The students' critical thinking guide
to science and astrology

Lessons for informed evaluation

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Abstract: Students who write about astrology need to understand common problems that confuse the relationship between science and astrology today. Often, criticism of astrology is flawed by rational fallacies under the guise of “critical thinking.” These fallacies must be removed in order to clarify the actual disagreements and to center the discourse on necessary evaluation. The statistical evidence of astrology to date has not been as widely recognized as it deserves, and discourse on astrological ranking and eminence effects has been conspicuously lacking on the part of skeptics. The limitations of both the astrological premise and astrological practice are not well understood by some researchers and this has led to unrecognized errors in the more widely publicized chart matching tests, which assume no limitations. This article attempts to delineate some critical hypotheses and guidelines for the proper evaluation of astrology within its limitations.

Student essays on astrology at most universities are usually expected to demonstrate the weaknesses of astrology and this article has been named so students can easily find it when they write their papers. It offers criticism but is intended to transform what students should write about. Students should not rely upon rhetorical arguments against astrology, which are often expounded under the guise of “rationality” or “critical thinking.” Rhetorical arguments are often flawed, and properly evaluated evidence of astrology is often overlooked. The new requirement, as advocated by this article, is that students should learn how to empirically evaluate astrology and to engage in discourse rather than rhetoric. As astrologer Bob Marks (2008) asserts, “Before one can discuss whether or not astrology ‘works,’ one has to know how the subject is practiced. Before one asks for evidence, one has to be able to evaluate that evidence. Science demands that knowledge of a subject must come before evaluation.”

This article contains five lessons. At first, these lessons might seem unfamiliar, dubious, or even pointless to some students, but persistence and patience will be rewarded. As a key to these lessons, students should pay attention to the following tips. The first tip is that popular Sun sign books and columns misrepresent astrology by overgeneralization. The second tip is an ancient maxim that states, “The stars incline; they do not compel.” Students who guard these tips wisely will come to understand their value, as we shall see.

Lesson 1: Rational fallacies and astrology

There are ongoing arguments between the astrological community and critics within the scientific community who call themselves “skeptics.” The actual disagreements between these skeptics and astrologers are not always easy to determine because the disagreements are often obscured by fallacies. Fallacies are rhetorical patterns that contain flaws in the logic of their assertions that can render arguments invalid. If these fallacies can be recognized and removed from the discourse, then there is an improved chance of resolving the disagreements. Some of the most common fallacies that students might see or hear concerning astrology are: arguments from ignorance, abuse of authority, ridicule, questions with false presumptions, false alternatives, and false burden of proof. These fallacies can be recognized as follows.

Argument from ignorance - Just because Sun signs are popular, or used by the majority population, this does not mean that they are complete astrology or entirely true. Astrology is a richly detailed study, yet Sun sign books and columns divide all humanity into just twelve categories, based solely on the zodiacal sign that the Sun was in at birth. They attribute far too much to this single factor while all the other factors in a complete astrological chart (such as the planets, houses, aspects, etc.) are ignored. Arguments and research that are based on the overgeneralizations of popular Sun sign astrology, or that equate the zodiacal signs with the starry...
Why are these rational errors made? No doubt the theories and applications that scientists are...
familiar with do not explain how astrology works. Yet no theory can be used to either support or deny what astrology actually claims in its texts. This requires evidence. To rely upon theory before evidence is, epistemologically speaking, to put the cart before the horse. Before astrology can be explained, or explained away, it is necessary to understand and evaluate its claims. All researchers, whether they agree or disagree with the claims of astrology, need to immerse themselves deeply into the empirical observations made by astrology. Without evidence, all arguments go down a slippery slope of rational errors. Astrologer Rob Hand (2000) asserts, “We should not be trying to explain astrology by means of science as it is, but there is no problem with trying to explain astrology by a science that has not yet come to be.”

