

Emotional Intelligence: Psychometric Status and Developmental Characteristics—Comment on Roberts, Zeidner, and Matthews (2001)

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There is now sufficient work in the literature on emotional intelligence to suggest that this construct or series of constructs deserves serious attention, but several questions remain as to adequate construct validation as well as to the emergence and development of these constructs. There is a need to conduct convergent and divergent validity studies on a midlife sample that is likely to show the optimal level of differentiation of the new constructs. The reference domain of cognitive intelligence should be constructed in a multiple-construct manner, and the validation procedure should use confirmatory factor analysis and P. S. Dwyer's (1937) extension method. Once properly validated, there is a need to study the emergence, age differences, and age changes in the level and structure of emotional intelligence. A paradigm that investigates the invariance of factor structure across age and uses the model of differentiation–dedifferentiation would be useful for this purpose.

It is probably true that the recent interest in emotional intelligence (EI) has been prodded by both the self-help movement and the examinations of managerial and other work cultures (Mayer, Salovey, & Caruso, 2000b). Nevertheless, the concept may not be quite as novel as some would think. Its antecedents are found not only in the work of Thorndike (1920), Guilford (1967), and Gardner (1983) but also in other contexts that are less likely to be well known or attended to in the psychometric community. For example, I would like to remind the reader that the concept of judgment, so essential to EI, appears prominently in Binet's classic definition: "To judge well, to comprehend well, to reason well, these are the essentials of intelligence. A person may be a moron or an imbecile if he lacks judgment; but with judgment he could not be either" (Binet & Simon, 1905, p. 106).

Also curiously absent from current historical discussions of EI is the impact of ego psychology, which was developed by early prominent as well as more contemporary psychoanalysts, such as Karl Abraham (1927), Erik Erikson (1964), and Jane Loevinger (1976), in their effort to explore the conscious mechanisms involved in the regulation of emotion. Issues of

self-management and their relation to cognition have also been raised in the effort to extend Piagetian stage theory into adulthood (cf. Schaie, 1977, 1978; Schaie & Willis, 2000, Sinnott, 1996). Finally, I missed any reference to a significant corpus of quite recent work on the topic of wisdom, which clearly involves issues of conscious control of emotions as part of the construct of wisdom (cf. Baltes, Smith, & Staudinger, 1992; Staudinger, Maciel, Smith, & Baltes, 1998).

However, my assignment in this commentary is to focus on the psychometric status of the construct or constructs defining EI and to consider the role of EI in the context of assessing intellectual development over the life span. In this context, I also need to address the hazards of construct validations using a single age group or cross-sectional data, and I need to discuss issues of factorial invariance that are particularly relevant to a construct for which developmental changes in level and structure are to be expected.

In doing so, I agree with Roberts, Zeidner, and Matthews' (2001) contention that it is very difficult to provide a rationale that would justify mapping an EI construct or constructs measured by self-report into the traditional domains of intelligence. My comments therefore are confined to the measurement of EI by means of objective measures that have been subjected to conventional psychometric scrutiny.

Considering the standards proposed by Mayer et al. (2000a), I provisionally stipulate that their first criterion of an operationalized set of emotion-related abili-

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ties has been met reasonably well in the form of the Multi-Factor Emotional Intelligence Scale (Mayer, Caruso, & Salovey, 1999). However, I do remain skeptical about the appropriateness of expert scoring without explicit specification of target criteria. Obviously such criteria would need to be built by a much larger panel of experts rather than by relying solely on the investigators of a single study, and perhaps it would not be inappropriate to propose that an agency like the National Institute on Aging might sponsor a consensus conference for such an important topic. In the absence of commonly agreed-upon target criteria, it may well be necessary in a particular study to rely upon consensus judgments. Given the relatively low k 's reported thus far, it would seem highly advisable to use more than two raters for consensus scoring approaches.

In this commentary, however, I concentrate on Mayer et al.'s (2000a) second and third criteria. Their second criterion is the need to demonstrate that the new emotional abilities be correlated positively to other operational measures of psychometric intelligence (i.e., be contained in a positive manifold with the well-established intellectual abilities). This criterion, of course, only addresses convergent validity and must be supplemented by studies of divergent validity so as to demonstrate that the new emotional abilities are not simply performance measures of well-established personality traits. As I indicated in my introductory remarks, one may also question whether divergent validity analyses are needed to differentiate EI from concepts such as wisdom, social intelligence, ego resiliency, or even some of the concepts that neo-Piagetians propose for a postformal stage (cf. Kramer, 1983).

