farnham, 2000). There are other procedures for measuring implicit self-esteem than the IAT. However, no other procedure is as psychometrically strong (Bosson, Swann, & Pennebaker, 2000). The IAT's method of assessing implicit self-esteem is shown schematically in Figure 1.

## Previous Methods

*Standard IAT – Confounding positively valenced traits with implicit self-esteem*. The straightforward use of the IAT to assess a personality trait is to replace the category contrast of *pleasant* and *unpleasant* (which is appropriate for self-esteem) in Figure 1 with categories of words selected to represent a different trait contrast, such as *agreeable* vs. *disagreeable*. A recent use of the IAT by Steffens and Schultze König (in

press) illustrates this standard IAT strategy. These authors represented the agreeable–disagreeable contrast with the sets of words (trait adjectives) shown in Figure 2A. What can be seen in Figure 2A is that, at the same time that contrasted word groups represent the contrast between agreeableness and disagreeableness, they also represent a contrast between positive and negative valence. This is so because all the agreeable-representing words are pleasant (i.e., affectively positive in meaning), and all the disagreeable-representing words are unpleasant (i.e., affectively negative in meaning).

Figure 1. Sequence of Tasks for Standard Self-Esteem IAT

| Block | no. of trials | Function | Instructions for left key | Instructions for right key |
|---|---|---|---|---|
| 1 | 20 | target concept practice | *self* words (I, me, mine, self) | *other* words (they, them, their other) |
| 2 | 20 | attribute practice | *unpleasant* words (poison, hate, vomit, monster) | *pleasant* words (angel, truth, diamond, beauty) |
| 3 | 20 | first combined task practice | *self* words OR *unpleasant* words | *other* words OR *pleasant* words |
| 4 | 40 | first combined task test | *self* words OR *unpleasant* words | *other* words OR *pleasant* words |
| 5 | 40 | target concept reversal practice | *other* words | *self* words |
| 6 | 20 | second combined task practice | *other* words OR *unpleasant* words | *self* words OR *pleasant* words |
| 7 | 40 | second combined task test | *other* words OR *unpleasant* words | *self* words OR *pleasant* words |

*Alternative method – Counfound with a second trait*. The consequence of confounding agreeableness and valence, as in Figure 2A, is to produce an IAT that is as much or more a measure of implicit self-esteem than it is a measure of an implicit trait of agreeableness. This is unsatisfactory for trait measurement — a procedure that confounds what it intends to measure with something else is considered invalid.

A previously tried solution for this undesirable circumstance is to avoid confounding other traits with self-esteem by using two contrasting traits that are equally positive (or equally negative) in valence. This solution was first used by Rudman, Greenwald, and McGhee (2001). For example, in place of the agreeableness–disagreeableness contrast of Figure 2A one could contrast agreeableness with extraversion, as shown in Figure 2B. This alternative approach indeed does avoid the confound with implicit self-esteem. At the same time, this approach introduces a new and equally troublesome source of invalidity: The obtained measure will be as much a measure of implicit extraversion as it is a measure of implicit agreeableness. Consider two hypothetical respondents assumed to have the same level of implicit agreeableness while one is

higher in implicit extraversion. An IAT constructed with the contrast shown in Figure 2B will indicate that the respondent higher in implicit extraversion is lower in implicit agreeableness (even though the two are assumed to be identical in implicit agreeableness). More generally, the measure of implicit agreeableness is affected by the respondent's level on whatever positive trait is chosen to contrast with agreeableness.