A dangerous gauntlet of fallacies surrounds and obscures astrology, and few students are willing to take the challenge of venturing into a place where they are told not to go. If students do not completely understand these fallacies, and end up matching wits with their professors in arguments over astrology, then their courses might be in jeopardy. Yet students who successfully pass through the gauntlet of these fallacies will have integrity. On this point, a special notification is in order. Students who have read this article this far have already taken the first step of this challenge. So which will it be, integrity or not? Please read on.

Lesson 2: Statistical evidence of astrology

Some researchers have successfully passed through the gauntlet of rational fallacies and have explored astrology like a lost city. They have taken with them modern tools that enable them to evaluate astrological claims, and they have found both interesting and puzzling things.

To understand how these researchers have been able to evaluate astrology, we must examine one of our tips, which was handed down to us by the 17th century leader of the scientific revolution, Francis Bacon (2000), who in 1605 wrote: “The last rule (which has always been held by the wiser astrologers) is that there is no fatal necessity in the stars; but that they rather incline than compel.” This tip explicitly tells us that astrology is not thought to be deterministic; we cannot expect to make precise predictions. Yet it tells us more. We can further deduce that the inclinations of the stars (all celestial objects) are quantifiable, for example by using modern statistical methods, even though no outcome will happen by necessity. This logic serves as a guidepost, along with the fallacies of popular Sun sign astrology and so on, to understand how astrology can be evaluated. To properly evaluate “inclinations,” it is necessary to compare astrological charts. Not just one or two charts, but numerous charts.

Leading researchers in astrology have understood the statistical potential of astrology and have published evidence of correlations between astrological patterns and features of behavior and character. This research has followed normal scientific methods and the findings to date tend to support some of the traditional understandings of astrology, while raising questions about others. The following summaries give examples of some of these findings.

Birth planets linked to eminence in professions - The most rigorous hypothesis relating the planets to professions was postulated by Michel Gauquelin, who himself was a strongly empirical skeptic of astrology. This hypothesis states that the higher the rank of professional eminence, the more pronounced the correlated planetary effect would be (Gauquelin, 1955, 1988). This postulation of eminence was objectified by Suitbert Ertel (1988) with the help of citation frequencies, a sensitive procedure that Gauquelin had not used himself. The application of citation frequencies is an objective procedure in principle. It minimizes sampling bias (the unintentional screening of a sample for a favorable outcome), which had been a major skeptic concern.

Besides the 1988 eminence evidence, Ertel and Irving (1996) have replicated the presence of an eminence effect by re-analyzing data collected independently by the US and French skeptics. Additionally, Müller and Ertel (1994), in a replication with new data of one of Gauquelin's earliest major findings, found evidence of the eminence effect for Saturn and Mars in the birth data (N=1083) of the members of the French Académie de Médecine, an exclusive group selected not by Müller and Ertel, but by the Académie itself. For over 20 years, it has remained the task of the skeptics to refute the presence of the detected astrological eminence effect in all of the samples of data, including all of their own samples, which they have conspicuously failed to do.

Within the body of his work, Gauquelin has statistically linked Mars, Jupiter, Saturn, and the Moon to achievement in various professions as both indicators and counter-indicators. The importance of the astrological eminence studies is that they are objective, unrefuted, and support the traditional astrological properties of the planets involved.

Seismic activity linked to aspects between planets - Earthquakes appear to be more likely to occur as planets approach major aspects to each other. Preliminary evidence of this was
Johnston found that seismic activity is significantly associated with all major aspects, whether “hard” or “soft,” when they are applying. This research needs further replication, and it would be useful to provide correlation with seismic magnitudes, but appears to support the traditional astrological association between applying aspects and the timing of critical events.

**Naturally red hair linked to Mars rising at birth** - Subjects with naturally red hair were found more likely to be born with Mars within 30 degrees of the ascendant and not within 30 degrees of the descendant. This finding, by Judith Hill and Jacalyn Thompson (1988-89), has successfully passed time switching tests (O'Neil 1991), and has been replicated using hundreds of accurately timed birth data from different countries. With the exception of a sample of British test subjects, who produced results “in the correct direction of the hypothesis,” all large combined groups of red-haired test subjects achieved levels of significance. This evidence supports the traditional associations of Mars with red hair and the ascendant with physical appearance.

