MARS, JUPITER, AND SATURN EFFECTS ON EXTRAVERSION/INTROVERSION

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Abstract:

The Eysenck Personality Inventory (EPI) was administered to 982 college students. Subjects with Mars and/or Jupiter in plus zones according to Gauquelin's theory of planetary effects are hypothesized to have higher E-scale scores than students with Saturn in these plus zones. Of the 982 subjects, 274 meet these criteria, and a t-test comparing mean scores between the two groups was significant (one tailed p = .025, two-tailed p =. 05). Older subjects were also found to have lower E-scale scores. A structural equation model obtained significant effects of age ($p<.001$) and the astrological planetary effect ($p=.02$) on E-scale scores. A regression analysis confirmed these results. Visual inspection of the graphs suggests that modification to the definition of "plus zones" may increase statistical significance in future studies. Landscheidt's theory of golden means was not supported, and measurement in Placidian arc sectors was found to produce more consistent results than measurement in zodiac longitude or right ascension. The results may not be considered conclusive because (1) statistical significance of the two-tailed hypothesis test was marginal, and (2) there is little or no theoretical basis for the findings or for astrological theory in general. Therefore, future research is suggested. Advantages of the research design over Gauquelin's methodology are discussed.

Keywords: Astrology — Gauquelin — Mars Effect — Landscheidt — Eysenck Personality Inventory — Extraversion/Introversion

Introduction:

Michel Gauquelin proposed that individuals who achieve eminence in various professions are more likely than other people to have been born when particular planets had just risen or culminated. Eminent athletes and military leaders, for example, are hypothesized to have Mars, the planet of action and courage according to astrologers, located in these "plus zones" at birth. Eminent people in other professions are more likely to have a different planet and one that is appropriate according to astrological concepts, in the plus zones. (Gauquelin, 1988). Gauquelin's findings have been a source of intense debate and controversy (Ertel and Irving, 1996; Dean, 2002; Dean, 2003, Nienhuys, 1997).

One of the complexities of the Gauquelin research is that the random distribution of planetary positions in diurnal sectors is affected by several variables that can vary in the experimental and control groups in complex ways. For example, there is a tendency for most natural births to occur at particular times of the day and in most studies the peak is in the early afternoon

(Mancuso, et al, 2004). However, where surgical operations are frequently performed to deliver the baby, there are increased numbers of births at times regularly scheduled for the operation. Further, because some planets are more often conjunct the Sun, there may be a greater likelihood for those planets to be in sectors where the Sun is located. Because the subjects in each of the professional groups were born during somewhat different spans of years and in different regions, comparing the professional groups presents additional potential problems. For example, if one professional group has an average age that is younger than another professional group, or has more births in a different country, it is possible that the groups differ in number of induced births, which will likely affect the diurnal distribution of planets. The issue is also complicated by the fact that there are seasonal variations in births and these seasonal variations are different for different geographic regions, and appear to be related to local factors like climate (Mancuso, et al, 2004). These issues and other technical issues have been discussed at great length in the past (Ertel, 1993; Ertel & Irving, 1996). The lengthy and heated debates over these issues will not be summarized again here, and many of these issues may be minimized through the methodology employed in the study we conducted and which is described later in this paper.

A Study of Mars, Jupiter, and Saturn Effects on Extraversion-Introversion

Gauquelin considered the possibility that purported astrological effects on professional eminence may be a function of an association between planetary birth placement and human personality attributes, and that it is the personality attributes in turn which incline a person toward a particular profession (Gauquelin, 1983). Perhaps research would produce more significant results if the variables variables investigated were measures of psychological traits associated with a planet rather than symbolic career representations of the planet. A military leader is a symbolic representation of the mythological god Mars, but military leaders may, or may not, have the attributes of vitality, energy, and drive to succeed more than leaders in other professions. This may be especially true in modern times where warfare and military endeavors employ advanced technology, global planning and strategy, and the military leader is typically only rarely involved in direct combat. Modern astrological theory tends to ascribe more subtle, psychological qualities to planets, rather than the imagery and persona of a planet's mythological associations. Thus, we suggest that a study design that more directly targets the psychological traits that astrologers associate with planets is preferable to a study design that investigates symbolic planetary associations with career groups. In the study described below a psychological test was administered to measure the subjects' extraversion/introversion of subjects rather than subjects' affiliation with professional groups.