The third criterion proposes that EI should vary with experience and age. Contrary to Roberts et al. (2001), I suggest that this is an important requirement both for understanding the mechanisms for the origin and life course of EI. Unless it is posited that EI is nothing but a genetically determined trait—and I doubt anyone would take such a position—it is the gene-environment interaction and the developmental timing of EI that would support its potential importance in understanding human intellectual functioning.

If one assumes that EI is an experimentally acquired set of intellectual skills, then one would expect that it should be significantly related to crystallized intelligence and only marginally so to fluid intelligence. However, one would expect that fluid ability levels above a minimum threshold are needed in early

life to develop crystallized skills. I have more to say about this issue later when I discuss the emergence, differentiation, and dedifferentiation of EI.

Conditions Required for the Demonstration of Construct Validity for EI

As suggested above, it is necessary to demonstrate both convergent and divergent validity. Here it should immediately be stressed that it is not sufficient to show that the new abilities reveal moderate positive correlations with an omnibus measure of general intelligence or that low correlations can be demonstrated with overly broad second-order measures of personality. Such correlations would and have been observed between all measures of second- and third-order constructs that are scored in the direction of characteristics viewed as positive or socially desirable in a given culture. What is needed is a test of theoretical models that specify the established primary abilities that are hypothesized to be related to EI and that specify the first-order personality traits that are thought to be unrelated to the newly proposed constructs. However, perhaps some of the advocates of EI may argue that such a completely specified theoretical model of the status of EI within cognitive science is not yet available or is premature. In that case, there are other methods available that can be used to empirically determine how the new constructs project into well-established construct domains, which I expound on below.

Convergent Validity: Relation to Other Forms of Intelligence

As I have indicated above, I suggest that establishing the construct validity of EI by demonstrating moderate correlations with omnibus measures of g , such as the Army Alpha, or for that matter the Air Force Qualifying Test, merely establishes that measures of EI are located in the positive manifold of societally approved competencies. The other Armed Services Vocational Aptitude Battery composites could best be described as aptitude tests that are well established for personnel selection (most relevant to outcome validation of the utility of EI with respect to its practical utility) but are not all that easily translatable into the constructs commonly used to describe the structure of intellect (Carroll, 1993; Horn & Hofer, 1992). Hence, one would prefer a test of convergent validity to be conducted with a currently well-established multidimensional battery of intelligence tests. Such a battery should sample fluid, crystallized, speed, and memory

abilities. An appropriate sampler could easily be obtained from sources such as the Educational Testing Service sampler (Ekstrom, French, Harman, & Derman, 1976). Essential aspects of fluid ability in this context should include measures of inductive reasoning, and essential aspects of crystallized ability should include verbal ability as well as some measure of social intelligence. Although concurrent validity can be examined in a single time-point study, it should be remembered that there has been substantial evidence of cohort differences in the structure of cognitive intelligence (cf. Flynn, 1987; Schaie, 1996). Replication over time will be needed to determine whether the present relationships are time-specific or generalizable over longer time frames.

Divergent Validity: Demonstrating That EI Is Not a Personality Trait

It is equally important to show that a new set of constructs is not simply a reification of an existing domain. In the case of EI, it is therefore essential to show that it is not simply an alternative way of describing already established personality dimensions. Here, one would use a currently well-accepted system of personality trait descriptions such as the NEO. The Trait Self-Description Inventory used by Roberts et al. (2001) seemed to provide an appropriate surrogate to assess the Big Five personality traits. However, because it may be questionable whether one should validate new behavioral constructs with self-report methods, one may suggest supplementation with a more behaviorally oriented measure (cf. Golfried & Kent, 1972). An example of a relevant cognitive style measure is found in the Test of Behavioral Rigidity (Schaie & Parham, 1975). The construct validity of this measure was assessed in relation to a set of multiple intellectual ability constructs (Schaie, Dutta, & Willis, 1991). Another objective personality measure that has been related to personality trait ratings but has not been used much in recent decades is the Color Pyramid Test (Schaie, 1963; Schaie & Heiss, 1964).

