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The relationship between date of birth and individual differences in personality and general intelligence: A large-scale study

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Abstract

We investigated the relationship between date of birth and individual differences in personality and intelligence in two large samples. The first sample consisted of 4000+ middle-aged male subjects from the Vietnam Experience Study; personality was measured by the MMPI items converted to EPQ (scales) and a large battery of cognitive tests were factored to derive general intelligence, *g*. The second sample consisted of 11,000+ young adults from the National Longitudinal Study of Youth from 1979. *g* was extracted from the ten subtests of the Armed Services Vocational Aptitude Battery.

In no cases did date of birth relate to individual differences in personality or general intelligence.

A further goal was to test Eysenck's notion of possible relationships between date of birth and the popular Sun Signs in astrology. No support could be found for such associations.

We conclude that the present large-scale study provides no evidence for the existence of relevant relationships between date of birth and individual differences in personality and general intelligence.

Keywords: Astrology; Intelligence; Personality; Date of birth; Seasonal variation

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1. Introduction

Several studies have investigated the relationship between date of birth and individual differences in personality or general intelligence but, in general, these studies are based on small sample sizes. Only a couple of newer studies by Chotai, Forsgren, Nilsson, and Adolfsson (2001) and by Chotai, Lundberg, and Adolfsson (2003), operate with appropriate sample sizes (i.e. 2130 and 1145 subjects, respectively). The present study circumvents the inherent problems with small samples by combining two unusually large populations to a total of more than 15,000 subjects. To optimise the chances of finding even remote relationships between date of birth and individual differences in personality and intelligence we further applied two different strategies. The first one was based on the common chronological concept of time (e.g. month of birth and season of birth). The second strategy was based on the (pseudo-scientific) concept of astrology (e.g. Sun Signs, The Elements, and astrological gender), as discussed in the book "Astrology: Science or superstition?" by Eysenck and Nias (1982).

A thorough review of the scientific literature is beyond the scope of this article since the voluminous literature dates back to the forties, but it is worth noting that many relationships have been established between date of birth and normal intelligence, personality, and also with psychiatric diseases and differences in physical attributes (Chotai et al., 2001; Joinson & Nettle, 2005). This present study limits itself to examining associations between date of birth, personality, and general intelligence.

1.1. Intelligence

A series of articles suggest that subjects born during spring or summer are significantly more intelligent than subjects born during the rest of the year, though the differences are small (e.g. Bibby, Lamb, Leyden, & Wood, 1996; Eysenck, 1995; Eysenck & Nias, 1982; Pintner & Forlano, 1943). We found no post-1996 studies suggesting that date of birth is related to intelligence, but based on the early reports we expected to find a small but significant difference in intelligence in favour of subjects born during the spring or summer time.

1.2. Personality

A complete review of this topic is also beyond the scope of the present report so, with one exception, we emphasise studies from the past decade.

Forlano and Ehrlich (1941) studied the relationship between date of birth and personality and found that subjects scoring high on Extraversion (E) and low on Neuroticism (N) were more prone to be born during the colder months of the year. Gupta (1992) used the Hindi version of the EPI on 104 subjects (27–38 years of age) and the I_6 reports that people born during the summer score higher on Neuroticism than subjects born during winter or autumn, and lower on Impulsiveness than subjects born during spring and autumn. Moreover, subjects born during summer and winter appeared more Venturesome than subjects born during spring or autumn.

Chichilenko and Barbarash (2001) studied 154 male 17–20 year old young adults and found that those born during winter, in general, scored significantly higher on Neuroticism N than those born during autumn, who again scored significantly higher than those born during summer. The female subjects ($N = 373$) born during winter or summer scored significantly higher on N than those born during spring. With respect to Extraversion E, males and females born during autumn scored significantly higher than those born during summer.

A series of more recent and large-scale studies (Chotai et al., 2001; Chotai, Jonasson, Hägglöf, & Adolfsson, 2002; Chotai et al., 2003) used the TCI to measure personality, in order to discover differences in Novelty Seeking (NS) as a function of date of birth. These studies show that younger subjects (below the age of 25) born during winter (October–January/March) are in general significantly more likely to score high on NS, than subjects born during the rest of the year (Chotai et al., 2002, 2003). However, for subjects above the age of 25, the picture is reversed. In general, subjects born during winter show lower NS scores than subjects born during the rest of the year or during spring only (February–April). (*A certain overlap between some winter and spring months could be noted only in this presentation of the literature and is due to the summarizing nature of the present review*) (Chotai et al., 2001; Chotai et al., 2003). However, the inverted relationship was more pronounced in females. Furthermore, the three studies by Chotai and colleagues found that older males born during winter scored significantly lower on Persistence (PS) than others (Chotai et al., 2001); and that younger subjects born during spring scored significantly lower on Self Directedness (SD) than others (Chotai et al., 2002); and lastly that subjects born during winter scored significantly higher on Harm Avoidance (HA) than others (Chotai et al., 2003).