Advantages of Administering Psychological Tests rather than Comparing Professional Groups

A psychological test provides information regarding psychological traits, and therefore is likely to be a more direct assessment of a proposed planetary association with personality than would be the chosen vocation of a person (assuming that there is a planetary effect which is more directly related to personality than to symbolic representations).

Another benefit of a psychological test is that it can be given to nearly anyone. The Gauquelin studies of eminent people are very difficult to replicate because one must be able to obtain the birth information of individuals who have achieved distinction in a profession. Obtaining the data involves contacting birth record offices or hospitals, and this is likely to be an expensive and laborious process. The population being targeted is relatively small, as there are a limited number of eminent professionals. (Gauquelin's results were significant only with career eminence, not with mere employment in a particular vocation.)

A third benefit of administering a psychological test is that the test is administered to living subjects, rather than relying on biographical data about elderly or deceased people who achieved career eminence. Although a detailed analysis has not been conducted, it is reasonable to expect that birth records in modern times tend to be recorded with better accuracy than in earlier eras. A nurse or doctor generally records the time of birth and it is recorded on the appropriate forms. Given the clear regulations and concerns for litigation, birth times are likely to be recorded accurately. In contrast, a large percentage of the birth time data in the Gauquelin database is expressed on the exact hour or half hour. Because we can expect that birth rates do not peak exactly at half hour intervals, the birth times for many of Gauquelin's subjects are presumed to be rounded to the nearest half hour. Because a planet moves on average one degree in four minutes, birth times accurate within a few minutes of time are necessary for accurate measurement of the planet's sector placement. If the birth time is, for example, inaccurate by 16 minutes, the planet is likely to have moved about four degrees and consequently may be placed in an incorrect sector, perhaps at a point that is an expected low for the particular personality profile rather than a high.

A fourth advantage of using psychological tests is that the distribution of test scores grouped by astrological factor (as presented in the figures later in this paper) avoids some of the problems of complex planetary orbital motions. For example, Jupiter is about 120 degrees from the Sun for a longer period of time than it is in other angular relationships from the Sun due to the particular characteristics of Jupiter's orbit. Changing economic conditions, holidays, and many other factors can affect the inclination of people to either plan on having children or to engage in sexual relations that can result in pregnancy, thus affecting frequency of births. These irregularities in frequency of births may coincidentally be related to some cycles of planetary motion, thus confounding the research results. Because the effect sizes in the Gauquelin study and the current study are very small (as evidenced by the requirement for large sample sizes for achieving statistical significance) these potentially important confounding variables are important. As a simple example, some astrological factors may occur more often in some years than other years and if the distribution of births for one professional group happens to be more heavily weighted in years when the astrological configuration is more likely, the effect is likely the result of the distribution of birth dates rather than from an astrological factor. In most cases the differences between the random occurrences of astrological variables for the groups compared is minor and there are steps that can be taken to adjust for these problems.

Nevertheless, this is an issue and a reasonable argument can be made against the robustness of an astrological study even if the biases are relatively insignificant.

To summarize, in the present study it is the association of planetary placement at birth with the measurement of the psychological trait that is the key issue, rather than, as in Gauquelin's study, how many people in a given professional category have a particular astrological factor in their charts. Thus, seasonal and annual differences in subject birth distributions are less critical. For example, suppose that test scores are higher (or lower) for individuals with Sun about 120 degrees from Jupiter. The fact that there are more people with this angular relationship than other angular distances between the Sun and Jupiter has little, or no, bearing on whether the test scores are relatively high or low for this group. In a comparison of two professional groups, however, the uneven distribution of astrological factors may be a greater concern.