Previous behavioral assessments of personality characteristics have been conducted primarily in the context of psychodiagnostics (cf. Burns, 1990; Buss & Craik, 1986; Haynes, 1998), but there is no reason why performance tests of personality might not be helpful in resolving the types of issues raised here.

How Should Construct Validation Proceed?

The state-of-the-art validation procedure originates from the multitrait-multimethod approach long used in validating the construct validity of alternate modes

of assessing personality traits. However, it is now possible to test the hypotheses embodied in such a matrix by means of confirmatory (restricted) factor analysis (cf. Flamer, 1983).

If advocates of the EI constructs would rather not specify the theoretical model required to conduct restricted factor analysis, another more empirically based approach is also available. This approach is called *factor extension analysis* and was first described by Dwyer (1937). More recently, it has been identified as the method of choice in those instances where new measurement instruments are to be projected into existing measurement domains, particularly because it is now considered inappropriate to correlate directly observed measures with composite measures representing latent constructs (Tucker, 1971).

The Dwyer (1937) extension method begins with the correlation matrix that includes measures of the established constructs as well as the new measures (in this case, the EI scores). A confirmatory factor analysis is then conducted in which the factor loadings (and factor variances) identifying the known constructs are fixed to previously established values, and the factor loadings for the new measures are freely estimated. The results then indicate the regression of the EI measures on the ability factor latent constructs.

Differentiation–Dedifferentiation of Ability Structures

The second issue concerns the question of how one may examine the emergence and development of an EI domain over the life span. That is, do the EI dimensions emerge from other ability constructs, and once established, how does their structure unfold or in late life converge once again. In the developmental literature, this structural process has been called the process of differentiation and dedifferentiation of psychological structures. Given that EI is thought to require experience in judgment and management of emotionally relevant content, one may argue that certain fluid skills (e.g., judgment of relations and sequences) may need to attain a level of competence that could be akin to what Piagetians would call *formal operations*. Likewise, children would be expected to develop a vocabulary that includes descriptive terms relevant to judgments and emotional quality before the EI domain could emerge in its own right.

The conceptual basis for the differentiation and dedifferentiation of abilities and cognitive styles comes from the theorizing of Kurt Lewin (1935; also see

Schaie, 1962), and particularly from Heinz Werner (1948), who argued that the cognitive structures of young children were amorphous and undifferentiated but that the process of development would lead to a greater differentiation of distinct mental processes. The reason for the original lack of differentiation seems to be the fact that during early development all psychological processes are heavily dependent on their physiological infrastructures and hence would need to develop in an undifferentiated tandem with the physiological development. As adulthood is reached, however, environmental and experiential phenomena tend to dominate the psychological processes, with far lesser dependence on their physiological bases. However, once late midlife is reached, the decline of sensory motor and central nervous system functions tend to lead to a renewed dependence of individual differences on physiological infrastructures. Hence, a reversal of the earlier differentiation is to be expected as psychological processes increasingly depend on the physiological infrastructure (cf. Baltes & Lindenberger, 1997). This dedifferentiation can be expressed in more modern terms as the progressive decrease of individual differences variance and increase of individual differences covariance.

Evidence for the dedifferentiation phenomenon has been reported in the intelligence literature since the 1940s (e.g., Balinsky, 1941; Cornelius, Willis, Nesselrode, & Baltes, 1983; Garrett, 1946; Reinert, 1970). More recent work has also demonstrated increases in correlations between cognitive sensory functions (e.g., Lindenberger & Baltes, 1994; Salthouse, Hancock, Mainz, & Hambrick, 1996). Much of this work either has been at the level of individual marker variables or has relied heavily on cross-sectional data (e.g., Schaie, Willis, Jay, & Chipuer, 1989). However, there is now work, particularly in the Seattle longitudinal study (Maitland, Intrieri, Schaie, & Willis, 2000; Schaie, Maitland, Willis, & Intrieri, 1998) and in the Victoria longitudinal study (Hultsch, Hertzog, Dixon, & Small, 1998) that suggests that dedifferentiation can also be demonstrated at the latent construct level. These studies also permit direct comparison of longitudinal and cross-sectional dedifferentiation patterns by contrasting covariation of change trajectories across different abilities to dedifferentiation in age-cohort differences.

