

ESSAY

How to Think About the Astrology Research Program: An Essay Considering Emergent Effects

Kenneth McRitchie

SUBMITTED June 16, 2022
ACCEPTED August 27, 2022
PUBLISHED December 30, 2022

<https://doi.org/10.31275/20222641>

PLATINUM OPEN ACCESS



Creative Commons License
4.0. CC-BY-NC. Attribution
required. No Commercial use.

HIGHLIGHTS

A review of recent astrological research and a meta-analysis show a methodical program that is tackling problems and improving results in terms of quantifiable correlations and effect-sizes. The value of the program is not just to test the truth of standard astrological taxonomies but to understand, along with other disciplines, the process of how effects emerge from complex systems.

ABSTRACT

As it has been shaped by improvements in its tools and methods, and by its discourse with critics, I describe how the astrological research program has advanced through three stages of modelling and design limitations. Single-factor tests (for example, the many Sun-sign-only experiments that have been published) are typically underdeterministic. Multi-factor tests, unless they are very well designed, can easily become overdeterministic. Chart-matching tests have been vulnerable to confirmation bias errors until the development of a machine-based, whole-chart matching protocol that has objectively produced evidence of high effect-sizes. A meta-analysis of recent results shows the rapid advancement and how to further improve the results. The value of the program is not only to corroborate the taxonomic counterfactuals of astrological “cookbooks,” but to extend their explanatory reach by the comparison of astrological postulates and inferences with philosophies in other disciplines in terms of quantifiable processes and emergent effects.

KEYWORDS

Astrology, emergent properties, effect-sizes

INTRODUCTION

Quantitative research in astrology did not begin in earnest until the mid-twentieth century and has depended on statistical research tools and computational power to adequately look into the claims of the astrology postulate. By the term astrology, I mean as a definition the study of the positions and motions of celestial bodies in relation to the character of lives and events. By the term postulate, I refer mainly to the applied principles and applied theory documented in astrological textbooks, the so-called *cookbooks*. Some examples of modern cookbooks are: Sakoian and Acker’s *The Astrologer’s Handbook* (1973); Richard B.

Vaughn’s *Astrology in Modern Language* (1985); and Margaret Hone’s *The Modern Text Book of Astrology* (1978).

The word astrology comes from the Greek (*astr* + *logos*) loosely meaning “star word” or “star speech.” Modern cookbooks carry on the tradition from antiquity of organizing astrological properties as a semantic taxonomy of interpretations.¹ Each planet’s position in the sky is interpreted by the categories of: its sign; its diurnal house (a 12-fold frame of reference affixed to the local horizon and meridian); and its aspects (its angular distance to the other planets). For example, a cookbook-described position would be for: Mars in Sagittarius; Mars in the Ninth House; and Mars opposite Moon (with Mars and the Moon on opposite



sides of the Earth, 180° apart). Astrology presumes *emergent effects* from the consequential combinations of these astrological factors.

Most astrological research concerns *Natal Astrology*—the study of birth charts. A birth or *natal chart* is a sky-map positioned on the birth of the individual, called the *native*, as a microcosm at the relative center of the Solar System, and in the greater macrocosmic sense, at the center of the universe. Hence, the *native's planets* (including the Sun and the Moon) are relative planets because they, in a fashion, move around the native, as does the native's universe.² A natal chart is evaluated semantically for the native's potential characteristics and experiences, and how these are astrologically influenced, mainly by day-to-day interactions with other natives—who represent parallel universes or parallel worlds so to speak.³ There are other branches of astrology (deVore, 1947, p. 29) such as *World or Mundane*, that study eclipses, ingresses, and major planetary cycles with regard to populations. And there are *Horary* and *Electional*, which study propensities at the moment of a query, idea, or event (*Horary*), or seeks to optimize the time and place for a specific event in the future (*Electional*).

The research program can be understood in terms of what I will call three stages of experimental complexity. I will introduce them briefly here before giving examples in subsequent sections. The earliest stage, which first suggested quantifiable evidence of astrological effects, relied on relatively simple *single-factor* experiments. These consist of correlational tests of planetary features as a single factor and the corresponding theoretical interpretations that might be categorized, for example, under a single section in the cookbooks. Next came *multifactor* experiments that evaluate several chart factors in combination, postulated as a model or *signature* of an observable feature of the natives who have it. Most recently, are *whole-chart* automated simulations that evaluate all the combined factors in natal charts. All three of these experimental methods have specific uses within the research program.