Joinson and Nettle (2005) tested 448 subjects with a measure related to NS, namely Zuckerman's Sensation Seeking (SS) scale, and found that subjects aged 20–45 born during October–March scored significantly higher on SS than others, while subjects aged 46–69 and born during October–March scored lower than subjects born during the rest of the year.

All together the results suggest that there are individual differences in NS or SS or E as a function of month or season of birth, and that they vary as a function of age and gender. The present study operates with Eysenckian personality dimensions (EPQ), and can therefore approach the alleged relationship using alternative personality scales to test whether findings are valid across instruments. The EPQ factors have been found to be related to the TCI and ZKPQ from the Zuckerman and Kuhlman's Personality Questionnaire (see Zuckerman & Cloninger, 1996). Based on the positive correlations between Novelty Seeking, Psychoticism (P), and Extraversion (E) we expected to find differences in E and P as a function of date of birth. Other TCI factors, which have also been found to be associated with date of birth, are also related to the EPQ. For instance, Persistence is negatively related to Psychoticism; Self Directedness is related negatively to Psychoticism and Neuroticism. Finally, Harm Avoidance is negatively related to Extraversion and positively to Neuroticism (Zuckerman & Cloninger, 1996). Based on the previous findings and presuming that the instruments applied relate to Eysenck's factors, it seems reasonable to expect that the present study will confirm a relationship between date of birth and individual differences in personality.

1.3. Astrology

Several reviews of the literature on astrology (Dean, Nias, & French, 1997; Eysenck & Nias, 1982) show, in general, little support for any claim of an effect of astrology. As highlighted by Dean et al. (1997), the effect sizes of astrologer's judgment amount to no more than 0.05, indicating very little practical relevance of astrology. When astrological effects are in fact observed, they

Table 1
Translation of Sun Signs to Elements and gender

Sun Sign	From (dd-mm)	To (dd-mm)	Element	Gender
Aries	22-03	18-04	Fire	Masculine
Taurus	22-04	19-05	Earth	Feminine
Gemini	23-05	19-06	Air	Masculine
Cancer	23-06	20-07	Water	Feminine
Leo	24-07	21-08	Fire	Masculine
Virgo	25-08	21-09	Earth	Feminine
Libra	25-09	21-10	Air	Masculine
Scorpio	25-10	20-11	Water	Feminine
Sagittarius	24-11	19-12	Fire	Masculine
Capricorn	23-12	18-01	Earth	Feminine
Aquarious	22-01	17-02	Air	Masculine
Pisces	20-02	18-03	Water	Feminine

usually can be explained better by non-astrological factors like the Barnum effect (i.e. the "*...tendency for people to identify with personality descriptions of a general and vague nature...*") or by acquaintance with Sun Signs and so on (Eysenck & Nias, 1982, p. 43). More recently, Clarke, Gabriels, and Barnes (1996) conducted a study on the effect of astrology in a sample of 190 subjects, testing two hypotheses. First, subjects born with the sun, moon and/or ascendant in positive signs (or the masculine gender) will be more extraverted than subjects born with these planets in the negative signs (feminine gender). Second, subjects born with the three planets in water signs will be more emotional than subjects born in non-water signs (confer with Table 1 showing which Sun Signs correspond to which Elements and astrological gender). Several *t*-tests indicated that subjects born with the sun and the moon in positive signs (masculine gender) were in fact more extraverted than subjects born with the sun and moon in negative signs. However, the significant *p*-values (about 0.03) would loose their significance had the authors used the Bonferroni correction to compensate for multiple testing.

Based on these results we did not expect to find relevant relationships between astrology (Sun Signs, Elements and astrological gender) and individual differences in general intelligence and personality.

2. Methodology

2.1. Subjects

We drew subjects from two sources. First, archival data from the Vietnam Experience Study (VES) were kindly provided by Centers for Disease Control (1988, 1989). The purpose of the VES study (to assess possible long term effect of military service for male veterans), the subjects ($N = 4462$) and the test instruments used have been described in details elsewhere (Centers for Disease Control, 1988, 1989; Nyborg & Jensen, 2000, 2001). The VES sample is fairly representative of the US male population with respect to education, income, occupation, and race. However, subjects scoring below the 10th percentile in the pre-induction cognitive aptitude test were excluded, in accordance with a US Congress mandate, and this obviously truncates the lower-end tail of the ability distribution. For the present purpose we included a total of 4321 middle-aged male subjects in the analysis of month of birth and season of birth (see below). The veterans were inducted during 1965–71 (mean age = 19.92; SD = 1.72) and re-tested in 1985–86 (at mean age = 38.35; SD = 2.52) with a mean testing (span = 17.90; SD = 1.86). Intelligence was measured twice—at induction and during re-testing, whereas personality was monitored only at retesting.