This issue is particularly germane to the understanding of the development of EI, if it should turn out to be a set of constructs that are located somewhere between the domains of intelligence and personality.

The intellectual ability literature suggests that the ability space is only fully differentiated in early midlife (cf. Schaie, 1996). Likewise, work on the NEO suggests that changes or differences in personality traits may be observed through young adulthood (e.g., Costa & McCrae, 1993; McCrae et al., 1999). The series of personality inventories developed by the Cattell laboratory, culminating in the 16 Personality Factor Questionnaire (16PF; Cattell, Eber, & Tatsuoka, 1970), are characterized by the fact that successive versions of this test measuring personality from childhood to adulthood require an increasing number of first-order personality factors to fully describe individual differences. Decreases in levels of 16PF-like factors with increasing age have also been found in our work for superego strength and threat reactivity (Schaie, 1996).

These findings strongly suggest that, to define the status of EI, construct validity studies would best be conducted with midlife samples and that the emergence and change of the EI constructs, once properly validated, should be conducted over different age ranges. Specifically, I argue, that as is the case in other psychological domains, optimal differentiation of the EI constructs is not likely to be found in a sample of late teens to young adults, which is restricted to a particular range of education and occupational pursuit. I also argue that given differential societal role distributions, attention should be paid to possible Age \times Gender interactions in the measures of the new constructs (cf. Maitland et al., 2000).

A first approximation of a test of structure changes can and should be conducted with cross-sectional data (cf. Schaie et al., 1989). A more definitive test will, of course, eventually require longitudinal data (cf. Schaie et al., 1998). The articles referred to here provide examples of how factorial invariance should be assessed. Further theoretical rationales and practical guidelines for the study of factorial invariance may be found in Horn and McArdle (1992) and in Meredith (1993).

Conclusion

There is now sufficient work in the EI literature to suggest that this construct or series of constructs deserve serious attention. However, as the systematic efforts of Roberts et al. (2001) have shown, several questions remain that must be answered before EI can attain full scientific respectability. I have suggested that in addition to the issues raised by these investigators, there is a need to conduct convergent and di-

vergent validity studies on a midlife sample that is likely to show the optimal level of differentiation of the new constructs. The reference domain of cognitive intelligence should be constructed in a multiple-construct manner. Also, the personality variables chosen to test divergent validity should be supplemented by behavioral personality measures. The validation study or studies should use confirmatory factor analysis, either with a theoretically specified convergence-divergence hypothesis matrix or by empirical determination of the status of the constructs when projected into existing domains by means of Dwyer's (1937) extension method.

Once properly validated, there is a need to study the emergence, age differences, and age changes in the level and structure of EI. A paradigm that investigates the invariance of factor structure across age, and that uses the model of differentiation-dedifferentiation previously examined in cognitive intelligence, would be useful for this purpose.