**Accidents linked to transiting solar angles to the birth Sun** - Workplace accidents were found to be significantly more frequent around days when the Sun is conjunct, opposite, or square (90 degrees) to the Sun's exact position in the birth charts of the injured workers. This was reported by Sara Ridgley (1993) in a study of over a thousand people living in California who filed Workers’ Compensation claims and were disabled for at least three months. This evidence supports the traditional association of fourth harmonic planetary aspects with difficulties and challenges. A follow-up study, however, of a similar database of work-related injuries in Sweden failed to replicate the results of the California study, with the least amount of accidents around the birthday (the conjunction) due to the fact that Swedish workers get their birthdays off work. Ridgley suspects that the differences in results might stem from “very different cultural values and psychological attitudes toward work, people in places of authority, and the individual's self worth.” She has called for further replications by other researchers.

**Stock returns linked to the Moon cycle** - International stock market returns were found to be significantly lower on days on or around a full Moon than on days on or around a new Moon. This was demonstrated by a study by Kathy Yuan, Lu Zheng, and Qiaoqiao Zhu (2006). This study, which was much larger than previous similar studies and included data from 48 countries, was controlled for such factors as stock market volatility and calendar-related anomalies. The evidence of this study supports the traditional association of markets with the increasing and diminishing cycle of the Moon.

Skeptics and students who question these tests and make suggestions for improvements are doing the right thing. They are engaging in normal scientific discourse. They question the empirical evidence and explanation of astrological claims, not the presumed error of making astrological claims.

**Lesson 3: Astrology matching tests**

Besides the statistical testing described in Lesson 2, a special genre of astrological testing has been developed, mainly among astrology skeptics. In these tests, birth charts are matched one-to-one with questionnaire results or personal data. These matching tests are believed by some people to be the ultimate tests of astrology because they address the problem of divination. Astrological divination is the ability to coordinate the meanings of all the pieces in an astrological chart to create interpretations that are based on the chart as a whole, assisted by trained intuition. The best-known matching tests are the following.

**The Vernon Clark tests** - Psychologist Vernon Clark conducted three influential astrological tests between the years 1959 to 1961. A summary of this research is reported by Dean and Mather (1977). In these tests 50 experienced astrologers in several countries were asked to match accurately-timed birth charts to their owners. In test 1 the astrologers were given charts of five male and five female subjects and asked to match the charts in the order of best fit with the owners’ occupations. All test subjects were adults between the ages of 45 and 65, who had an accurately timed birth chart, and were long established in their professions. In test 2 astrologers were given ten pairs of charts and ten brief case histories. They were asked to decide in each case which chart correctly matched the case history. The astrologers were not told that one chart in each pair was genuine and the other was generated from a random time and place near the genuine case. In test 3, which was a double-blind test, astrologers were asked to distinguish between each of ten pairs of birth charts. One chart of each pair belonged to a subject with cerebral palsy and the other belonged to a subject with high intelligence. In all three tests, the astrologers performed much better than chance.
specific interpretation errors. Of course, if the premise of the Astrotest was in error, then the
subjects' personalities or their charts, the test design is inscrutable to any statistical analysis of
might have made. By using only unique matches without regard for uniform features in either the
unique, it is not possible to determine from this test what interpretation errors the astrologers
and there was no consistency in their matches. Because of this, and because each match was
not use astrologers. However, in the Astrotest the astrologers' results were no better than chance
to use as benchmarks, and for this we can look to the Astrotest, because the time twins test did
limited than they thought, and some concluded that astrology might only work in actual practice.
caution that although the results of Clark's tests are extremely significant, they might not be
useful, though they offer no demonstration of this.