Second, further data was drawn from the National Longitudinal Study of Youth 1979 (NLSY1979; NLSY1979 User's Guide, 2004). The purpose of this study, the subjects, and the instruments used have been described elsewhere (Evans, 1999; Legree, Pifer, & Grafton, 1996). The sample comprised of 11,448 young adult subjects (male N = 5749, female N = 5699). Age ranged between 15 and 24 years (mean age = 19.6; SD = 2.26).

2.2. Instruments

2.2.1. The VES study

2.2.1.1. Intelligence. Principal Component Analysis (PCA) was conducted on 19 cognitive variables (Grooved Pegboard Test, *left and right hand*; Paced Auditory Serial Addition Test; Rey-Osterrieth Complex Figure Drawing, *direct copy*, *immediate recall and delayed recall*; Wechsler Adult Intelligence Scale-Revised, *general information and block design*; Word List Generation Test; Wisconsin Card Sort Test; Wide Range Achievement Test; California Verbal Learning Test; Army Classification Battery, *verbal and arithmetic reasoning*, *administrated twice*; Pattern Analysis Test; General Information Test; Armed Forces Qualification Test).

The First Principal Component (PC1) was extracted to reflect general intelligence, and the *g* factor scores were used to estimate individual ability level.

2.2.1.2. Personality. The VES database also contained clinical MMPI-II data. Following the guidelines by Gentry, Wakefield, and Friedman (1985) we derived the four Eysenckian Personality dimensions: Psychoticism (P), Extraversion (E), Neuroticism (N), and Social Desirability (L: Lie scale). The reliabilities of the scales were: P ($\alpha = 0.74$), E ($\alpha = 0.60$) and N ($\alpha = 0.92$). These values are acceptable, but the L ($\alpha = 0.32$) reliability was too low. Thus, L scale results must be interpreted with caution.

2.2.1.3. Date of birth (VES). Five different indicators of date of birth were computed based on the birth dates of the subjects:

(a) *Month of Birth*: The month during which the subject was born (January, February, etc.).
(b) *Season of Birth*: Seasons of birth was somewhat rather arbitrary defined as: Spring (March–May), Summer (June–August), Fall (September–November) and Winter (December–February).
(c) *Extended Winter vs. Summer*: A cosinur analysis by Chotai et al. (2002, 2003) investigated whether any systematic fluctuations could be fitted to a cosines curve (~). The results suggested systematic cosines fluctuations from "Extended Winter" (October–March) to

"Extended Summer" (April–September). Based on these findings it was decided to construct two groups (Extended Winter/Summer) in order to investigate any seasonal differences based on this division of the year obtained from Chotai et al. (2002, 2003) studies.

(d) *Extended Spring vs. Fall*: Chotai et al. (2003) further suggest that the months January–June (Extended Spring) could be different from July–December (Extended Fall).

(e) *Sun Sign*: The astrological Sun Sign is the commonly known star sign based on the place of the sun in relation to the date of birth of the subject. This Sun Sign is commonly associated with different attributes for different signs (Eysenck & Nias, 1982, for details). Where one Sun Sign stops and another starts is not completely agreed upon among astrologers, due to slightly different methods of estimating an individual Sun Sign. This leads to minor differences in the dates used to incorporate people into certain Sun Signs, typically diverging by 1 day across methods. In order not to risk inclusion of subjects in an incorrect Sun Sign group, it was decided to exclude subjects born on the day, the day before, and the day after any of these division points provided by the two methods. This resulted in a gap of ca. 2–3 days around a division point from which subjects were excluded (see Table 1 for illustration). This conservative categorisation reduced the number of subjects for Sun Signs analysis from 4321 to 4054.

(f) *Sun Sign associated with an Element* (*i.e. fire*, *water*, *air*, *and earth*): Subjects assigned to a Sun Sign group were also assigned to an Element group (see Table 1 for details).

(g) *Sun Sign associated with astrological gender* (*i.e. masculine/feminine*): Subjects assigned to a sun sign group were also assigned to a gender group (see Table 1 for elaborations).

2.2.2. The NLSY1979 study

2.2.2.1. Intelligence. A Principal Axis Factoring (PAF) was conducted on the 10 subtests of the Armed Services Vocational Aptitude Battery (ASVAB): (General Science; Arithmetic Reasoning; Word Knowledge; Paragraphs Comprehension; Numerical Operations; Coding Speed; Automobile and Shop Information; Mathematics Knowledge; Mechanical Comprehension; Electronics Information). The first Principal Axis Factor (PAF1) was applied to derive general intelligence, g, and the g factor scores were then used as an estimate of individual g.

2.2.2.2. Personality. We did not have access to personality data for NLSY1979 subjects.

2.2.2.3. Date of birth (NLSY1979). As NLSY1979 study only provides the month of birth of the subjects, we were restricted to perform analyses based on month of birth, season of birth, Extended Spring vs. Fall, and Extended Winter vs. Summer.

2.3. Statistical evaluation

For all analyses the conventional alpha value of 0.05 (two tailed) was used.