References

- Abraham, K. (1927). *Selected papers on psychoanalysis*. London: Hogarth Press.
- Balinsky, B. (1941). An analysis of the mental factors of various age groups from nine to sixty. *Genetic Psychology Monographs*, 23, 191-234.
- Baltes, P. B., & Lindenberger, U. (1997). Emergence of a powerful connection between sensory and cognitive functions across the adult life span: A new window to the study of cognitive aging? *Psychology and Aging*, 12, 12-21.
- Baltes, P. B., Smith, J., & Staudinger, U. (1992). Wisdom and successful aging. In T. Sonderegger (Ed.), *Psychology and aging: Nebraska symposium on motivation, 1991* (pp. 123-167). Lincoln: University of Nebraska Press.
- Binet, A., & Simon, T. (1905). *Methodes nouvelles pour le diagnostic du niveau intellectuel des anormaux* [New methods for the diagnosis of intellectual levels in abnormal persons]. *L'Annee Psychologique*, 11, 102-191.
- Burns, G. L. (1990). Affective-cognitive-behavioral assessment: The integration of personality and behavioral assessment. In G. H. Eifert & I. M. Evans (Eds.), *Unifying behavior therapy: Contributions of paradigmatic behaviorism* (pp. 98-125). New York: Springer.
- Buss, D. M., & Craik, D. H. (1986). Acts, dispositions, and clinical assessment: The psychopathology of everyday conduct. *Clinical Psychology Review*, 6, 387-406.
- Carroll, J. B. (1993). *Human cognitive abilities: A survey of factor-analytic studies*. New York: Cambridge University Press.
- Cattell, R. B., Eber, H., & Tatsuoka, M. M. (1970). *Handbook for the 16PF*. Champaign, IL: Institute for Personality and Ability Testing.
- Cornelius, S. W., Willis, S. L., Nesselroade, J. R., & Baltes, P. B. (1983). Convergence between attention variables and factors of psychometric intelligence in older adults. *Intelligence*, 7, 253-269.
- Costa, P. T., Jr., & McCrae, R. R. (1993). Stability and change in personality from adolescence through adulthood. In C. A. Halverson, G. A. Kohnstamm, & R. P. Martin (Eds.), *The developing structure of temperament and personality from infancy to adulthood*. Hillsdale, NJ: Erlbaum.
- Dwyer, P. S. (1937). The determination of the factor loadings of a given test from the known factor loadings of other tests. *Psychometrika*, 2, 173-178.
- Ekstrom, R. B., French, J. W., Harman, H., & Derman, D. (1976). *Kit of factor-referenced cognitive tests* (Rev. ed.). Princeton, NJ: Educational Testing Service.
- Erikson, E. H. (1964). *Insight and responsibility*. New York: Norton.
- Flamer, S. (1983). Assessment of the multitrait-multimethod matrix validity of Likert scales via confirmatory factor analysis. *Multivariate Behavioral Research*, 18, 275-308.
- Flynn, J. R. (1987). Massive gains in 14 nations: What IQ tests really measure. *Psychological Bulletin*, 101, 171-191.
- Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. New York: Basic Books.
- Garrett, H. E. (1946). A developmental theory of intelligence. *American Psychologist*, 1, 372-378.
- Golfried, M. R., & Kent, R. N. (1972). Traditional versus behavioral personality assessment: A comparison of methodological and theoretical assumptions. *Psychological Bulletin*, 77, 409-420.
- Guilford, J. P. (1967). *The nature of human intelligence*. New York: McGraw-Hill.
- Haynes, S. N. (1998). The changing nature of behavioral assessment. In A. S. Bellack & M. Hersen (Eds.), *Behavioral assessment: A practical handbook* (4th ed., pp. 1-21). Needham Heights, MA: Allyn & Bacon.
- Horn, J. L., & Hofer, S. M. (1992). Major abilities and development in the adult period. In R. J. Sternberg & C. A. Berg (Eds.), *Intellectual development* (pp. 44-99). Cambridge, England: Cambridge University Press.
- Horn, J., & McArdle, J. J. (1992). A practical and theoretical guide to measurement invariance in aging research. *Experimental Aging Research*, 18, 117-144.
- Hultsch, D. F., Hertzog, C., Dixon, R. A., & Small, B. J. (1998). *Memory changes in the aged*. New York: Cambridge University Press.

