

# On the Applicability of the Big Five Implicit Association Test in Organizational Settings

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**Abstract** Two studies were conducted with the aim of investigating whether the Big Five traits, as measured by the Implicit Association Test (IAT), predict supervisor ratings of job performance. Two incumbent groups composed respectively by 52 security guards (Study 1) and 71 semi-skilled workers (Study 2) completed a self-report measure of the Big-Five and five IATs for assessing the same personality dimensions in an implicit way. In study 1, job performance was positively related to self-ratings of energy/extraversion ( $r = .35, p < .01$ ), agreeableness ( $r = .25, p < .01$ ), and conscientiousness ( $r = .22, p < .05$ ), and to the implicit measure of conscientiousness ( $r = .27, p < .05$ ). In study 2, job performance was positively related to explicit conscientiousness ( $r = .26, p < .05$ ) and emotional stability ( $r = .26, p < .05$ ), and to the implicit counterparts of the same traits ( $r = .25, p < .05$ , for conscientiousness, and  $r = .24, p < .05$ , for emotional stability). These relations held after controlling for the effect of pure valence, as measured by implicit self-esteem (Study 2). In both studies, implicit and explicit measures of personality traits predict unique aspects of job performance (i.e. they have incremental validity over each other). Practical implications of findings and future research directions are discussed.

**Keywords** Big Five · IAT · Implicit measures · Implicit personality traits · Job performance

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Individual differences in personality traits have proved to play a significant role in shaping important organizational criteria, including occupational level and success at work (Judge et al. 1999). After earlier criticism, the development of the Five Factor Model of personality (Digman 1990) has lead both practitioners and researchers to reevaluate the utility of personality tests for Industrial and Organizational (I/O) psychology. Several meta-analytic procedures have shown that the Five Factors are valid predictors of job performance (Barrick et al. 2001). Conscientiousness and emotional stability are the traits with the highest criterion-related validity across different occupational groups and performance criteria (Barrick et al. 2001). These traits showed incremental validity over mental ability tests (e.g., Dunn et al. 1995), and a lower adverse impact against minority groups than cognitive measures (Hough et al. 2001).

Yet, the use of personality measures in personnel selection has been criticized for being vulnerable to faking, namely respondents’ deliberate alteration of responses aimed to present a favourable impression of themselves. Empirical research has revealed that job applicants scored systematically higher than non-applicants on a number of personality measures (e.g., Birkeland et al. 2006). Other studies have shown that faking does not substantially decrease the criterion validity of personality tests, but is likely to change hiring decisions, and may therefore have detrimental effects on both fairness and effectiveness of the testing process (Ellingson et al. 1999; Rosse et al. 1998).

Several strategies have been advanced to prevent or mitigate the effect of faking, among which the use of forced-choice formats, subtle items, respondents warnings, and corrections based on social desirability scales. Yet, none of these approaches has proved to be fully adequate (Hough 1998). Therefore, concern over applicants’ faking still represents a major impediment to the use of personality measures in applied settings.

A promising approach for addressing this problem may come from the implicit social cognition area, where several

experimental paradigms have been proposed to assess several psychological constructs at an implicit (i.e., unconscious, automatic) level (see Gawronski and Payne 2010, for a review). One of the most well-known and widely used paradigm is the Implicit Association Test (IAT, Greenwald et al. 1998). The IAT has revealed to be less prone to faking and impression management biases than self-report questionnaires (e.g., Steffens 2004), which operate at the explicit (i.e., conscious, reflective) level.

Recently, the IAT has been applied to the measurement of implicit psychological constructs within organizational research areas, such as job attitudes, stereotypes, and self-concepts (Haines and Sumner 2006; Leavitt et al. 2011). Most importantly for the present study, several authors have used the IAT to assess the Big Five Factors of Personality (Schmukle and Egloff 2005; Steffens and Schulze König 2006).

In the Big-Five IAT, respondents are presented a set of stimuli, representing two target categories (*me* vs. *others*) or two attributes (e.g. *conscientiousness* vs. *carelessness*). They are asked to press a left- or right-hand key to classify each stimulus (as quickly and accurately as possible) into one of two sides of the screen, each comprising one target category and one attribute (e.g., *me* and *conscientiousness* in the left side vs. *others* and *carelessness* in the right side). Subsequently, they are asked to perform a second task in which the two target categories (*me* vs. *others*) are switched (e.g. *others* and *conscientiousness* in the left side vs. *me* and *carelessness* in the right side). The IAT scores are based on the difference between the mean response latencies on the two categorization tasks. Assuming that reaction times are faster when the target concept and the attribute are strongly connected in memory than when they are not (Greenwald et al. 1998), the size of such difference can be used to infer the extent to which the individual's self-concept is associated to a given personality characteristic, such as conscientiousness.