2.3.1. The VES study

The four personality factors and the PC1 scores were entered one by one as the dependent variables in an ANCOVA design, while controlling for the remaining four variables and the chronological age of the subjects. The categorical predictor variables were the seven indicators of date of birth, namely month of birth (12 groups), season of birth (four groups), Extended Spring vs. Fall (two groups), Extended Summer vs. Winter (two groups), Sun Sign (12 groups), Elements (four groups), and astrological gender (two groups). This resulted in a total of seven times five ANCOVA's.

2.3.2. The NLSY1979 study

Only four ANCOVA's were performed with the PAF1 score as the dependent variable and month of birth, season of birth, Extended Spring vs. Fall, Extended Summer vs. Winter served as categorical predictor variables while controlling for age.

3. Results

Due to the space limitation only figures for the relationship between the dependent variable (personality and general intelligence) and month of birth are reported, since the other results are categorizations of these, and can accordingly to some extent be derived from these. Furthermore, all significant relationships are also reported.

3.1. The VES study

As can be seen from Figs. 1–6, out of 35 analyses only one reached the specified level of significance (see Figs. 1–6). This was for Extended Spring vs. Fall (Fig. 6), but the difference amounted

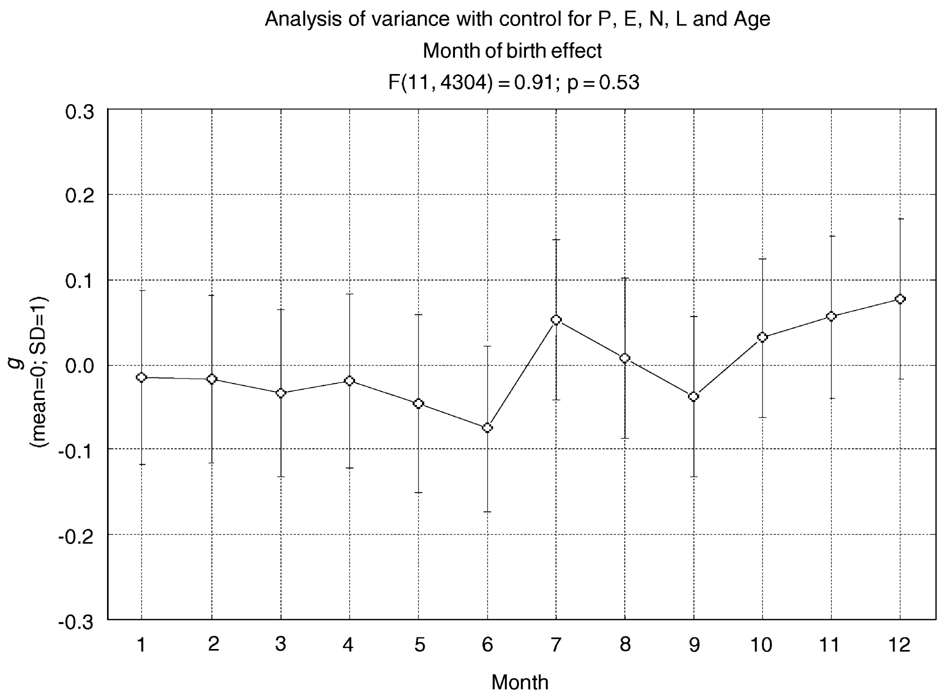

Fig. 1. Predicting general intelligence *g* (PC1) from month of birth.

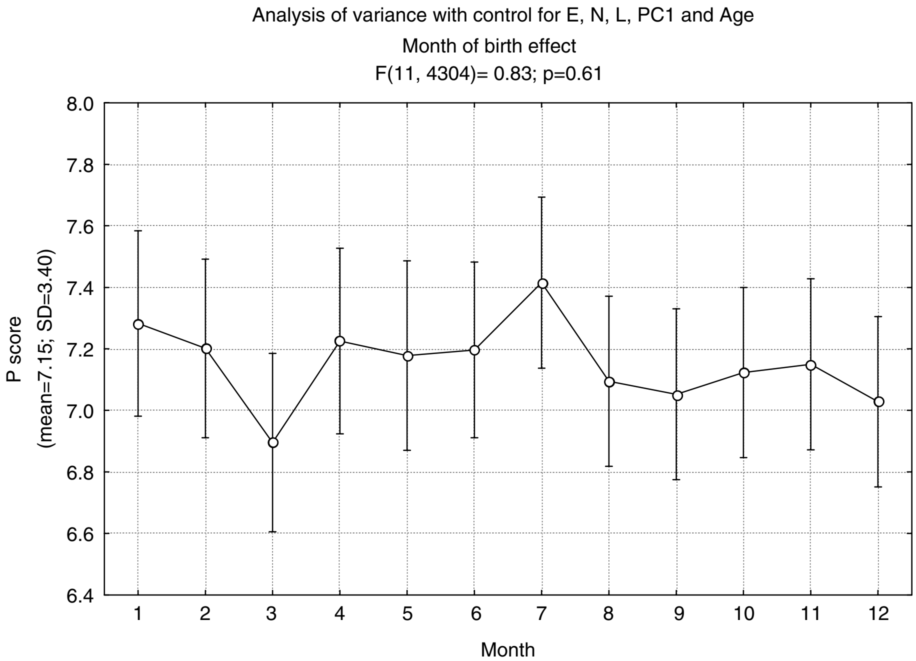

Fig. 2. Predicting Psychoticism (P) from month of birth.