Procedure

The Eysenck Personality Inventory (EPI) was administered to students enrolled in courses at three northern New England colleges (University of Maine - Orono, Johnson State College, and University of Vermont) during the years 1985 to 1996. Each class size was generally less than 30 students. A total of 982 students comprise the sample after students with incomplete data were removed.

The EPI consists of 57 items with a Yes/No response. The EPI measures two psychological traits: extraversion-introversion and neuroticism-stability. Other traits and sub-traits of these two basic traits have been proposed but in this study only the basic extraversion-introversion score was analyzed. The EPI also includes a 9-item "lie scale" to detect feigned or deceptive responses. In the data analysis, a score of 6 or higher on the lie scale resulted in the subject being removed from the analysis. After removing these subjects, the number of subjects in the statistical analysis is 944. The age of subjects varied from 18 years to 55 years and the median age was 21 years. Of the 944 subjects, 566 are female and 378 are male.

After the test was administered, students were given a form to complete which included their date, time, and place of birth. In order to prevent corruption of EPI responses by prior knowledge of the birth questionnaire, students were not informed that an astrological study would be conducted, and they were not asked for their birth information until after the EPI questionnaire was completed.

Hypothesis

Gauquelin used a method of measuring the position of a heavenly body in its diurnal path which we refer to in this article as "Placidian arc sectors." In this study we divided the possible birth positions of planets into 36 Placidian arc sectors. Sectors are numbered clockwise starting just above the eastern horizon, so that sector 1 is just after rising, sector 10 just after culminating, sector 19 just after setting, and sector 28 just after anti-culminating.

The hypothesis tested in this study is that subjects who were born with Mars and/or Jupiter, but not Saturn, in Placidian arc sectors 1, 2, 10, or 11 of the 36-sector Placidian arc sectors will score significantly higher in extraversion than subjects who have Saturn, but not Mars or Jupiter, in these sectors.

The hypothesis was stated before data were collected and analyzed. Sectors 1, 2, 10, and 11 are the sectors just after rising and culminating, which accords with Gauquelin's definition of planetary "plus zones". Gauquelin also considered the "plus zones" to include the sectors immediately following the ones included in this hypothesis (i.e., sectors 3 and 12), and in his later studies he sometimes included the preceding sectors (36 and 9). Gauquelin regarded the opposite sectors (namely, 19, 20, 28, and 29) as having some minor importance as well. By restricting the hypothesis of the present study to sectors 1, 2, 10, and 11, only the most consistently supported sectors in the Gauquelin studies were included. Sectors 1, 2, 10, and 11 are, in a sense, the "heart" of the strong plus zones according to Gauquelin.

Consistent throughout the astrological literature and tradition, the planet Mars is associated with aggressive assertive action and impulsivity, and the planet Jupiter is associated with social expansiveness, gregariousness and outgoingness. By contrast, Saturn is associated with focus, discipline, and the inclination to be quiet and reserved. Thus, many of the qualities of Jupiter are extremely similar to the modern concept of psychological extraversion, while many of the qualities of Saturn are extremely similar to the modern concept of introversion. The extraverted qualities of Mars may not be as obvious as the extraverted qualities of Jupiter, but assertiveness and impulsivity would seem to incline a person toward extraversion.

By selecting subjects who were born with Mars or Jupiter, but not Saturn, in sectors 1, 2, 10, and 11, these subjects are identified as being "astrologically inclined" to extraversion. We shall refer to this group as the "Mars-Jupiter group". Conversely, the subjects with Saturn, but not Mars or Jupiter, in the strong sectors at birth are identified as being astrologically inclined to introversion. We shall refer to this group as the "Saturn group".

Of the 944 subjects included in the study, there were 200 subjects whose planetary placements qualified them for the Mars-Jupiter group, and there were 74 subjects whose planetary placements qualified them for the Saturn group. These 274 subjects were included for analysis of mean differences on the EPI introversion/extraversion scale.