Previous research on the Big Five IATs showed a low implicit-explicit relationship (Schmukle and Egloff 2005; Steffens and Schulze König 2006) and a different pattern of correlations with significant criteria (Back et al. 2009). Several interpretative frameworks have been made available in order to explain these results (e.g. Greenwald and Nosek 2008). According to the Reflective-Impulsive Model (Strack and Deutsch 2004), for example, social behavior depends on both impulsive (associative, spontaneous, effortless, and non-voluntary) and controlled (propositional, deliberative, voluntary, and effortful) processes. Within this model, impulsive behaviors are best predicted by implicit measures of personality traits, whereas controlled behaviors are best predicted by self-report measures.

Recently, Back et al. (2009) present a behavioral model that considers individual's behaviour as the product of both the explicit and the implicit self-concept of personality. As authors wrote, "social behavior is executed whenever the activation of a behavioral schema exceeds a certain threshold. This activation may be triggered by reflective and impulsive processes" (Back

et al. 2009, p. 534). In this line of reasoning, complementing self-ratings by implicit measures should increase the predictive validity of personality measures, deepening at the same time our understanding of individual's actual behavior.

## The Current Research

Based on previous results, and given the fakability of personality measures commonly used in organizational contexts, the application of the Big-Five IATs for personnel testing and selection seems a promising area of research. As a first step in this direction, it is essential to assess the criterion validity of implicit Big Five on job performance, and their incremental validity over established personality questionnaires.

The current research is the first to address this issue. We conducted two studies that adapted the IAT for the assessment of the Big Five personality traits in an organizational context.<sup>1</sup> In both studies, we assessed the impact that implicit (IAT) and explicit (self-report) measures of the Big Five have on supervisor ratings of job performance. The incremental validity of implicit traits was investigated with respect to the Big-Five Questionnaire-2, an explicit measure whose psychometric properties have been already documented within organizational contexts (e.g., Vecchione et al. 2012). We expect that individual differences in both implicit and explicit measures of the Big Five should be able to account for employee's behavior at work. In particular, since explicit and implicit measures of the Big Five are posited to account for different aspects of job performance (the more reflective aspects the former, the more automatic the latter), we expected that both measures have a unique contribution in predicting job performance.

## Study 1

The first study focuses on the predictive validity of the implicit Big Five on supervisors' job performance appraisals in a sample of security guards. In accordance with above reasoning, and with extant literature, we posited the following hypotheses:

1. Self-ratings of conscientiousness and emotional stability would be positively associated with job performance. This hypothesis rests on meta-analytic evidence on the relationship between self-reported measures of these traits and job performance of various occupational groups (e.g., Barrick et al. 2001);

<sup>1</sup> Data from both studies partially overlaps with data used in a recent study aimed at investigating the fakability of implicit measures of the Big Five (masked). The present research is new in that it focuses on a different aim and includes supervisory ratings of job performance.

2. Energy/extraversion would be positively associated with job performance. This trait has been found to be related to job performance in occupations that are similar to that investigated in the present study. Specifically, earlier studies have shown that self-reported measures of extraversion, and its facets (e.g., activity), predict job performance in samples of police officers (Barrick et al. 2001; Black 2000);
3. Implicit measures of conscientiousness, emotional stability, and energy/extraversion would exhibit similar validity coefficients to those hypothesized for self-reported measures of the same traits;
4. Implicit and explicit measures of personality traits predict unique aspects of job performance (i.e. they have incremental validity over each other).

**Participants and Procedures**

Data were collected on a convenience sample of 52 Caucasian males, working as security guards for an Italian security company. The mean age was 39.02 (*SD* = 10.62). Personality tests were administered as part of a personnel assessment program performed by the human resource management. The IATs were administered during a specific testing session held by three trained researchers. Data were collected individually, in several rooms made available by the company. Participation in the IAT-session was voluntary and offered to all workers. The response rate was 91 % (five workers refused to participate). Performance data of all study participants were gathered from the human resources department after six months.

The study was approved by the Ethics Committee of the department of psychology, Sapienza University of Rome. Informed consent was obtained from all the study participants. They were advised that their responses on personality tests and the IATs would be linked with supervisor ratings of job performance, and used in a research project aimed at investigating the personality predictors of job performance. Confidentiality about the results was ensured.

**Measures**

**Self-Ratings of the Big Five** Participants were administered a shortened, 60-item version of the Big Five Questionnaire-2 (BFQ-2, Caprara et al. 2007). The BFQ-2 is a revised version of the BFQ (Caprara et al. 1993), a widely used measure of the Big Five (energy/extraversion, agreeableness, conscientiousness, emotional stability, and openness) developed in Italian. High correlations with the corresponding scales in the NEO-PI, in both US and Italian samples, established the construct validity of the instrument (Caprara et al. 1993). In the present study, Cronbach’s alpha reliability coefficients ranged from

.72 (energy/extraversion) to .87 (emotional stability). Reliability estimates are reported in Table 1.