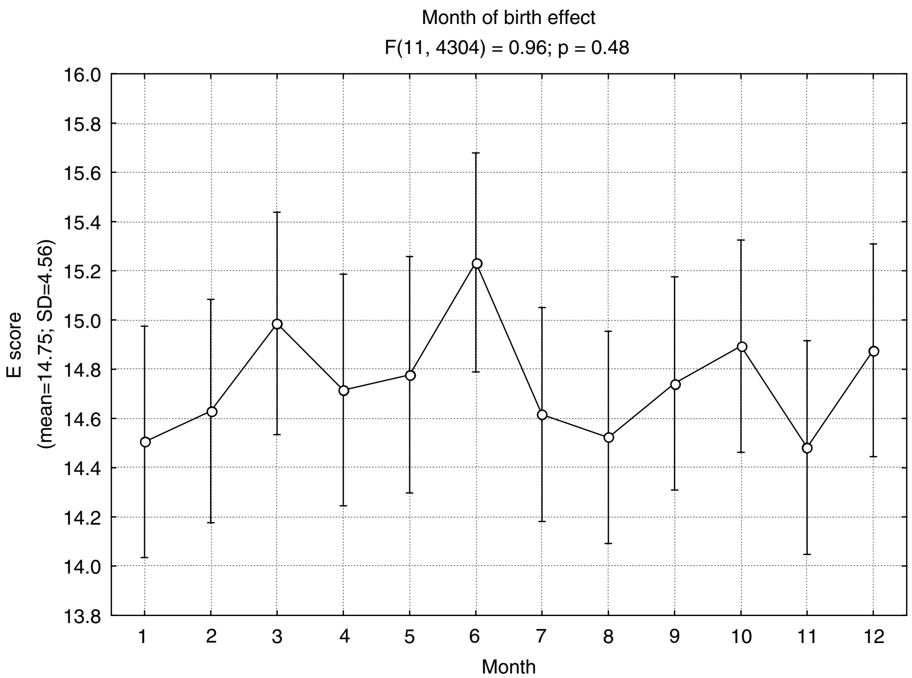

Fig. 3. Predicting Extraversion (E) from month of birth.

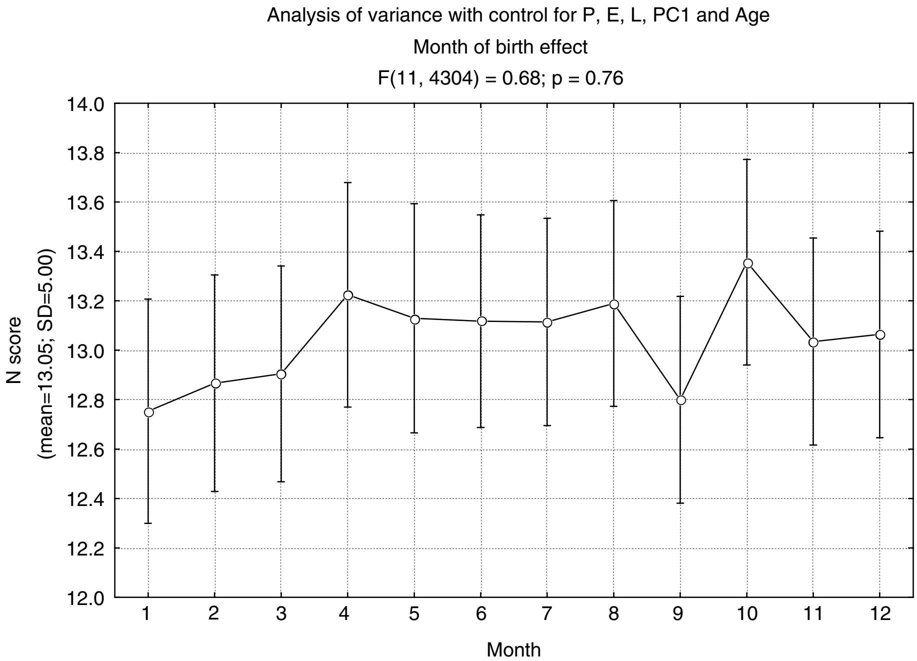

Fig. 4. Predicting Neuroticism (N) from month of birth.