Hypothesis Test Results

A t-test was conducted to compare the mean E-scale (extraversion) score on the EPI test of the Mars-Jupiter group and the Saturn group. The hypothesis is directional so a one-tailed t-test was conducted. The difference in mean scores was significant with the one-tail significance level ($p=.025$). (At the $p=.05$ two-tail significance level, differences were marginally significant.) Totals for each group are given in Table 1.

Table 1.

Summary Results for the Mars-Jupiter group and Saturn Group

Group	N	Mean	Std Dev
Saturn	74	12.378	4.299
Mars-Jupiter	200	13.480	4.020

The null hypothesis is rejected and an association of the planetary placements with the personality trait of extraversion/introversion is suggested. However, note that the level of statistical significance is modest, and also, as shown in Table 1, the range of standard deviations compared to the means is relatively large. With standard deviations in the range of about 4 to 4.3, and a difference in means of 1.1, the difference in means is only about one-fourth of the standard deviation, which is in accordance with the modest significance level.

Graphs of Test Results

Graphs of mean e-scale scores by the Placidian arc sector placement of a planet at birth enable us to better understand the relationship of e-scale scores with planet sector placement obtained in this study.

The distribution of Jupiter (the planet most clearly associated by astrologers with extraversion) in the Placidian arc sectors is given in Figure 1. The mean E-scale score (y axis) is plotted for each of 72 Placidian arc sectors (x axis). The eight circled scores in Figure 1 are equivalent to the scores for sectors 1, 2, 10, and 11 in the 36-sector division of the diurnal circle, so therefore the circled scores are the scores hypothesized to be above the mean in the hypothesis test. The arrows in Figure 1 indicate golden ratio points and are discussed later in this paper.

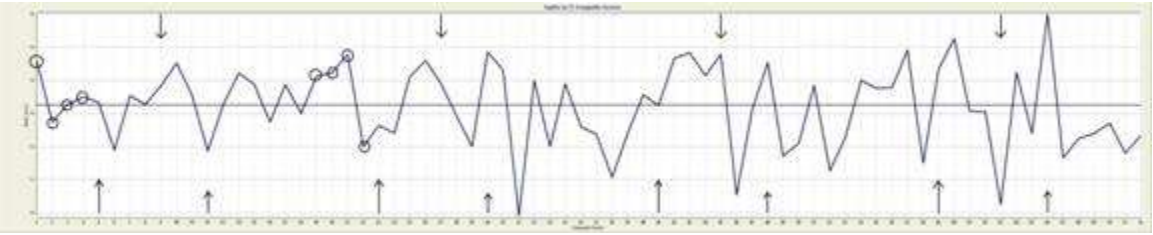

Fig. 1: Graph of Mean E-scale Scores by Distribution of Jupiter in 72 Placidian arc sectors

Note that if the hypothesis had been stated to include sectors after these circled sector scores (in accordance with Gauquelin's original "plus zones"), the additional points would not be high, i.e. the two points following the four circled points are not high. Only one of the four points preceding the circled points is above the median. The stated hypothesis therefore selected the best possible range of sectors to obtain significant results.

In Figure 2 are the results for the planet most associated with introverted qualities: Saturn. The astrological hypothesis is that sectors with circled scores in Figure 2 will be low (because Saturn inclines the personality towards introversion according to the theory).

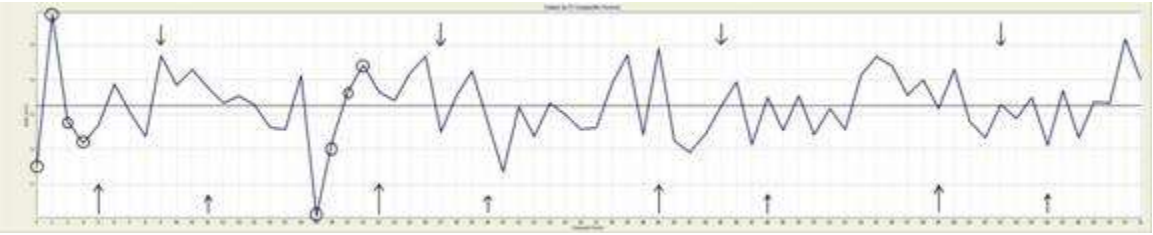

Fig. 2: Graph of Mean E-scale Scores by Distribution of Saturn in 72 Placidian arc sectors