The Shawn Carlson test - Probably the best-known matching test was done by Shawn Carlson
(1985), who at the time was a physics student and the University of California at Berkley, and
had no training in or understanding of astrology. This test, published in the large-circulation
science journal Nature, showed that qualified astrologers could not match test subjects' charts
with the results of the California Personality Inventory (CPI) any better than by chance. It also
found that the test subjects could identify neither their own CPI results, nor their astrological
interpretations provided by the astrologers, any better than by chance. This test was highly
controversial. Among the many objections raised, it was argued that while psychology failed the
matching test in the same degree as astrology, only astrology was given a negative conclusion,
whereas psychology was given a pass. Another objection was that the test required expertise with
both astrology and the CPI, which none of the participating astrologers had. Yet another objection
was that astrology and psychology might look at personality somewhat differently and do not
share enough of a common language and structure of interpretation.

The Astrotest - Another matching was conducted by Rob Nanninga (1996), which he called the
Astrotest. The Astrotest was based on a questionnaire that was designed mainly from the
suggestions of the participating astrologers themselves. This questionnaire required each of
seven volunteer test subjects to provide, besides birth data, information on such things as
education, vocation, hobbies, interests, main goals, personality, relationships, health, religion, as
well as dates of important life events. The questionnaire also contained some multiple choice
questions from the Berkley Personality Profile. The astrologers were asked to match the birth
charts of each of the seven test subjects with their questionnaire results. The astrologers
performed no better than chance. Moreover, the astrologers' choices were inconsistent,
demonstrating a lack of agreement among themselves as to which chart should match which
questionnaire result. Some of the participating astrologers admitted that astrology might be more
limited than they thought, and some concluded that astrology might only work in actual practice.
However, despite these disappointing results, most of the astrologers still believed that science
can show that astrology works.

The time twins test - Researchers Geoffrey Dean and Ivan Kelly (2003) published the results of
what they describe as a "definitive" matching test. Unlike other matching tests, this test did not
depend on the interpretive skills of astrologers because the test subjects were astrologically
matched "time twins." Time twins are two unrelated persons who are born at nearly the same
time and place, and hence have nearly identical charts. According to popular astrological lore,
time twins should have numerous similar themes in their lives. This test used a sample of over
1000 pairs of time twins who were all born in London. Each time twin pair was born an average of
4.8 minutes apart. The results of this test showed that the time twins were not matched any better
than chance when compared using a set of predetermined personality criteria and life events.

The Astrotest and time twins tests raise interesting questions for researchers. It appears that the
statistical tests described in Lesson 2, and the Vernon Clark tests, provide a certain amount of
evidence in support of astrological claims. Why then do these matching tests not show the
slightest amount of support? Two possible explanations should be considered. One involves
astrological practice, which has to do with astrological interpretation or divination, and the other
involves the astrological premise, which has to do with astrological theory, requirements, and
limitations. Firstly, as a question of practice, the astrologers might have made interpretation errors
in matching the charts. Secondly, as a question of premise, the designs of these matching tests
might not be within the testable limits of astrology and be in error.

To determine errors of practice, there needs to be uniform consistencies in the interpretive results
to use as benchmarks, and for this we can look to the Astrotest, because the time twins test did
not use astrologers. However, in the Astrotest the astrologers' results were no better than chance
and there was no consistency in their matches. Because of this, and because each match was
unique, it is not possible to determine from this test what interpretation errors the astrologers
might have made. By using only unique matches without regard for uniform features in either the
subjects' personalities or their charts, the test design is inscrutable to any statistical analysis of
specific interpretation errors. Of course, if the premise of the Astrotest was in error, then the
As for errors of premise, it is useful to examine what assumptions were made in these matching tests that make them different from the statistical tests, which appear to have some measure of success. Also, it is necessary to determine if assumptions were made that fail to meet the requirements and limitations of astrology.