**Big-Five IATs** To assess implicit personality traits five IATs were administered, including the same category labels and stimuli-words used by Back et al. (2009) in their research on the predictive validity of the implicit self-concept of personality. The target categories (*me* vs. *others*) and their relative stimuli-words were the same for each IAT, whereas the attributes (*extraversion* vs. *introversion*; *agreeableness* vs. *disagreeableness*; *conscientiousness* vs. *carelessness*; *anxiety* vs. *calmness*; *openness* vs. *narrow-mindedness*) and their relative stimuli-words were specific for each trait. In particular, 5 stimuli for each trait were presented (e.g. sociable and shy for *extraversion* vs. *introversion*, friendly and hostile for *agreeableness* vs. *disagreeableness*, reliable and unreliable for *conscientiousness* vs. *carelessness*, nervous and relaxed for *anxiety* vs. *calmness*, imaginative and unimaginative for *openness* vs. *narrow-mindedness*).

The entire procedure consisted of 21 blocks of trials that encompass 5 subtests, one for each of the Big Five (5 blocks for the first trait, and 4 for the remaining four). Since the first target-concept categorization task (e.g. *me* vs. *others*, 20 trials) is the same for all IATs, it was presented only in the first subtest. The following sequence of blocks was presented in each subtest: A single attribute categorization task (e.g., *conscientiousness* vs. *carelessness*, 20 trials), a combined

**Table 1** Intercorrelations among explicit and implicit measures of the Big Five (Study 1, *N* = 52)

	Big Five IAT					Self-report (BFQ-2)				
	E	A	C	S	O	E	A	C	S	O
IAT										
E	<i>.62</i>									
A	<i>.48**</i>	<i>.69</i>								
C	<i>.50**</i>	<i>.50**</i>	<i>.82</i>							
S	<i>.34*</i>	<i>.29*</i>	<i>.53**</i>	<i>.83</i>						
O	<i>.44**</i>	<i>.58**</i>	<i>.60**</i>	<i>.48**</i>	<i>.69</i>					
Self-report										
E	<i>.19</i>	<i>.15</i>	<i>-.03</i>	<i>.24</i>	<i>.02</i>	<i>.72</i>				
A	<i>.17</i>	<i>.22</i>	<i>.06</i>	<i>.22</i>	<i>.10</i>	<i>.34*</i>	<i>.84</i>			
C	<i>.37**</i>	<i>.12</i>	<i>-.09</i>	<i>.15</i>	<i>-.02</i>	<i>.09</i>	<i>.62**</i>	<i>.73</i>		
S	<i>.11</i>	<i>.09</i>	<i>.09</i>	<i>.18</i>	<i>-.08</i>	<i>.15</i>	<i>.33*</i>	<i>.58**</i>	<i>.87</i>	
O	<i>.36**</i>	<i>.21</i>	<i>.04</i>	<i>.29*</i>	<i>.07</i>	<i>.32*</i>	<i>.36**</i>	<i>.33*</i>	<i>.23</i>	<i>.81</i>

Split-half (IAT) and Cronbach’s alpha reliability coefficients (self-report) are shown in italics. Correlations between implicit and explicit measures of the same trait are in bold

*E* energy/extraversion, *A* agreeableness, *C* conscientiousness, *S* emotional stability, *O* openness

\**p* < .05; \*\**p* < .01

compatible categorization task (e.g., *me or conscientiousness vs. others or carelessness*, two sub-blocks of 20 and 40 trials, respectively), a single target categorization task (e.g. *others vs. me*, 40 trials), and a combined non-compatible categorization task (e.g. *others or conscientiousness vs. me or carelessness*; two sub-blocks of 20 and 40 trials, respectively).

The sequence of the five subtests, as well as the order of the combined blocks, were counterbalanced across participants. Moreover, all stimuli were presented in a random order within each block of trials. For each IAT, data from combined blocks were used to compute the difference scores, according to a built-in error penalty procedure (Greenwald et al. 2003). Positive scores indicate a stronger association of the self with the positive pole of the examined trait (e.g. *conscientiousness*) than with the negative pole (e.g. *carelessness*), and vice versa for negative scores.

The internal consistency of the IATs was calculated by using the Spearman-Brown corrected split-half reliability. Specifically, reliability coefficients were calculated as the correlations between the scores derived from two sub-blocks within each of the two combined blocks. Coefficients, reported in Table 1, ranged from .62 (extraversion) to .83 (emotional stability), with a mean of .73 ( $SD = .09$ ). Reliability levels observed in the present study are quite similar to the ones reported by Back et al. (2009), where the mean alpha coefficient for the five factors was .76 ( $SD = .06$ ).