The development of single-factor and multifactor protocols included identification of astronomical and demographic artifacts that would confound the measurements of astrological effects. The developed protocols include data randomization methods that generate neutral control groups to evaluate significant correlations (Gauquelin, 1988; O'Neill, 1995; Ertel, 1995; Ruis, 2008; Tarvainen, 2012).

Single-Factor Experiments

The best-known examples of single-factor experiments are the large-scale studies of eminent professionals done by French researchers Michel and Françoise Gauque-

lin (1955, 1975). Guided by traditional interpretations, Michel Gauquelin initially tried to correlate astrological properties (from the cookbooks) with the natal charts of famous professionals whose timed birth data he could obtain. The main groups tested were: athletes; actors; scientists; doctors; artists; writers; corporate executives; military leaders; musicians; and politicians. When Gauquelin did not immediately find any clear effects, he experimented by dividing the four diurnal quadrants into finer slices of 36 and 18 sectors as well as the customary 12 Placidus houses.

Gauquelin's research led to the discovery of what he called *keysectors*, which are two slices of sky within which he found that certain planets (Moon, Mars, Jupiter, or Saturn) correlate significantly to attainment of eminence in their astrologically associated professions. The data peaks of the keysectors are located just after rising above the eastern horizon and just after culmination at the upper meridian. The inference of professional prominence due to the planetary placements in these sectors became known as the *eminence effect*. Because achievement in sports is measured exactly and Gauquelin found the Mars-key-sector sports correlation to be especially strong, and because there is a constant supply of young athletes to use as subjects, Gauquelin recommended that replication experiments test eminent athletes for Mars in keysectors.

The Mars-athletes replication tests proved to be a battleground with many experiments conducted and accusations of sampling bias from both sides over what qualified as professional eminence (Ertel & Irving, 1996). The controversy has diminished, however, following a critical study by Professor Suitbert Ertel (1988) that objectively ranked the eminence of famous athletes in the entire sample that had accumulated ($N = 4291$) by a frequency of 1 to 5 based on whether they were cited in five sports reference books.

Ertel found that the Mars-eminence effect diminishes for each lower rank of athletes in a near-linear fashion. Compared to a randomized control group, the "monotonic trend with ranked qualitative data" (p. 71) demonstrates a very low probability against chance of $p < 0.005$ (where $p < 0.05$ is considered to be significant in the social sciences). To show the size of this effect, Ertel calculates Kendall's Tau ($\tau = 0.037$) as the correlation coefficient of the ranks (where perfect correlation is 1). This calculation indicates a quite weak effect, although this is not surprising as it is the evaluation of a single astrological factor among the many possibly related factors in a chart that could be contributors. The significance of Ertel's finding comes from the very low probability of the ordered ranks occurring by chance: ($N = 4291, p = 0.005, \tau = 0.037$).⁴

Most astrological experiments, however, do not measure ranked results as in Ertel's example, and other evaluations of effect-size (ES) would apply. Until recently, ES has

not been included in astrology studies (nor in most scientific studies) and it is proving to be a highly useful metric, as I will show. There are various methods of calculating ES, and the one applicable for most astrological experiments (Currey, 2022) is the Pearson product-moment correlation coefficient between pairs of variables, r (Cohen, 1988, p. 75), where $r = 1$ is perfect correlation, as used in the remaining examples of this article.⁵

A more typical design of a single-factor experiment is one by astrologer Paul Westran (2021). Westran studied 1300 romantic relationships of famous people (2600 natal charts) in terms of *synastry*—the mutual alignments between two natives' charts. This study looked for correlations between the starting time of a relationship or marriage and the transit or secondary (day-for-a-year) progression aspects of the Sun and Venus between the partners' charts.⁶ The results show an extraordinarily high significance for the Sun/Venus aspects that are traditionally conducive of intimate relationships (*conjunctions*, *trines*, and *oppositions*) compared to a control group of the same size ($N = 5200$, $p = 4.76 \times 10^{-11}$, $r = 0.09$).⁷

These examples give an idea of how single-factor experiments can work to find a specific astrological value, thereby reducing ambiguity in the result. But single factors have limitations because they tend to require very large samples and they ignore all the other factors in the natal charts, resulting in weak effect-sizes. To say that any single factor must be definitive in the lives of the natives who have it seems an extraordinary claim considering that there are always other factors in a natal chart that can have somewhat similar values and effects. Indeed, most professionals who have attained eminence in their fields do not have their Gauquelin-correlated planet in either of the two keysectors. If we were to seriously consider emergent effects, then we need to include other astrological factors that contribute to the recipes of correlational outcomes. Indeed, we can typically find many suggestions of such related combinations scattered among the single-factor descriptions in the cookbooks.