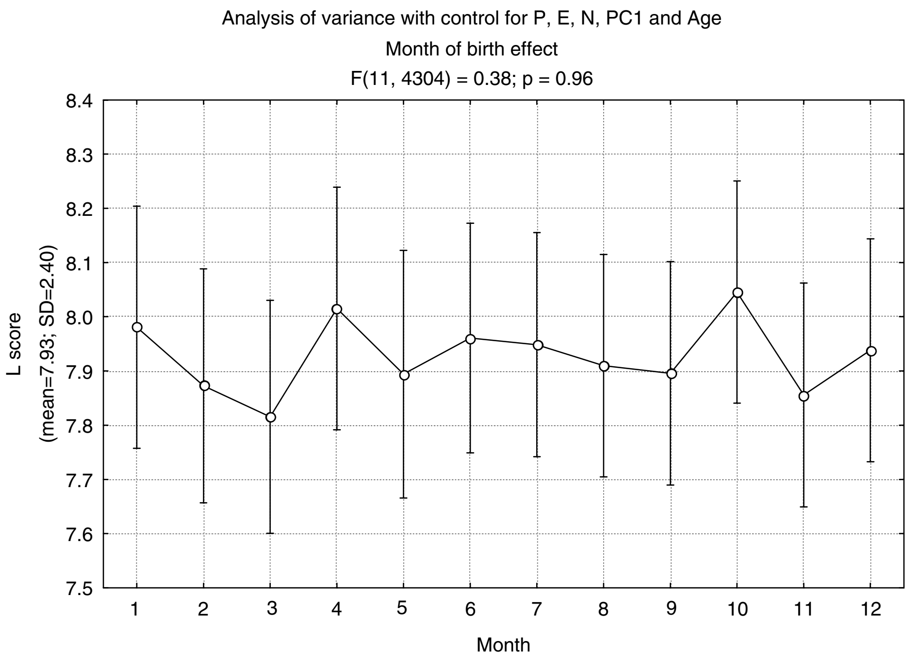

Fig. 5. Predicting Social Desirability (Lie score, L) from month of birth.

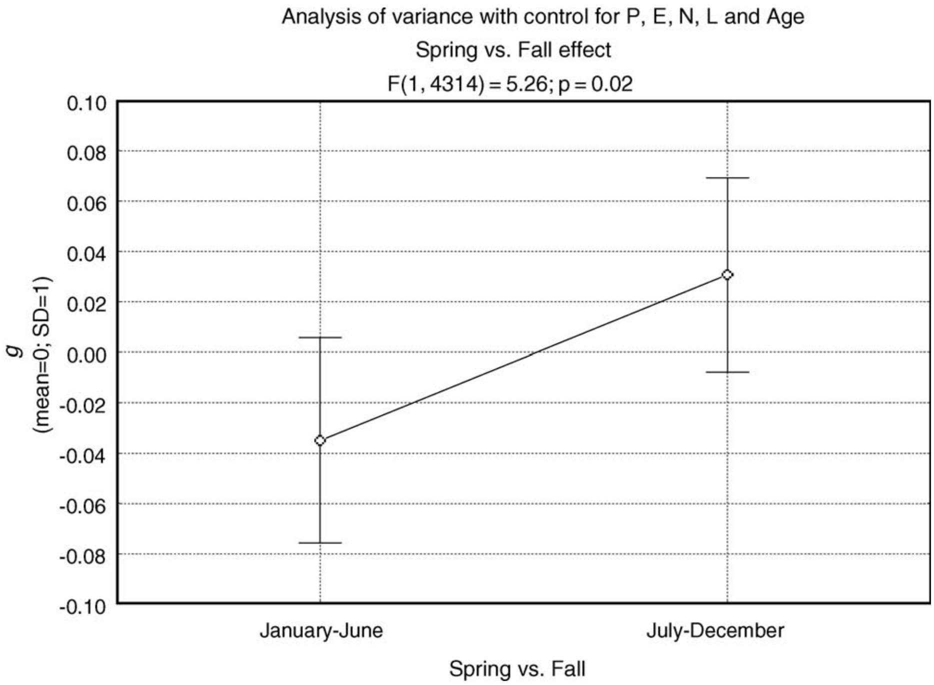

Fig. 6. Predicting general intelligence *g* (PC1) from Extended Spring vs. Fall.

to less than one IQ point in favour of subjects born in the Extended Fall. No significant relationships could be observed between date of birth and personality. A simple eye-ball inspection of the five graphs for month of birth did not suggest any systematic relationship besides the ones already tested.

It was not possible to conduct separate analyses for sex as the VES database did not contain female data.

3.2. The NLSY1979 study

From the four analyses (see Figs. 7–9), the relationship between month of birth and PAF1 score came close to significance ($p \approx 0.08$), whereas the relationship between PAF1 score and season of birth reached significance ($p < 0.025$) as well as for Extended Spring vs. Fall ($p < 0.002$). Fig. 8 illustrates that subjects born during spring obtained higher *g* than subjects born during fall. Subjects born during winter or summer seem to score closer too, but less than subjects born during spring. Fig. 8 also shows that the relationship is very modest (less than one IQ point) even if statistically significant. These results are corroborated by the Extended Spring vs. Fall results, where subjects born during the Extended Spring score somewhat higher *g* (but less than one IQ equivalent point). A simple eye-ball inspection of the graph for month of birth did not suggest any systematic relationship besides the ones already seen.

