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Null sex differences in general intelligence among elderly

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ABSTRACT

The *g* factor is common to a wide set of cognitive abilities and it is usually considered the most important predictor of success both in academia and everyday life. The information provided by summary intelligence scores, such as IQ, may or may not involve the *g* factor. This must be explicitly tested. With this main purpose in mind here we analyzed the Italian standardization sample of the Wechsler Adult Intelligence Scale-Revised (WAIS-R) for aged individuals, which was administered to 1168 healthy older adults from 65 to 84 years (584 men and 584 women). Their mean education was equivalent to 6.0 years of formal schooling (SD = 3.6). The average sex difference in FSIQ was equivalent to 7 IQ points favouring men. However, Multi-Group Confirmatory Factor Analysis revealed a null average sex difference in *g*.

1. Introduction

Intelligence is a strong predictor of life achievements (Deary, Strand, Smith, & Fernandes, 2007) and it is also a biologically rooted factor (Ebisch et al., 2012, 2013; Perfetti et al., 2009). There are reports showing a small average sex difference in general intelligence favoring men (Irwing, 2012; Nyborg, 2003). Lynn (1999) reasoned that a men advantage can be predicted from their larger brains because general intelligence is positively correlated with brain size (McDaniel, 2005; Nyborg, 2003; Rushton & Ankney, 2009). However, there are reports finding a null or negligible sex difference in *g* (e.g. Aluja-Fabregat, Colom, Abad, & Juan-Espinosa, 2000; Colom, Garcìa, Juan-Espinosa, & Abad, 2002; Colom, Juan-Espinosa, Abad, & Garcìa, 2000; Jensen, 1998).

There are several methods for analyzing sex differences in *g* (see, for example, Dolan, 2000; Nyborg, 2003) but multi-group covariance and mean structure modeling (MGCMSA) seems to be especially appropriate. MGCMSA allows the determination of the level by which the factor structure of a test is invariant (factor patterns, means or variances of unique factors) but also if the constructs measured by the specific test and its theoretical framework have the same validity across groups (Meredith, 1993). Using this modeling approach, Dolan et al. (2006) found that sex differences in performance on the standardization of the WAIS-III for Spain favoured men and were mainly due to Perceptual Organization (PO) and Working Memory (WM) rather than to the general factor of intelligence (*g*). Irwing (2012) analyzed the US standardization sample of the WAIS-III finding a small average advantage for men in the general factor of intelligence equivalent to 3 IQ points. Surprisingly, Irwing found that women showed a large advantage in Processing Speed.

It has been suggested that previously documented sex differences in cognitive abilities are disappearing (Colom, Quiroga, & Juan-Espinosa, 1999). Thus, for instance, studies published before 1973 for verbal ability reported an effect size of .23 (e.g., Maccoby & Jacklin, 1974), while studies published after 1973 have shown an effect size of .10 (Hyde & Linn, 1988). Similarly, math performance revealed an effect size of .31 for studies published before 1973 and of .14 for those published afterwards (Hyde, Fennema, & Lamon, 1990). Nevertheless, the meta-analytic review published by Hedges and Nowell (1995) concluded that "average (sex) differences do not appear to be decreasing, but are relatively stable across the 32-year period investigated" (p. 45).

Regarding the age variable, Kaufman, Kaufman-Packer, McLean, and Reynolds (1991) compared men and women on the Wechsler Adult Intelligence Scale-Revised (WAIS-R) to determine differences in crystallized and fluid abilities across the adult life-span. They concluded that men and women preserve their crystallized abilities through old age, but fluid ability shows a systematic decline. Meinz and Salthouse (1998) published a meta-analysis comprising 25 studies (5201 Ss between 18–64 years) for investigating sex differences in the patterns of age–cognition relations. Only a small

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number of measures (speed and reasoning) showed age–sex significant interactions: men had smaller age-related declines. Sex differences were quite small and only spatial abilities demonstrated a large sex gap favoring men.

In a 20-year longitudinal study of octogenarians, Blum, Fosshage, and Jarvik (1972) observed several changes in a battery of tests (Similarities, Digits Forward, Digits Backward, Digit Symbol Substitution, and Block Design of Wechsler Bellevue, a Vocabulary test, and a Tapping test). Women had higher mean scores than men on all tests except Digits Forward and Digits Backward. Sex differences were statistically significant for Tapping and Digit Symbol Substitution. After 20-years, the follow-up showed that women maintained their advantage. Further, men showed a greater rate of decline than women on all tests except Digit Symbol Substitution and Tapping. The authors concluded that this greater decline may reflect the earlier morbidity and mortality of men. Similarly, Larrabee and Crook (1993) observed that women show less decline in delayed recall than men. However, Finkel, Reynolds, McArdle, Gatz, and Pedersen (2003) failed to find sex differences in the rate of change.