**Job Performance** Three supervisors, each with a different responsibility with respect to the workers, rated job performance through the company's performance appraisal tool. This instrument comprised fourteen performance aspects. Examples are "discipline" (e.g. "meets the norms of the workplace"), "work quantity" (e.g. "completes work on schedule"), "work quality" (e.g. "perform his/her accountabilities with skill and knowledge"), "cooperation" (e.g. "responds positively to instructions and procedures"), and commitment to safety (e.g. "performs work in safe manner and adheres to safety rules"). Ratings were made on a 4-point scale ranging from 1 (does not meet expectations) to 4 (outstanding).

To estimate the degree of agreement among the three supervisors, the intraclass correlation coefficient (ICC) was calculated.<sup>2</sup> Coefficients for the fourteen behavioral domains ranged from .48 to .73 ( $M = .61$ ). This is fairly consistent with meta-analytic evidence (Viswesvaran et al. 1996), which provide an estimate of .52 for the interrater agreement of supervisory ratings of job performance.

To obtain a single measure for each domain, the fourteen items were averaged across informants. An exploratory principal axis factoring was conducted to examine whether the fourteen indicators of job performance can be traced to a

single factor. The list of eigenvalues was consistent with a one-factor solution (the first five eigenvalues were 7.87, 1.30, 1.14, .72, and .57). The one-factor model accounted for 53.3 % of the variance. Thirteen out of fourteen items loaded higher than .55 on the single factor. The Standardized Root Mean Square Residual (SRMR) was .07. After the unidimensionality of the items was established, we summed the domain scores with the aim to obtain an overall job performance index. This index follows a normal distribution, with skewness and kurtosis indices lower than 1 in absolute value. The alpha coefficient for the composite measure was .94. The mean was 31.88 ( $SD = 5.53$ ).

## Results and Discussion

### Intercorrelations Among Implicit and Explicit Measures

Correlations among the Big Five dimensions measured by either the IAT and self-report were reported in Table 1. Correlations among explicit Big Five and those among implicit ones were positive and mostly significant: .34 on average for explicit traits ( $SD = .17$ ), .47 for implicit traits ( $SD = .10$ ). Some correlations were especially high ( $>.50$ ).

In the case of explicit measures, correlations might be inflated by the specific context in which personality tests were administered. In applied settings, indeed, the motivation to fake introduces a systematic source of artifactual variance that may increase correlations among personality scale scores (e.g., Ellingson et al. 1999).

This is the first study to adopt the Big Five IATs in an applied setting. Therefore, we can only speculate about possible factors at the origin of the high correlations among implicit traits. A possible explanation has to do with the fact that all IATs include trait attributes that have a clear positive or negative valence. Correlations among implicit traits could therefore be inflated by a generalized tendency to associate the self with positive rather than with negative attributes, irrespective of the semantic content of the attribute stimuli (Schnabel et al. 2008). We tested this possibility in the second study.

As shown in Table 1, correlations between implicit and explicit measures (in bold) were not significant. This finding is consistent with earlier studies, showing that implicit and explicit measures of the Big Five are weakly correlated (e.g., Schmukle et al. 2008; Steffens and Schulze König 2006). The average absolute correlation for the five traits was .15, that is only slightly lower than the .17 reported in the meta-analysis of Greenwald et al. (2009) for personality traits. Our results are also consistent with those of Back et al. (2009), which showed a mean absolute intercorrelation of .13 (in the study by Back et al. 2009, implicit-explicit correlations were significant only for extraversion and neuroticism).

<sup>2</sup> Specifically, we assessed the consistency of agreement using the two-way random effects model (ICC 2,1).



### Big Five and Supervisory Ratings of Job Performance

Correlations of security guards’ job performance with implicit and explicit measures of the Big Five are reported in the left panel of Table 2. Hypothesis 1 was partially supported. As expected, a positive and significant correlation was observed between self-ratings of conscientiousness and supervisory ratings of performance. Self-reported emotional stability, by contrast, was unrelated to job performance. Self-ratings of extraversion showed a positive and significant correlation, supporting hypothesis 2. Self-reported agreeableness also showed a positive correlation. Although not expected, this is not inconsistent with the extant literature, which has shown that agreeableness can be a valid predictor of performance in job types involving teamwork or dyadic interactions (Barrick et al. 2001; Mount et al. 1998), as may occur for security guards.