As we found with Jupiter, sectors 19 and 20 agree with our hypothesis. In fact, the very sharp drop in scores in sector 19 is very dramatic and the mean score for sector 20 is also one of the lowest mean scores in the graph. Based on these findings we conclude that the greatest support for a planetary effect in this study is the effect of the first two sectors after culmination, which is equivalent to the first sector after culmination in a 36-sector graph. Just as in the case of Jupiter, the two points before and after the two groups of four circled degrees in Figure 2 do not suggest support for Gauquelin's theory of plus zones. If there are plus zones, the current research suggest that the plus zones are much smaller than those hypothesized by Gauquelin. Both the reanalysis of the Gauquelin research and the results of this study indicate that the statistically significant results obtained by Gauquelin are the result of sharp peaks just after culmination and possibly also just after rising, and greater statistical significance would be achieved by defining the plus zones as being smaller than the plus zones defined by Gauquelin.

In Figure 3 is a similar graph for Mars. As discussed above, the extraverted qualities of Mars according to some astrologers are not as clear and obvious as the extraverted qualities of Jupiter, and given the somewhat modest positive indications found above, we may not be surprised if support for the hypothesis that the placement of Mars in plus zones correlates with greater extraversion is not strongly supported.

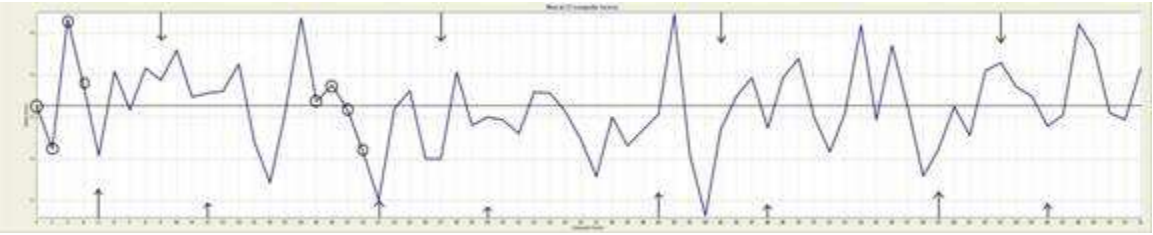

Fig. 3: Graph of Mean E-scale Scores by Distribution of Mars in 72 Placidian arc sectors

<pGraphical Exploration of Landscheidt's Golden Mean Theory

The up arrows in the Figure 1 and Figure 3 are hypothesized by Theodor Landscheidt to indicate places in the graph that are high and the down arrows indicate places in the graph that are low

(Landscheidt, 1989). In Figure 2 the opposite result is expected because Saturn is hypothesized to be associated with low e-scale scores rather than high e-scale scores. Thus in Figure 2 up arrows are hypothesized to point to lows in the graph, and down arrows to lows in the graph. A detailed explanation of the placement of the up and down arrows in these graphs is given in an earlier paper by the authors (Cochrane and Fink, 2010).

Contrary to the expected results based on golden ratio points, the first three up arrows in Figure 1 do not clearly point to peaks in the graph. The second and third up arrows (first small up arrow and second large up arrow) point to lows in the graph.

As in Figure 1, the first four up arrows in Figure 3 do not point to peaks. The third and fourth circled scores are above the mean, but this does not agree with the findings for Jupiter shown in Figure 1. Because extraversion is a broad concept and astrologers associate different attributes to Mars and Jupiter, these differences in the results for Mars and Jupiter are perhaps not surprising. The circled scores for sectors 19 and 20 (first two circled scores in the second group of four circled scores) are at, or above, the mean, so this at least does not contradict the conclusion obtained earlier that sectors 19 and 20 are the most strongly supported in this study. The strong drop in scores after the second group of four circled scores again supports the indication that the plus zone area does not extend very far after culmination.