It seems to me that single-factor testing is susceptible to *underdetermination*, meaning that a single factor is not necessarily sufficient to evaluate an astrologically significant effect. The listings in the cookbooks suggest that a multiplicity of factors in any natal chart are assumed to converge, intersect, or otherwise blend together to produce emergent results. Yet, this critical assumption has been ignored by hundreds of single-factor experiments, including a disproportionate number of Sun-sign-only studies (e.g., Dean et. al., 2016; Helgertz & Scott, 2020), and Moon-phase only studies (Marko, 2017), many of which have been done with unrealistic expectations and have led to disappointing results (Houran & Bauer, 2022). The

evaluation of emergent effects would seem to entail an additional approach—a multifactor testing or some variation of multiple regression, and these are methods that the research program also explores.

Multifactor Experiments

By relating, blending together, and modelling some of the factors in a natal chart into what we might call astrological *signatures*, multifactor experiments overcome the problem of underdeterminism. This approach tries to identify tell-tale combinations of natal chart factors that have either similar or antagonistic tendencies that we would presume to amplify, diminish, or otherwise moderate a theme of given characteristics in a native. To give a simple two-factor example observed by the Gauquelins, keysector Mars positively correlates to athletic eminence and yet the Moon in a keysector is antagonistic and negatively correlates to the athletic effect (Gauquelin, 1988, p. 144). The Moon appears to *moderate* the Mars effect, which is consistent with the astrological properties of the Moon. Many suggestions as to how some factors moderate other factors and impose contingencies on interpretation as to what may manifest are scattered throughout the cookbooks.

The problem with multifactor testing is that it can easily suffer from nomological *overdetermination*, which is the opposite problem of single-factor testing. This is where there are too many similar and potentially sufficient factors according to the documented rules in the literature to easily sort out exactly which astrological features are responsible for which experienced effects. A few authors have compiled interpretations of combined chart factors, although such works are rare because of the semantic complexity of blending the many potential factors in a chart. To help accomplish this, the verbose descriptions typical of single-factor interpretations are conceptually condensed to very brief statements. For example, in German astrologer Reinhold Ebertin's (1940) classic *The Combination of Stellar Influences*, single-factor and combined-factor descriptions are listed with just a few short phrases and keywords to be used as building blocks.

In view of the overdeterministic limitations, a multifactor experiment would try to identify a characteristic feature of interest in a homogeneous sample of subjects and combine only a few well-defined, appropriate descriptions from the cookbooks to test as a hypothetical model of the feature. The modelling could include such common manipulations as applying planetary "weights" where, for example, the Sun and Moon are given more weight and the outer planets are given less weight. Planets with astrological properties that suggest dominance in an effect

can be tested with more weight to better assess their contribution. Such treatments or interventions of a sample would seem to have the best chance of corroborating and improving the cookbooks. Of course, this is not to say that completely new theories cannot be usefully tested and explained. Let me give some example studies of how multifactor modelling has been done.

As written in virtually all astrology textbooks, Venus and the sign Libra, over which it is said to “rule” (being the sign most consonant with the planet’s characteristics), and Jupiter and its rulership sign Sagittarius, are associated with judges. A multifactor study modelled on these associations by British astrologer Robert Currey (2021a, 2021b, 2022) tested the natal charts of 115 justices of the Supreme Court of the United States (SCOTUS) appointed since 1789. The frequency of astrological combinations of these two planets, whether by occupying their own or each other’s sign or house, or by their astrological conjunction, shows a significant correlation to the textbook theory ($N = 115$; $p = 4 \times 10^{-4}$; $r = 0.31$). Currey’s test corrects a claim against astrology by author Alexander Boxer (2020, pp. 86–89) that concluded from a single-factor test that there was “no correlation” between any Sun sign and SCOTUS justices, including Sun in Libra, which had been Boxer’s chosen astrological hypothesis.

Another multifactor study by Currey (2017) uses Eysenck’s Personality Inventory (EPI) and also corroborates astrological theory. The model semantically matches the EPI trait words for Extraversion [E] and Neuroticism [N] to the corresponding keywords for the astrological elements (Fire, Earth, Air, and Water) drawn from the texts of well-known astrologer authors. The multifactor keywords are from the interpretations given for the positions of the Sun, Moon, and Ascendant, which are traditionally the most personal chart factors and make a suitable model for such a test.