In accordance with hypothesis 3, the implicit measure of conscientiousness was significantly related to job performance. The correlations of the other implicit traits, by contrast, were not significant. Although emotional stability was expected to predict job performance (hypothesis 3), correlations were not significant for both explicit and implicit measures of this trait. It should be noted, however, that the magnitude of the validity coefficient observed in our study for both the IAT and the BFQ-2 (.11) was identical to the one reported in the meta-analysis by Barrick et al. (2001) for a similar occupational group (i.e., police officer). Thus, our results seems in line with those of previous studies.

To further examine the criterion validity of the Big-Five IATs, a set of five multiple regressions were carried out, each including implicit and explicit measures of the same trait as predictors of job performance.<sup>3</sup> As reported in Table 2 (left panel), both implicit and explicit measures of conscientiousness had a significant unique contribution to job performance, supporting hypothesis 3. Cumulatively, they accounted for 14 % of the variance in supervisory ratings of job performance. The other implicit measures did not exhibit incremental validity. Self-reported energy/extraversion and agreeableness accounted for additional unique variance after the implicit counterpart was taken into account.

### Study 2

Study 1 showed that implicit conscientiousness predicted supervisory ratings of job performance in a sample of security guards. In the second study we aimed to extend these findings

<sup>3</sup> Given the available sample size, it was not statistically appropriate to include all traits in a single equation. As recommended by Tabachnick and Fidell (2007), a sample of size of at least  $50 + 8(k)$  is needed for testing a full regression model, where  $k$  is the number of predictors.

**Table 2** Relations of job performance with self-ratings of the Big Five (BFQ-2) and Big-Five IATs (Study 1,  $N = 52$ )

	Big-Five IAT		Self-report		R <sup>2</sup>
	r	β	r	β	
Energy/Extraversion	.18	.22	.35**	.37**	.17
Agreeableness	-.13	-.17	.25*	.26*	.08
Conscientiousness	.27*	.29*	.22*	.25*	.14
Emotional stability	.11	.10	.11	.11	.02
Openness	.12	.11	.12	.09	.02

rs represent bivariate (zero-order) correlations; βs and R<sup>2</sup> represent regression weights and the proportion of variance accounted in a model that includes both the IAT and self-ratings of the same trait

\* $p < .05$ ; \*\* $p < .01$

by focusing on a different occupational group (semi-skilled workers). Moreover, we assessed the potential confound effect of pure valence on participants’ scores on implicit traits. As it has been argued (Back et al. 2009), two components are likely to coexist in the assessment of both implicit and explicit self-concept of personality: A general valence factor (i.e. positive or negative evaluation of the self) and a specific personality dimension, different for each trait (see Schnabel et al. 2008, for a more detailed discussion). Including implicit self-esteem has two main advantages with respect to the aims of the study. First, it allows us to investigate whether the high intercorrelations among implicit traits observed in study 1 are due to the shared variance among implicit traits related to implicit self-evaluation (Schnabel et al. 2008). More specifically, we examined whether correlations among implicit traits decrease by controlling for the effect of the positive or negative meaning of the attribute stimuli. Second, the predictive validity of traits can be assessed after the contribution of implicit self-esteem was partialled out. This would allow us to evaluate whether the correlations between the Big-Five IATs and job performance are contaminated by the valence of the attribute stimuli.

The following hypotheses were generated for the present study:

1. Self-ratings of conscientiousness and emotional stability would be positively related to job performance (Barrick et al. 2001);
2. Implicit measures of conscientiousness and emotional stability would show similar validity coefficients to those expected for self-reported measures of the same traits;
3. The predictive validity of implicit conscientiousness and emotional stability would hold even after controlling for the effect of pure valence, as measured by implicit self-esteem;
4. Implicit and explicit measures of conscientiousness and emotional stability would make a unique contribution to the prediction of job performance.

## Participants and Procedures

Data were collected on a convenience sample of 72 semi-skilled workers (24 % women, all Caucasian), working in a food manufacturing company. The mean age was 34.23 (SD=9.10). Personality tests and IATs were administered at the company site, during a specific testing session held by two trained researchers. The participants were free to take part in the study. Similarly to study 1, they were advised through informed consent that their responses on personality tests and the IATs would be used in a research project aimed at investigating the personality predictors of job performance. The response rate was 90 % (eight workers decided not to participate). Differently from study 1, job performance was rated by a single informant (the direct supervisor), and concurrently with measurement of explicit and implicit measures of personality. The procedure was approved by the Ethics Committee of the department of psychology, Sapienza University of Rome.

## Measures

**Self-Ratings of the Big Five** Participants were administered the same 60-item version of the BFQ-2 used in the first study (Caprara et al. 2007). Reliability estimates are reported in Table 3. As can be observed, Cronbach's alpha reliability coefficients were all higher than .60, ranging from .63 (energy/extraversion) to .91 (emotional stability).

**Big-Five IATs** Implicit Big Five were assessed using the same procedure described in study 1. Split-half reliability coefficients, reported in Table 3, ranged from .62 (energy/extraversion) to .77 (agreeableness, conscientiousness).