Figure 2 also fails to confirm Landscheidt's theory. Up arrows do not point to lows, and down arrows do not point to highs as would be expected for the planet Saturn.

A Structural Equation Model that Includes Age of Subjects as an Explanatory Variable

An analysis of the data indicated that older subjects tend to have lower E-scale scores. In other words, older subjects are more introverted than younger subjects. This finding confirms findings from previous research.

Labouvie-Vief, et al (2000) found a main effect of age on extraversion as well as an interaction effect of culture (comparing people in the USA and China), with older people in both the USA and China having lower mean extraversion scores. Various dimensions of extraversion were analyzed and the consistent effect of lowered extraversion with increasing age, although with varying rates and depending on the dimension of extraversion measured, confirms the finding presented below in the present study: extraversion decreases with age.

The gender of the subjects was also obtained in this survey and could be included as a predictor of extraversion. However, unlike age, gender has not been identified as a predictor of extraversion and gender was not found to be a significant predictor of E-scale scores for subjects in this study either (results for analysis of gender are not presented in this paper). Consequently the main structural equation model of interest has two predictors of Extraversion: Age and "Astro Score", i.e. the astrological influence of Mars, Jupiter, and Saturn in specific Placidian arc sectors. In our structural equation model, extraversion is a latent variable measured by the E-scale score of the EPI.

The Astro Score was calculated by assigning a number of points to the placement of Mars, Jupiter, and Saturn in Placidian arc sectors as shown in Table 2. Note that, for purposes of greater precision, this model employs a finer division of arc sectors, with each sector half as wide. Thus, this model uses 72 total sectors, rather than 36. A structural equation model is essentially a regression analysis with a latent variable, and the Astro Score is a continuous variable. Rather than measuring the astrological variable dichotomously as either in a plus zone or not in a plus zone as done by Gauquelin and in our study of E-scale scores of students, the astrological variable, like the E-score, is a continuous variable that measures a person's personality on an extraversion-introversion continuum.

The relationship between placement of Mars, Jupiter, and Saturn with E-scale scores given in the graphs in Figure 1, Figure 2, and Figure 3 suggest that the strongest association with E-scale scores occurs when the planet is in the area of the sky just after culmination at the time of birth. The somewhat less extreme e-scale scores towards the end of this "plus zone" area suggests that the association weakens as distance from the culminating point increases. The graphs in Figure 1, Figure 2, and Figure 3 also suggest that the sectors just after rising have a weaker association with deviations from the mean e-scale score of all subjects than the sectors after culmination. Also, the planets Jupiter and Saturn have a stronger association with extreme e-scale scores than does the planet Mars. Based on these observations, a weighting scheme is desired that (1) assigns more weight to the 3 sectors (in 72-sector division of the sky) after culmination that the 4th sector after culmination, (2) assigns more weight to the 4 sectors after culmination than the 4 sectors after rising, (3) assigns more weight to the first 3 sectors after rising than the fourth sector after rising. (4) assigns a positive value to Mars and Jupiter as indicators of extraversion, and a negative weight to Saturn as an indicator of introversion, and (5) the absolute value of the weight assigned to Jupiter and Saturn is greater than the weight assigned to Mars.

In accordance with these five desired characteristics of our weighting scheme, we assign the most points to Jupiter in the three sectors after culmination, i.e. sectors 19, 20, and 21. The value of this weight is arbitrarily set to equal 20 points. Saturn is given the same weight, but as a negative value, for placement in these same sectors. Placement of Jupiter and Saturn in the fourth sector of culmination is set to a lower weight, arbitrarily selected as a little less than half of the weight for the first three sectors of culmination, 8 points. The fourth sector after rising is set to a lower weight and has been arbitrarily set to 4 points. Saturn is given the same points as Jupiter but with negative values. Mars, which the graphs suggest has a much weaker association with extreme E-scale scores than Jupiter and Saturn, is assigned a weight that is 25% of the weight given to Jupiter. A summary of these values is given in Table 2. Note that in Table 2 the information regarding sector and placement in the diurnal circle is redundant, but is given as both sector numbers and descriptively to help make the assignment of weights to sectors clear.