Figure 2A. Standard IAT Trait Contrast for an Agreeableness IAT Measure

| Agreeable Trait Words | Disagreeable Trait Words |
|---|---|
| understanding | critical |
| compliant | antagonistic |
| cooperative | stubborn |
| benevolent | persistent |
| polite | irritable |

Figure 2B. Modified IAT Trait Contrast for an Agreeableness IAT Measure

| Agreeable Trait Words | Extraversion Trait Words |
|---|---|
| understanding | energetic |
| compliant | bold |
| cooperative | active |
| benevolent | vigorous |
| polite | assertive |

## Present Invention — Multifactor Trait IAT (MFT–IAT)

This invention avoids the problems just described by constructing, for any specific implicit trait measure, a comparison set that uses the full set of alternative traits with which one wishes to compare the specific implicit trait. This comparison set is, at maximum, the entire (huge) population of traits in which personality psychologists have ever expressed interest. This is obviously impractical, even though one could sample from that large population. The present descriptions are limited to the much smaller and well defined sets of traits that are used in *multifactor trait inventories*. The best known of these inventories are the *Big Five* (reference) and the *Myers–Briggs Type Inventory*. The method of the MFT–IAT is illustrated here for these two inventories.

*Illustration for The Big Five*. The five major traits of the Big Five Inventory are Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness to Experience. Each of these can be considered a trait category, composed of a number of more specific, or *exemplar*, traits. Figure 3 gives short lists of exemplar traits for each of the Big Five's major trait categories. The first two exemplars for each trait category are the two best exemplars for each. Those in the third and fourth rows are the next most suitable exemplars. Additional exemplar traits, where available, are shown to indicate that there may be more than four trait-representing exemplars per category, in which case it is also possible to use these additional traits. The present illustrations of the MFT–IAT use four traits per category, even though the invention could be used with more or fewer. The invention can be easily used with only two

exemplars per trait category, but may be of uncertain value if only one trait per category is available.

Figure 3 contains the materials for generating five IAT measures, one for each trait category of the Big Five. Figure 4 illustrates one of these five, an IAT measure of *implicit conscientiousness*. The key procedure is the one that appears initially in Block 2, where the top four exemplars of *conscientiousness* (organized, pactical, efficient, careful) are contrasted with eight words that comprise a collection the top two exemplars of each of the remaining four traits of the Big Five. In contrast with what is shown in Figure 4, the original standard IAT method applied to measuring conscientiousness would contrast the four conscientious trait words with four words representing the opposite of conscientiousness — namely, *undependability* (negligent, haphazard, sloppy, careless). As noted earlier, such a measure is undesirable because of invalidity in the form of a confound with implicit self-esteem. The same would be true of measures similarly constructed for the other four traits of the Big Five by opposing one of Figure 3's traits with its opposite. The alternative procedure (as used by Rudman et al., 2001 and several others) would produce a total of 10 measures, representing all 10 possible pairs of the five Big Five traits. Each trait would participate in four of these 10 measures, and any single measure (e.g., the Agreeableness–Extraversion IAT based on the contrast in Figure 2B) would be a mutually confounded measure of Agreeableness and of Extraversion. The MFT–IAT approach avoids both of these confoundings. Each of the five traits has a single measure, not shared with any other trait.

Figure 3. Exemplar Traits for the Five Big Five Trait Categories

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| EXTRAVERSION | AGREEABLENESS | CONSCIENTIOUSNESS | STABILITY | OPENNESS |
| **energetic** | **kind** | **organized** | **relaxed** | **creative** |
| **bold** | **warm** | **practical** | **calm** | **bright** |
| active | helpful | efficient | secure | artistic |
| vigorous | pleasant | careful | steady | imaginative |
| assertive | agreeable | thorough | quiet | inventive |
| | cooperative | dependable | | |
| | polite | disciplined | | |
| | | systematic | | |

Figure 4. Multifactor Trait IAT Measure of Conscientiousness

| Block | no. of trials | Function | Instructions for left key | Instructions for right key |
|---|---|---|---|---|
| 1 | 20 | target concept practice | *self* words (I, me, mine, self) | *other* words (they, them, their other) |

| | | | | |
|---|---|---|---|---|
| 2 | 20 | attribute practice | *conscientious* words (organized, practical, efficient, careful) | *other-trait* words (energetic, bold, kind, warm, relaxed, calm, creative, bright) |
| 3 | 20 | first combined task practice | *self* words OR *conscientious* words | *other* words OR *other-trait* words |
| 4 | 40 | first combined task test | *self* words OR *conscientious* words | *other* words OR *other-trait* words |
| 5 | 40 | target concept reversal practice | *other* words | *self* words |
| 6 | 20 | second combined task practice | *other* words OR *conscientious* words | *self* words OR *other-trait* words |
| 7 | 40 | second combined task test | *other* words OR *conscientious* words | *self* words OR *other-trait* words |