The tests described in Lesson 2 use a one-to-many method, in which one type of character or behavior is statistically evaluated by sampling the astrological features in many charts. This statistical method can work where there are low or even fuzzy levels of correlation. Unlike the statistically-oriented tests, these matching tests in Lesson 3 require one-to-one relationships that assume a high or even complete level of determinism. In both the Astrotest and the time twins tests, each single chart is to be matched with only one unique thing. Again, because the matches are unique, this experimental method does not provide data to statistically evaluate the features of the charts or how the stars might "incline." By assuming high levels of determinism, these one-to-one matching tests may have done nothing more than provide evidence in support of the astrological premise that "the stars do not compel." These tests appear to be outside the limitations of astrology.

The Vernon Clark tests might hold clues to the design of improved whole-chart tests that would have less dependency on strict determinism and would allow for the fuzzy logic and limitations of astrology. Rather than simply match a sample of charts to unique personal information on a one-to-one basis, astrologers could be asked to decide between extreme pairs, or asked to sort test subjects' charts into categories and rank them for best fit. For example, astrologers could be asked to sort the charts of 25 people with cerebral palsy which they would rank by severity, from the charts of 25 people with superior intelligence, which they would rank by level of intelligence. This example would test whole chart divination, as the one-to-one matching tests were intended to do. The difference is that a sorting and ranking test would allow the possibility of finding chart patterns that associate with the measured severity or eminence of personal characteristics that incline toward the more extreme cases, and this could potentially add to the evidence of astrology.

Although one-to-one matching tests have been attractive to both skeptics and astrologers, they do not provide useful analysis of chart features and appear to be outside the limitations of astrology. They may be a straw man fallacy that diverts attention away from the statistical evidence of astrological features already found and the need for continued statistical experimentation that uses ranking levels that still needs to be done.

Lesson 4: Sample hypotheses for astrological research

The limitations of astrological matching tests discussed in Lesson 3 do not necessarily mean that questionnaires cannot be used in research. Questionnaires can be used provided specific features of character and behavior are quantifiable by using a sample of many charts, not just one. There needs to be enough sample data to allow potential astrological inclinations to be evaluated and errors or artifacts to be discovered and removed.

To avoid the error of comparing unlike things, the best approach would be to search for common ground between astrology and equivalent areas assessed by specifically-focused questionnaires. Astrology is based on planets. The planets are instruments of personality that the individual learns to use with the satisfaction of skill. This suggests that applicable questionnaires should focus on personal satisfactions and adaptations. For example, these areas could include love, shared values, intelligence skills, and emotional competence. The following sample hypotheses are based on my own published work on astrological theory (2004), in which various structures drawn from the social sciences are compared with the astrological frames of reference. They are offered as suggestions for this potentially interesting and useful research.

**Love expectations** - The more strongly the evaluated style of love, as assessed by a questionnaire developed by sociologist John Alan Lee (1975), the more likely the hypothetically equivalent signs will be found on the horizon at birth.

**Shared values** - The more strongly the assessed social values, as evaluated by a psychographic survey developed by social psychologist Arnold Mitchell (1983), the more likely a preponderance of planets will be found in the hypothetically equivalent sign quadrants of the subjects' birth charts.

**Intelligence skills** - The more strongly the evaluation of interpersonal intelligence and intrapersonal intelligence, as assessed by the multiple intelligences test developed by psychologist Howard Gardner (1983), the more likely a preponderance of planets will
hypothetically be found near the descendant and ascendant respectively in the subjects’ birth charts.

**Emotional competence** - The more strongly the evaluation of emotional intelligence, as assessed by the tests developed by psychologists Peter Salovey and John Mayer (2004), or psychologist Daniel Goleman (1996), the more likely a preponderance of the hypothetically equivalent aspect types between planets will be found either in the subjects' birth charts or as aspects of planetary transits to the subjects' charts at the time of testing.

Besides the applications described in these few examples, astrology has been used in many different areas. Astrology has been applied to such "world" issues as history, business enterprises, sports, war, ideas, and as already described in Lesson 2, genetic traits, market activity, and large geophysical events. Practically any type of event can be tracked and analyzed with astrology, and could potentially provide statistical evidence.