Conducting the analyses separately for gender showed that the ANCOVA for month of birth and PAF1 was significant for males ($p < 0.05$) but not for females ($p > 0.1$). This pattern is also

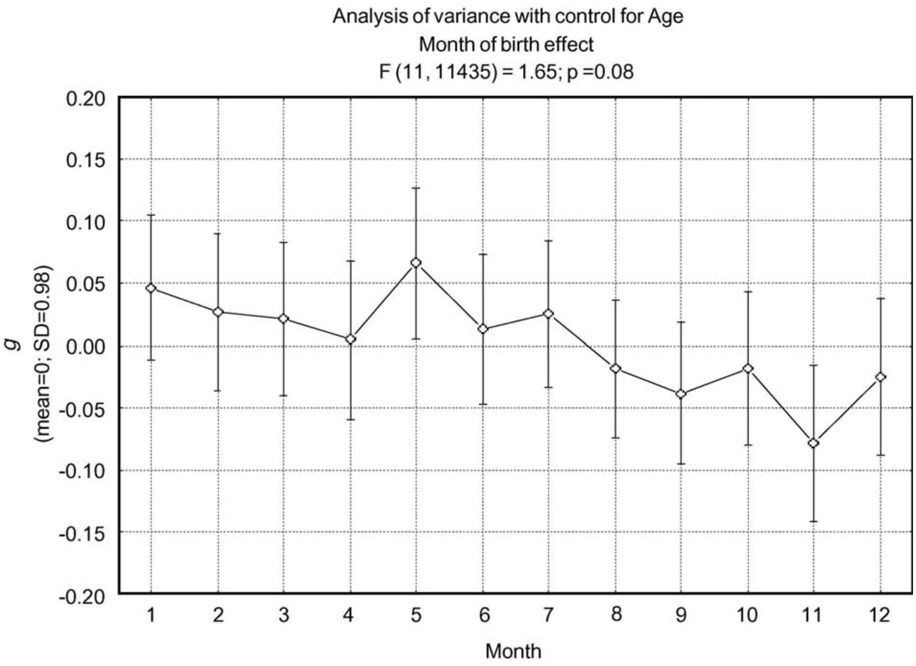

Fig. 7. Predicting general intelligence *g* (PAF1) from month of birth.

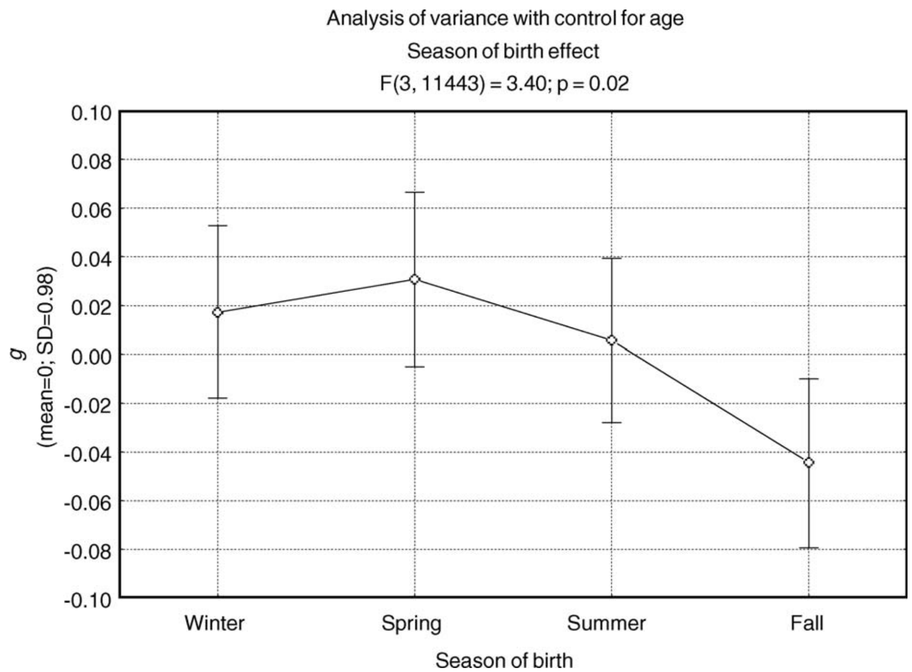

Fig. 8. Predicting general intelligence *g* (PAF1) from season of birth.