Table 2

Points Assigned to Planets in 72-Sector Placidian Arc Sectors to Determine Astro Score

Planet	Sectors	Placement in Diurnal Circle	Points
Jupiter	19, 20, 21	3 sectors after culmination	20
Jupiter	22	fourth sector after culmination	8
Jupiter	1, 2, 3	3 sectors after rising	8
Jupiter	4	fourth sector after rising	4
Mars	19, 20, 21	3 sectors after culmination	5
Mars	22	fourth sector after culmination	2
Mars	1, 2, 3	3 sectors after rising	2
Mars	4	fourth sector after rising	1
Saturn	19, 20, 21	3 sectors after culmination	-20
Saturn	22	fourth sector after culmination	-8
Saturn	1, 2, 3	3 sectors after rising	-8
Saturn	4	fourth sector after rising	-4

Although the assignment of these weights is somewhat arbitrary, they do reflect the five desired characteristics described above for a weighting scheme, and therefore provide a useful and appropriate, albeit somewhat crude, weight to the effects of planets in Placidian arc sectors. This weighting scheme, although crude, is a more sensitive measuring instrument than the even more crude dichotomous assignment of plus zones and non-plus zones employed in Gauquelin's research

Results of the Structural Equation Model Analysis

The alpha reliability coefficient of the EPI reported in previous studies is between .74 and .87 (Sato, 2005). An analysis using the .74 reliability and the .87 reliability coefficient were conducted. Table 3 presents the results of the analysis using a .74 reliability coefficient for the E-scale score. The MPlus program (Muthen, 2009) was used to perform the analysis.

Table 3

Standardized Results of the Structural Equation Model Analysis

Predictor	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Age	-0.266	0.064	-4.153	0.000
Astro Score	0.160	0.066	2.441	0.015

Calculations with a .87 alpha coefficient value, estimation with robust maximum likelihood, and a multiple regression with OLS all produced p-values that are within less than .01 of the values given above. Estimated coefficients with these alternative analyses were also similar. For example, the analysis with a .87 alpha reliability coefficient for the E-scale score produced an estimated Age coefficient of -0.245 and an estimated Astro Score coefficient of 0.147 and the same p-values given in Table 3. A multiple regression analysis using ordinary least squares estimation with the E-scale score regressed on the two predictor variables without employing the concept of a latent variable using the SAS program also produced coefficient estimates that matched those given by the structural equation model within .001. Also, conducting the structural equation model analysis with robust maximum likelihood estimation produced nearly identical results. The model is a saturated recursive model so evaluation of goodness of fit indexes is not possible.

Including Gender as a third predictor variable had no noticeable effect on the Age coefficient and Astro Score coefficient (difference of less than .01) and the Gender coefficient of -0.055 is non-significant ($p = 0.41$). Correlations of predictor variables to each other were also non-significant (results not presented here).

The negative Age coefficient (-0.266) indicates that older people score lower on Extraversion as expected, and this results confirms the findings of other studies.

As expected, the level of statistical significance of the Astro Score coefficient ($p < .02$) is better than the significance level found in the hypothesis test ($p = .05$ for two-tailed test) because the placement of Mars, Jupiter, and Saturn was weighted in accordance with the distribution of these planets in the Placidian sectors as shown in the graphs presented earlier. An argument could be made, in fact, that the exercise of conducting the structural equation model analysis is merely a quantitative analysis of observations made through exploratory research and therefore is of no practical importance. However, the structural equation model and the regression analysis demonstrate the usefulness of using continuous variable scores to more accurately reflect the astrological model rather than using the kind of analysis done by Gauquelin where an astrological factor is classified as a dichotomous variable, thereby constituting a less sensitive

measure. Also important is the combination of astrological and non-astrological predictors like age.