- Kramer, D. A. (1983). Post-formal operations? A need for further conceptualization. *Human Development*, 26, 91–105.
- Lewin, K. (1935). *Dynamic theory of personality*. New York: McGraw-Hill.
- Lindenberger, U., & Baltes, P. B. (1994). Sensory functioning and intelligence in old age. *Psychology and Aging*, 9, 339–355.
- Loevinger, J. (1976). *Ego development: Conception and theory*. San Francisco: Jossey-Bass.
- Maitland, S. B., Intrieri, R. C., Schaie, K. W., & Willis, S. L. (2000). Gender differences and changes in cognitive abilities across the adult life span. *Aging, Neuropsychology, and Cognition*, 7, 32–53.
- Mayer, J. D., Caruso, D., & Salovey, P. (1999). Emotional intelligence meets traditional standards for an intelligence. *Intelligence*, 27, 267–298.
- Mayer, J. D., Salovey, P., & Caruso, D. (2000a). Competing models of emotional intelligence. In R. J. Sternberg (Ed.), *Handbook of human intelligence* (2nd ed., pp. 396–420). New York: Cambridge University Press.
- Mayer, J. D., Salovey, P., & Caruso, D. (2000b). Emotional intelligence as *Zeitgeist*, personality, and as mental ability. In R. Bar-On & J. D. A. Parker (Eds.), *The handbook of emotional intelligence* (pp. 92–117). New York: Basic Books.
- McCrae, R. R., Costa, P. T., Jr., de Lima, M. P., Simoes, A., Ostendorf, F., Angleitner, A., Marusic, I., Bratko, D., Caprara, G. V., Barbaranelli, C., Chae, J. H., & Piedmont, R. L. (1999). Age differences in personality across the adult life span: Parallels in five cultures. *Developmental Psychology*, 35, 466–477.
- Meredith, W. (1993). Measurement invariance, factor analysis, and factorial invariance. *Psychometrika*, 58, 525–543.
- Reinert, G. (1970). Comparative factor analytic studies of intelligence through the human life span. In L. R. Goulet & P. B. Baltes (Eds.), *Life-span developmental psychology: Research and theory* (pp. 468–485). New York: Academic Press.
- Roberts, R. D., Zeidner, M., & Matthews, G. (2001). Does emotional intelligence meet traditional standards for an intelligence? Some new data and conclusions. *Emotion*, 1, 196–231.
- Salthouse, T. A., Hancock, H. E., Meinz, E. J., & Hambrick, D. Z. (1996). Interrelations of age, visual acuity, and cognitive functioning. *Journal of Gerontology: Psychological Sciences*, 51B, P317–P330.
- Schaie, K. W. (1962). A field-theory approach to age changes in cognitive behavior. *Vita Humana*, 5, 129–141.
- Schaie, K. W. (1963). The Color Pyramid Test: A nonverbal technique for personality assessment. *Psychological Bulletin*, 60, 530–547.
- Schaie, K. W. (1977–1978). Toward a stage theory of adult cognitive development. *International Journal of Aging and Human Development*, 9, 129–138.
- Schaie, K. W. (1996). *Intellectual development in adulthood: The Seattle longitudinal study*. New York: Cambridge University Press.
- Schaie, K. W., Dutta, R., & Willis, S. L. (1991). The relationship between rigidity–flexibility and cognitive abilities in adulthood. *Psychology and Aging*, 6, 371–383.
- Schaie, K. W., & Heiss, R. (1964). *Color and personality*. Bern, Switzerland: Huber.
- Schaie, K. W., Maitland, S. B., Willis, S. L., & Intrieri, R. L. (1998). Longitudinal invariance of adult psychometric ability factor structures across 7 years. *Psychology and Aging*, 13, 8–20.
- Schaie, K. W., & Parham, I. A. (1975). *Manual for the Test of Behavioral Rigidity*. Palo Alto, CA: Consulting Psychologists Press.
- Schaie, K. W., & Willis, S. L. (2000). A stage theory model of adult cognitive development revisited. In R. Rubinstein, M. Moss, & M. Kleban (Eds.), *The many dimensions of aging: Essays in honor of M. Powell Lawton* (pp. 175–193). New York: Springer.
- Schaie, K. W., Willis, S. L., Jay, G., & Chipuer, H. (1989). Structural invariance of cognitive abilities across the adult life span: A cross-sectional study. *Developmental Psychology*, 25, 652–662.
- Sinnott, J. D. (1996). The developmental approach: Post-formal thought as adaptive intelligence. In F. Blanchard-Fields & T. Hess (Eds.), *Perspectives on cognitive change in adulthood and aging* (pp. 358–383). New York: McGraw-Hill.
- Staudinger, U. M., Maciel, A. G., Smith, J., & Baltes, P. B. (1998). What predicts wisdom-related performance? A first look at personality, intelligence, and facilitative experiential contexts. *European Journal of Personality*, 12, 1–17.
- Thorndike, E. L. (1920). Intelligence and its use. *Harper's Magazine*, 140, 227–235.
- Tucker, L. R. (1971). Relations of factor score estimates to their use. *Psychometrika*, 36, 427–436.
- Werner, H. (1948). *Comparative psychology of mental development*. New York: International Universities Press.

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