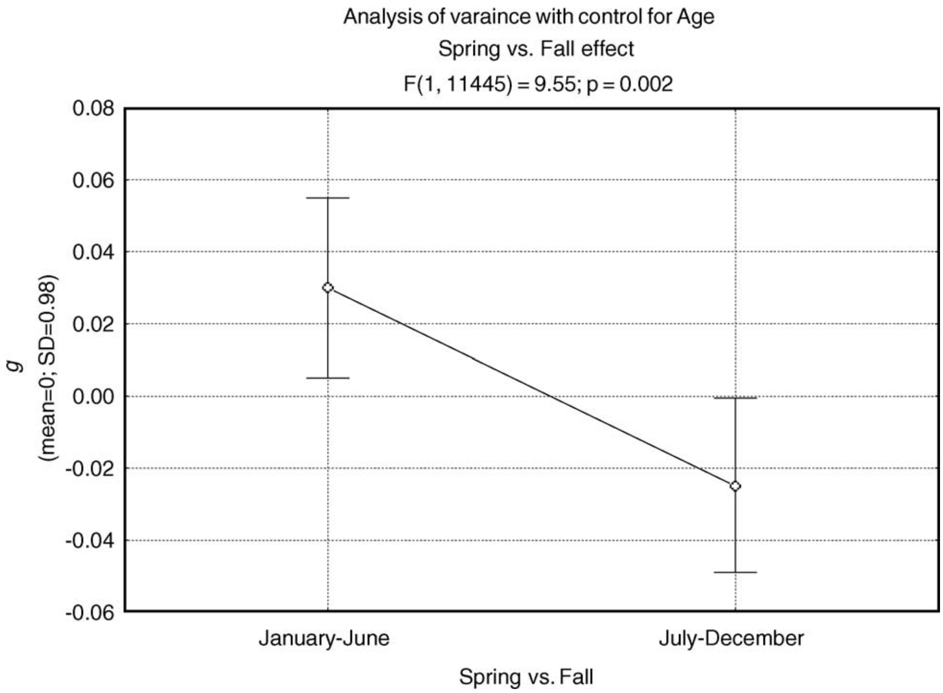

Fig. 9. Predicting general intelligence *g* (PAF1) from Extended Spring vs. Fall.

found when substituting month of birth by season of birth. The ANCOVA reached significance ($p < 0.001$) for males but not for females ($p > 0.1$). The Extended Spring vs. Fall analysis showed the same pattern, where the relationship was significant for males ($p < 0.006$) but not for females ($p < 0.1$). Apparently the overall relationship between season of birth and Extended Spring vs. Fall is mediated by gender.

4. Discussion

The large-scale analyses of the VES data show no relationships between date of birth and personality as defined by the four Eysenckian personality dimensions. Given the rather liberal level of significance used in relation to the numerous analyses performed, it is rather surprising not to find at least one spurious relationship. Based on the research literature we expected to find at least some differences in personality as a function of date of birth.

The reason for the discrepancy is unknown. The small effect sizes could be a factor, but the present samples are large enough to trace even small effects. Another reason could be the age of our subjects. Perhaps personality differs over time, and one could then argue that our middle-aged "personality" sample is at a point where the differences in personality as a function of date of birth are shifting and therefore differences will be minimal. However, there is consensus that personality tends to be stable over life-span; but it cannot be excluded that a larger age span or different age categories than in the present study might have provided different results. Moreover, as argued by a reviewer, it cannot be ruled out that the selection bias inherent in this sample, i.e. all armed service veterans, could have modified the effect of date of birth. However, multiple socio-economic indicators demonstrated that veterans who had served in Vietnam about 20 years later in general fared as well in society as those who did service elsewhere at the same time, and that both groups distributed themselves socio-economically as expected for the general population (Centers for Disease Control, 1988, 1989). Another argument was raised by a reviewer: Perhaps years of military service and possible war experiences could affect the personality of the subjects? Since the personality measures were collected during the re-testing phase in 1985/86 at middle-age, one cannot rule out that an effect of date of birth has been eliminated on this account. In sum, the selection bias of the present sample was probably lighter than that of most college samples typically investigated, and no serious personality bias could be traced.

With respect to general intelligence we found evidence that subjects born during the Extended Fall from June–December are slightly more intelligent (less one IQ point) than subjects born during the Extended Spring. However, these results contrast the findings in NLSY1979 database, which showed approximately the same difference but in the opposite direction. However, NLSY1979 findings dovetail with the research literature and are therefore more likely to be correct. The question is, however, whether the findings are solid and whether the relationship between date of birth and general intelligence may be mediated by the age of the subjects as perhaps for personality. It is even possible both findings are artefacts of using rather liberal *p*-values in the light of the number of analyses performed and the huge sample size. When the *p*-values are subjected to the Bonferroni correction for 39 analyses, then no significant results survive. In any case, even if the differences are, in fact, valid, the effect size is far too low to be of any practical relevance.

Our findings on astrology concord in general with the reviews of the research literature (Dean et al., 1997; Eysenck & Nias, 1982). In fairness, the present study cannot falsify astrology at large since the position of planets other than the sun might also have an effect. However, as pointed out by Eysenck and Nias (1982, p. 31 and 49) if there is some truth to astrology then some general effects of prominent astrological factors like Sun Signs should be detectable using large enough samples. The present large-scale study certainly found no independent effects of Sun Signs, Elements, or gender, and thus yields no support for the common claims of astrology.

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