**Implicit Self-Esteem** An additional IAT for assessing implicit self-esteem has been administered after the Big Five IATs. Similarly to Back et al. (2009), we used “*me vs. others*” as target category labels and “*like vs. dislike*” as attribute category labels. Five words for each category were presented in random order within each block (e.g., positive and negative for *like vs. dislike*, self and them for *me vs. others*). As described by Greenwald et al. (1998), the procedure comprised seven blocks of trials: 1 (*me vs. others*), 2 (*like vs. dislike*) and 5 (*others vs. me*) were single categorization blocks of 20 trials; 3, 4, 6, and 7 were combined blocks (e.g., *me or like vs. others or dislike*) of 20 (3, 6) and 40 (4, 7) trials. Data from combined blocks were used to compute the IAT scores, using the built-in error penalty procedure. Positive scores indicate high implicit self-esteem, negative scores indicate low implicit self-esteem. The split-half reliability coefficient was .56.

**Job Performance** Direct supervisor rated workers' job performance using an appraisal tool composed by six items related to aspects that were identified as important for job performance. These included: “quality of work”, “quantity of work”, “attendance”, “accuracy”, “dependability”, and “know-how”. Ratings were made on a 4-point scale ranging from 1 (does not meet expectations) to 4 (outstanding). The six behavioral

**Table 3** Intercorrelations among the explicit and implicit measures of the Big Five (Study 2,  $N=71$ )

	Big Five IAT					Self-report (BFQ-2)				
	E	A	C	S	O	E	A	C	S	O
IAT										
E	.63									
A	.16 (.02)	.77								
C	.19 (.06)	.32** (.09)	.77							
S	.12 (.04)	.45** (.35*)	.36** (.25*)	.74						
O	.31** (.24*)	.36** (.23*)	.47** (.37*)	.28* (.19)	.67					
Self-report										
E	<b>.31** (.30*)</b>	.05 (.07)	.15 (.08)	.12 (−.04)	.23** (.09)	.63				
A	.04 (.00)	<b>−.05 (.00)</b>	−.12 (−.11)	.07 (.03)	.07 (.00)	.45**	.76			
C	−.12 (−.11)	−.16 (−.08)	<b>.11 (.21*)</b>	.15 (−.28*)	−.07 (−.07)	.25*	.37**	.72		
S	−.09 (−.09)	−.06 (−.10)	.16 (.19)	<b>.14 (.20*)</b>	.01 (.12)	.09	.26*	.56**	.91	
O	−.04 (.21*)	.08 (.10)	.02 (−.10)	.17 (.07)	<b>.26* (.22*)</b>	.28*	.31**	.28*	.25*	.74

Split-half (IAT) and Cronbach's alpha reliability coefficients (self-report) are shown in italics. Correlations between implicit and explicit measures of the same trait are in bold. Correlations in parenthesis are partialled out for implicit self-esteem

*E* energy/extraversion, *A* agreeableness, *C* conscientiousness, *S* emotional stability, *O* openness

\* $p < .05$ ; \*\* $p < .01$

domains were highly interrelated (average Pearson  $r$  was .51,  $SD=.17$ ). A composite index of job performance was obtained by summing the scores on the single performance aspects. The distribution of the overall job performance index was extremely close to normality (skewness and kurtosis were both equal to .03). The alpha coefficient of the composite measure was .85. The mean was 12.70 ( $SD=2.29$ ).

## Results and Discussion

### Intercorrelations Among Implicit and Explicit Measures

Correlations among implicit and explicit measures of the Big Five were reported in Table 3. Correlations among implicit Big Five and those among explicit ones were generally positive and most of them were significant. On average, they were .31 ( $SD=.13$ ) for explicit traits, and .30 for implicit traits ( $SD=.12$ ). Correlations among the Big Five IATs dropped substantially after implicit self-esteem was controlled for. Partial correlations ranged from .02 to .37, with an average of .18 ( $SD=.13$ ). This seems to suggest that the variability shared by implicit traits is due, at least in part, to a general factor related to stimulus valence (Steffens and Schulze König 2006) and, more in general, to method-related factors that may contribute to the IAT effect but are unrelated to the strength of the association between target and attribute categories (Teige-Mocigemba et al. 2010).

As shown in Table 3, the implicit-explicit correlations of energy/extraversion ( $r=.31$ ,  $p<.01$ ) and openness ( $r=.26$ ,  $p<.05$ ) were positive and significantly different from zero, indicating a moderate degree of convergence between IATs and self-ratings of these traits. The other correlations were not significant. The average implicit-explicit correlation was .15 ( $SD=.14$ ). Interestingly, after controlling for implicit self-esteem the correlation between implicit and explicit measures of conscientiousness ( $r=.21$ ,  $p<.05$ ) and emotional stability ( $r=.20$ ,  $p<.05$ ) turned out to be significant. Thus, the implicit-explicit consistency tends to increase when the effects of the specific semantic content of Big Five IATs can be disentangled from the effect of a more general evaluative factor (Schnabel et al. 2008).