The challenge for students, astrologers, and empirical skeptics, is to quantitatively evaluate hypotheses that are within the claims, theories, and limitations of astrology.

**Lesson 5: Guidelines for astrological research**

Although astrology skeptics are often mindful of astronomical, demographic, and statistical artifacts that affect astrological research, which are all good, criticism and actual research by skeptics has sometimes demonstrated a disregard for astrological operations, claims, and limitations, and this can be more obscurantist than helpful. Some of the most common errors that skeptical researchers might commit can be avoided by using the following guidelines offered as a summary, which astrologers and students should heed as much as empirical skeptics.

**Sun signs** - Popular books and columns that attribute all the features of personality and behavior to only the twelve zodiacal signs occupied by the Sun at birth are misrepresentations. These sources ignore the complexity and limitations of astrology and should be denounced at every opportunity. Anyone who has studied astrology knows that other factors in a birth chart can outweigh the features commonly attributed to the Sun sign. Additionally, Sun sign tests are particularly prone to astronomical and demographic artifacts that skew results. These artifacts have often gone unrecognized by untrained researchers. There have been innumerable Sun sign tests, conducted in the name of science by researchers of every stripe and persuasion, which unfortunately have typified scientific research at its worst.

**General personality tests** - Comparisons of birth chart interpretations with the results of general personality questionnaires, such as the CPI, are far from ideal. Such comparisons require expertise in both astrology and the use of these tests. Furthermore, it has not been clearly demonstrated or claimed that the profile scales of these personality tests and astrology describe the same things. As desirable as such tests might seem, there is no reasonable foundation available to warrant making comparisons between astrology and general personality tests with any degree of expectation.

**One-to-one tests** - Astrology uses fuzzy, not crisp, logic. As can be seen in any astrology text, each astrological indicator, or combination of indicators, has a range of related meanings that could include both probable and improbable outcomes. One-to-one comparisons assume nearly or completely deterministic matches and avoid statistical correlations of chart features. They are unlikely to find any astrological associations. Unless science advances to provide some better means of quantification, astrological research should use one-to-many tests. This means that one astrological hypothesis should be tested against a suitably-defined sample of many accurately-timed astrological charts to allow the possibility of finding astrological correlations and inclinations.

**Eminence and severity** - Astrology is guided more by the exceptional and momentous than the norm. Whether its natives and subjects are viewed as being famous or infamous, eminently virtuous or eminently reviled, whatever rises to prominence as being fortuitous, disastrous, unusual, or rare is of special interest to astrology. Statistical tests in astrology should examine a single strongly-presented feature of character or behavior and take a large sample. In any such tests, it is especially useful to determine whether the sampled feature increases in eminence, severity, or rarity in covariance with astrological factors, which would suggest a species of astrological meaning. A good example of eminence evaluation is Ertel's assessment of the Mars data for sports champions, a landmark astrological finding that has stood without refutation for twenty years. Müller and Ertel's eminence test for Saturn and Mars of members of the French Académie de Médecine is even more convincing because the sample itself is exclusive and self-chosen, but not for astrological reasons. These findings strongly support the traditional associations between the planets involved and their corresponding characteristics as predicted
by astrology. Because testing for eminence or severity is a highly sensitive and objective technique that minimizes sampling errors and the possibility of unknown artifacts, it can quell controversies of sampling bias and effect size while potentially providing additional support for astrological factors. Evaluation of eminence or severity should be required as a rule.

This concludes the lessons. Some students might find that these lessons go counter to what they are taught in class, which is unfortunate. For those students who finish this article, congratulations are in order. It is disconcerting to focus for more than a moment on information that might not help to pass a course, and most students have little time to engage in major conflicting contemplations. Those students who finish this article, who have chosen the path of integrity, may include a brief note on opposing views in their essays critical of astrology.

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