Aartsen, Martin, and Zimprich (2004) studied cognitive changes in 1553 aged individuals. No sex differences in information processing speed and nonverbal reasoning were observed. Also the rate of cognitive decline was not significantly different for men and women. The Seattle Longitudinal Study examined adult cognitive functioning for approximately 40 years and the sample (982 Ss) was divided in three age groups (younger, middle, and older adults). Maitland, Intrieri, Schaie, and Willis (2000) provided one of the few examinations of sex differences and longitudinal changes (over 7 years) in latent cognitive abilities for the entire adult life span, using structural equation modeling. Their results revealed substantial sex and time invariance.

Here we study a large group of elderly participants taken from the Italian standardization sample of the Wechsler Adult Intelligence Scale-Revised (Orsini & Laicardi, 2003) using Multi-Group Confirmatory Factor Analysis (MG-CMSA). This was the main research question: are there average sex differences in general intelligence (*g*) among elderly populations?

2. Method

2.1. Participants

The Italian version of the Wechsler Adult Intelligence Scale-Revised was administered to 1168 healthy old adults (584 men and 584 women, age range from 65 to 84 years) (Orsini & Laicardi, 2003). Their mean number of years of education was 6.0 (SD = 3.6). Further information can be found in the test manual (Orsini & Laicardi, 2003). A *t*-test was carried on to test if there is a significant age difference between men and women in our sample. The *t*-test resulted not significant ($t = -.94$, $df = 1166$, $p = .345$).

2.2. Analyses

We applied MGCFA assuming that each subtest measures the common general latent factor of intelligence (*g*). Fig. 1 shows the considered model.

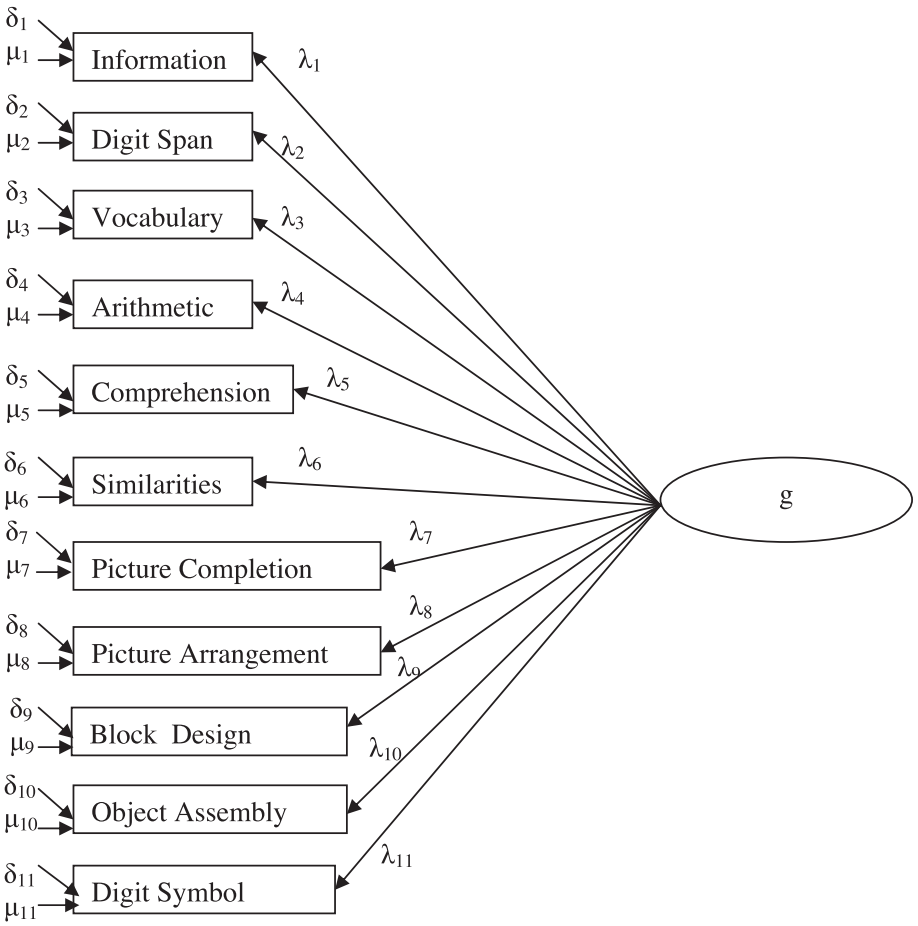

Fig. 1. Model testing for measurement invariance between women and men. *g* is the latent endogenous variable; λ_i are factor loadings; δ_i are residual variances of the observed variables; μ_i are intercepts ($N = 1168$).