Conclusions

Summarized below are important conclusions from the research presented in this paper.

Mild support for the astrological hypothesis: The results of the hypothesis provide mild support for the theory that planetary placements in the diurnal circle at the time of birth are associated with personality characteristics. The null hypothesis was rejected, supporting the astrological hypothesis. Because the levels of statistical significance are low, dependent on the precise definition of plus zones, and the definition of plus zones is slightly different from that defined in earlier studies of Gauquelin, this mild support must be regarded as inconclusive, and further research is recommended.

Plus zones smaller than those defined by Gauquelin: The null hypothesis was based on a definition of plus zones that are smaller than those defined by Gauquelin and inspection of the graphs strongly suggests that if plus zones are significant indicators of personality characteristics, the plus zones are smaller than they were defined by Gauquelin. The reanalysis of the eminent athletes data collected by Gauquelin indicated that the plus zones are four to five sectors in the 72 sector division after rising and culminating. The E-scale scores of students, however, indicated that the plus zones are immediately after rising and culminating, and the culminating plus zone is more powerful. It is possible that planetary effects on E-scale scores are different from plus zones that indicate potential for excellence in athletics, but this conclusion indicates a more complex relationship of behavior and personality characteristics and planetary positions than hypothesized by Gauquelin. If there is a planetary effect, we conclude that the plus zones are smaller than Gauquelin proposed, and perhaps also more complex as well. The use of birth data that is almost certainly more precisely recorded in our hypothesis test than the birth data collected by Gauquelin may be one important factor in helping identify these smaller plus zone areas than was identified by Gauquelin.

The golden ratio theory of Landscheidt was not supported: Although the theory of golden ratios was mildly supported in a reanalysis of the Gauquelin data in an earlier study (Cochrane and Fink, 2010), it was not supported in the data of college students in the hypothesis test. Fitting a theory to existing data in exploratory research is a first step towards theory building, and failure to replicate the finding strongly suggests that the proposed theory is not valid.

Importance of different astronomical measurement systems: Placidian arc sectors were supported in this study.

Analyzing Psychological Test Results: Rather than analyzing the birth charts of eminent professionals, research on psychological test scores provides a number of advantages discussed in more detail in Section 3: (a) more direct assessment of the psychological traits that are associated with astrological variables according to many modern astrologers, (b) greater

availability of data, (c) likelihood of more accurate birth data, and (d) reduced impact of the confounding variable of varying frequencies of astrological influences being correlated with the dependent variable being measured. See pages 13 and 14 for a more detailed discussion of these points.

Regression analysis and structural equation models using continuous variables rather than t-tests or ANOVA on groups separated from each other by cutoff points or a dichotomous criterion is recommended. By assigning a weight to planets in different Placidian arc sectors an instrument that more accurately reflects the underlying theory was created rather than categorizing subjects dichotomously as either having a planet in, or not in, a plus zone.

Extraversion and Introversion as Direct Expressions of Personal Proclivities: An assumption of the hypothesis test described in this paper is that extraversion is a natural expression of the Jupiterian inclination to be expressive and outgoing, while introversion is a natural expression of the Saturnian inclination to be quiet, focused, and self-controlled. On the other hand, Eysenck hypothesized that extraversion was an inclination to seek stimulation by people who are less internally aroused. (Eysenck & Eysenck, 1985). Therefore, our research is based on assumption that is not in agreement with Eysenck's theory, but Eysenck's theory is worthy of further study and analysis in future research. Also, one could argue that Eysenck's definition of extraversion which recognizes the potential for impulsivity and recklessness has some affinity to the qualities astrologers associate with Mars so consequently we recommend that future research continue to include Mars as well as Jupiter as potential indicators of high E-scale scores.

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