### Big Five and Supervisory Ratings of Job Performance

Correlations of workers' job performance with implicit and explicit measures of the Big Five are reported in Table 4. In accordance with hypotheses 1 and 2, supervisory ratings of performance were positively and significantly correlated with implicit and explicit measures of conscientiousness and emotional stability. We also found that implicit self-esteem correlated positively and

**Table 4** Relations of job performance with self-ratings of the Big Five (BFQ-2) and Big-Five IATs (Study 2,  $N=71$ )

	Big-Five IAT		Self-report		R <sup>2</sup>
	r	$\beta$	r	$\beta$	
Energy/Extraversion	-.04 (-.05)	.07	.06	.13	.02
Agreeableness	.00 (-.02)	.01	.04	.09	.01
Conscientiousness	.26* (.29*)	.26*	.25*	.21*	.11
Emotional stability	.26* (.26*)	.24*	.24*	.19*	.09
Openness	.08 (-.07)	.05	.07	.07	.01

rs represent bivariate (zero-order) correlations (the coefficients in parentheses are partial correlations controlling for implicit self-esteem);  $\beta$ s and R<sup>2</sup> represent regression weights and the proportion of variance accounted in a model that includes both the IAT and self-ratings of the same trait  
\* $p<.05$ ; \*\* $p<.01$

significantly with implicit traits. Pearson's  $r$  were .27 ( $p<.05$ ) with energy/extraversion, .51 ( $p<.01$ ) with agreeableness, .51 ( $p<.01$ ) with conscientiousness, .31 ( $p<.01$ ) with Emotional stability, and .34 ( $p<.01$ ) with Openness. As expected (hypothesis 3), correlations remained substantially the same after the effect of implicit self-esteem was taken into account (see Table 4).

Table 4 also reports the unique contribution of implicit and explicit measures of each trait. We did not include implicit self-esteem in the regression analyses, since it had no effect on the estimated correlations between predictors and criterion. As can be observed, both IAT and self-report have incremental validity over each other for the conscientiousness and emotional stability traits. This supports hypothesis 4, which stated that implicit and explicit measures of personality traits predict unique aspects of job performance. The R-squared of the model including both implicit and explicit measures was .11 and .09, respectively.

## General Discussion

Two studies were aimed at investigating the role of implicit Big Five traits in predicting performance at work, as well their incremental validity over a well-established personality inventory (i.e., the Big-Five Questionnaire-2). The first study showed that self-ratings of energy/extraversion, agreeableness, and conscientiousness predicted security agents' performance rated sixth months later by three direct supervisors. Among the Big-Five IATs, only implicit conscientiousness was significantly related to job performance. This trait showed incremental validity over the explicit measure of the same trait. The second study revealed that both explicit and implicit measures of conscientiousness and emotional stability were significantly

related to semi-skilled workers' performance, as rated concurrently by the direct supervisor. This result holds even after an implicit measure of self-esteem was controlled for. We can therefore conclude that the effect of the Big-Five IATs is not due to a general positive evaluation of the self. Similarly to study 1, implicit measures of conscientiousness and emotional stability added unique variance components to the respective self-report scales, and vice versa.

Taken together, these data suggest that automatic and controlled self-attributed traits can jointly predict supervisors ratings of job performance. Likely, in accordance with Back et al. (2009), both impulsive and reflective processes are able to trigger and maintain the behavioral schemata on which individuals' performance is rated.

The validity coefficients of conscientiousness and emotional stability, the two traits for which we expected a consistent effect across the two studies, were remarkably similar for implicit and explicit measures. Some differences emerged in the first study regarding the traits that showed a significant effect on supervisor-rated criteria. In particular, energy/extraversion and agreeableness predicted the outcome only for self-report data. This might be due, at least in part, to the different ways these factors have been operationalized in the explicit and implicit measures. The attribute stimuli used in the IAT, indeed, do not match the items included in the BFQ-2. Specifically, the first dimension of the BFQ-2 is defined as Energy, a dimension that includes facets as dominance (e.g. assertiveness and confidence) and dynamism (e.g. expansiveness and enthusiasm). In the IAT, by contrast, this personality dimension only includes stimuli related to the opposition between *extraversion and introversion* (e.g., sociable, talkative, shy, reserved).