*Illustration for the Myers–Briggs Type Indicator*. Applying the MFT–IAT approach to the Myers–Briggs Type Indicator (MBTI; Myers & McCaulley, 1985) is closely related to constructing MFT–IAT Big Five measures because of overlap between the Big Five traits and the the four trait dimensions of the MBTI. The MBTI's four trait deminsions are (a) Extraversion vs. Introversion, (b) Sensing vs. Intuition, (c) Thinking vs. Feeling, and (d) Judging vs. Perceiving. The relationship of these with four of the five dimensions of the Big Five has been described by McCrae and Costa (1989) and Furnham, Moutafi, and Crump (2003). The alignments are displayed in Figure 5.

Figure 5. Association of MBTI Type Contrasts with Big Five Trait Factors

| **MBTI Dimensions** | **Big Five Factors** |
|---|---|
| Extraversion (E) vs. Introversion (I) | Extraversion |
| Sensing (S) vs. Intuition (N) | Openness |
| Thinking (T) vs. Feeling (F) | Agreeableness |
| Judging (J) vs. Perceiving (P) | Conscientiousness |

These dimensional correspondences are based on the research of McCrae and Costa (1989), replicated by Furnham, Moutafi, and Crump (2003)

Based on the alignments shown in Figure 5, the implicit version of the MBTI uses four of the five IATs described for the preceding Big Five example. The significant difference from the Big Five MFT–IAT is in the reporting of results. This is because the standard format reporting MBTI results is to report each respondent's scores as one of 16 types, each of these 16 being formed as combinations of one of the two possible poles of the four dimensions. Whereas the Big Five MFT–IAT will be reported in the form of five separate trait scores, each in the usual *D* units of the IAT measure

(Greenwald, Nosek, & Banaji, 2003), the Myers–Briggs MFT–IAT would be scored as a combination of four letters, based on a dichotomous classification of the respondent on each of the test's four trait dimensions. For example, a respondent whose scores on the four IATs indicated greater association of self with the first (than the second) pole of each dimension shown in Figure 5 would be characterized Extraverted, Sensing, Thinking, Judging — abbreviated as ESTJ. The following has been offered as a description of Type ESTJ: "For ESTJs the driving force in their lives is their need to analyze and bring into logical order the outer world of events, people, and things. ESTJs like to organize anything that comes into their domain, and they will work energetically to complete tasks so they can quickly move from one to the next. Sensing orients their thinking to current facts and realities, and thus gives their thinking a pragmatic quality. ESTJs take their responsibilities seriously and believe others should do so as well." (This description is quoted from http://www.capt.org/The_MBTI_Instrument/Type_Descriptions.cfm.)

*Other areas of application*. Multifactor implicit trait measures can also be constructed by straightforward generalization on the methods described for the Big Five for the *Allport–Vernon Study of Values* (SOV) and for vocational preference inventories such as the *Strong Vocational Interest Blank* (SVIB) and the *Kuder Preference Record* (KPR). Each of these inventories provides scores on several trait categories that have been identified using factor analysis of self-report measures.

As an illustration of one of these the Study of Values assesses six traits that correspond to values identified as Theoretical, Economic, Political, Aesthetic, Social, and Religious (Allport, Vernon, & Lindzey, 1970; Vernon & Allport, 1931). This once widely used personality measure has recently been subject to a renovation to update about a third of its 45 self-report items, which had become outdated (Kopelman, Rovenpor, & Guan, 2003). Introduction of an implicit-assessment form of this inventory may revive interest in using it both for research and diagnosis.

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