We also found that implicit and explicit measures are substantially dissociated (i.e. they are weakly correlated and predict unique aspects of job performance). This result is not surprising. As Schmukle and Egloff (2005) wrote, implicit and explicit personality tests can be considered not only as different ways of measurement but also as measures of different constructs. Specifically, they tap the implicit and the explicit self-concept of personality, which respectively reflect associative and propositional processes in evaluation (see also Schmukle et al. 2008). Our findings support earlier studies showing weak correlations between implicit and self-reported measures of personality traits. The implicit-explicit correlations we found in both studies were similar to those observed in the literature (e.g., Greenwald et al. 2009). As evidenced above, the items of the BFQ-2 differ, both in structure and content, from labels used in the IAT. This might have contributed to heighten the explicit-implicit dissociation. Moreover, since the data have been collected in evaluative settings, incumbents may have been motivated to provide dissimulated responses. As

has been suggested (Hofmann et al. 2005), impression management bias and social desirability concerns represent potential moderating factors that may undermine the implicit-explicit consistency.

A limitation of the present research is the use of a relatively small sample size in both studies. This may have weakened the power of statistical tests, and thus the probability to detect important effects. A related issue is whether or not to adjust the level of significance of the correlation coefficients, considering the total number of tests that have been performed. This is an appropriate strategy, which would allow to reduce the number of false rejections of the null hypothesis. At the same time, however, it leads to a high Type II error rate, further decreasing the power to detect important effects. In our data, given our samples sizes, correlations would be of at least .40 to reach the statistical significance after a Bonferroni correction. Given the nature of the examined variables, however, correlations of this size are not expected in this study. In the meta-analysis by Barrick et al. (2001), for example, estimated true correlations between the Big Five and various performance measures (after correcting for statistical artifacts) were all lower than .35. We therefore decided to not to apply a Bonferroni correction to our data. Obviously, caution is needed in interpreting results. Future studies should test the robustness of our findings, using larger samples of workers from different work domains. A further drawback of the study is that it is limited to supervisor ratings of job performance. Findings from this research need to be replicated using objective measures of job performance (e.g., Măgurean et al. 2014).

To conclude, one may ask what is the gain to consider implicit measures of the Big Five in standard procedures for personnel selection and assessment. In wondering about the meaning of current results, one may have the impression to face the half-empty or half-full glass dilemma. At a first glance, the implicit Big Five are not better predictors of job performance than traditional self-report measures (i.e. validity coefficients of the implicit traits are not higher than those of explicit traits). Therefore, the required effort for their implementation seems not fully justified by the gain they promise in terms of practical utility. On the other hand, the incremental validity of the IAT seems to provide a justification for their consideration and use. This result attests to the importance of integrating implicit and explicit methods of assessment, for both theoretical and applied purposes. Such an integration might allow us to enhance our understanding of the processes underlying job performance, and to increase the effectiveness of personality tests for personnel testing and selection.

Yet, we warn against premature generalizations. This study represents only a first step towards the application of the implicit measurement of the Big Five in I/O psychology. There is still a long way to go before implicit measures will be introduced as a standard procedure in organizational settings. Empirical evidence needs to be accumulated about various critical issues, that



in last decades of research and practice were raised and discussed with regard to personality questionnaires. Avenues for future research are (1) the examination of the extent to which the criterion validity of implicit traits is stable and generalizable across different job types, (2) applicants' reactions to implicit assessment procedures, and (3) the incremental validity of implicit measures of traits with respect to cognitive measures.

Additional research is needed to elucidate the mechanisms through which implicit measures of personality traits are linked to specific work-related behaviors, as well as the conditions under which these mechanisms operate. Job performance is a multifaceted construct (Viswesvaran and Ones 2000), which seems to be predicted by different combinations of implicit and explicit personality traits. Future studies should aim to understand which dimensions of job performance are best predicted by implicit measures, and which ones are best predicted by explicit measures. Others should examine the moderating role of individual and contextual variables on the relationship between the Big Five IATs and job performance.

A further issue that needs to be addressed is the fakability of Big-Five IATs in organizational settings. Earlier studies have demonstrated that the IAT is more robust to faking and impression management than self-report scales (Schnabel et al. 2006). This does not mean, however, that the IAT is immune to faking. Steffens (2004), for example, showed that conscientiousness and extraversion IATs are less prone to faking than the relative self-report scales, but their susceptibility to response distortion increases when participants have previous experience with the IAT.

Finally, one should consider the optimal level of generality at which the association between implicit traits and job performance should be examined (an issue that in the literature on self-report measures of personality traits has often referred to as the bandwidth-fidelity dilemma). In this regard, it would be desirable to assess the extent to which the use of narrower traits than the Big Five is able to increase the criterion-related validity of implicit measures, as well as their convergence with explicit measures.

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#### Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflict of interest.

**Ethical Approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed Consent** Informed consent was obtained from all individual participants included in the study.

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