The results of Currey’s EPI study show that participants who scored high in Extraversion [E+] and low in Introversion [E–] were high in Fire signs and low in Earth signs ($N = 216$; $p = 0.009$; $r = 0.16$). Participants who scored high in Emotional Stability [N–] and low in Neuroticism [N+] were high in Air signs and low in Earth signs ($N = 216$; $p = 0.007$; $r = 0.17$). These results corroborate the cookbook interpretations. Currey’s test used original data provided by Geoffrey Dean (1985a, 1985b, 1986), who had claimed that his experiments showed no astrological correspondence to EPI results that are better than chance.

A study by mathematician Kyösti Tarvainen (2013) of professional mathematicians uses 25 natal chart factors that do not require birth times (which were unavailable for the sample) that are favorable to the profession based on a standard cookbook (Sakoian & Acker, 1973). The factors

are significantly more frequent in the mathematician group than in a randomized control group ($N = 2759$, $p = 0.03$, $r = 0.04$). The low effect size (r) of this result increases for the same factors in a much smaller subgroup of only those individuals who had won a prestigious prize in mathematics ($N = 99$, $p = 0.04$, $r = 0.18$).

Having some reliably significant although modest results in multifactor tests makes it possible to intervene in the same tests by substituting various claimed astrological theories, techniques, and settings to determine whether they fare better or worse against the best evidence so far. A descriptive summary of such substitution tests done by various researchers (Tarvainen, 2021a) includes comparisons of tropical versus sidereal zodiacs (where the tropical zodiac, which is based on the solstices and equinoxes is compared to the *Lahiri ayanamsha* sidereal zodiac that is traditionally used in Indian/Jyotisha astrology). Other comparison tests include: various diurnal house systems; sizes of orb settings (the margins of influence near an alignment); various midpoint configurations; and various synastry techniques. These evaluations are in the early stages but hold promise as I will show with an example later.

Whole-Chart Matching Experiments

To avoid the underdeterministic limitations of single-factor experiments, and the overdeterministic excesses of multifactor experiments, some of the research in the post-Gauquelin era has been drawn to whole-chart matching experiments. These tests do not discriminate any specific traits or characteristics but have been used simply as a verification test of whether astrology can work without describing how. Typically, these are blind tests that challenge astrologers to match natal charts to the biographies or personality test scores of their owners. Chart-matching experiments have been touted as the ideal test of astrology because: the subjects can be ordinary people; all factors in the chart are used; there are no demographic or astronomical artifacts; there is no need for control groups; and the statistical analysis is simple (Godbout, 2020).

The first notable blind matching tests were done between 1959 and 1970 by psychologist Vernon Clark (1961, 1970). For example, one of his experiments tests the efforts of 50 professional astrologers and a control group of 20 psychologists and social workers. All participants were asked to match the descriptions of 10 professionals with their charts, given the choice of the genuine chart and a bogus chart for each. The control group successfully matched 50% of the sample, as expected by chance. The astrologers matched 65%, which is significant ($N = 500$, $p = 1 \times 10^{-4}$, $r = 0.17$).

Despite this promising beginning, serious researchers have been reluctant to do chart-matching tests due to the organizational, logistical, and discomfiting issues of astrologers challenging their own colleagues. Typically, researchers have preferred to quietly develop their own theories and evidence by working independently.⁸ Also, while matching tests may be interesting as a game or a contest, they have not been regarded as adding explanatory value. This is because the Vernon Clark protocol blends the astrological interpretations of participants as an aggregate or a *black-box* result that does not expose the fine-grained *effective information* (Wolchover, 2017) on theory and problems where we think the emergence of astrological properties, effects, and agency can be traced. The usual multifactor models seemed to hold more promise for analysis than whole-charts. The resulting state of affairs left the door open for astrology critics who designed their own Vernon Clark tests, chose the participants and informed them as they saw fit, did their own analysis, and drew their own conclusions.

Like the earlier Gauquelin tests of Mars and eminent athletes, chart-matching tests soon became a battleground over questionable methods and published claims that astrologers did not perform any better than chance (Carlson, 1985; McGrew & McFall, 1990; Nanninga, 1996/1997). However, unlike the Gauquelin controversy, matching tests require neither control groups nor homogeneous samples. Consequently, flaws in the tests are more clearly identifiable. Some of the counter-criticism against the aforementioned tests include: samples that are too homogeneous to differentiate (cherrypicking); improper design and analysis (*p*-hacking); and discarding potentially corroborating data (publication bias) (Ertel, 2009; Currey, 2011; McRitchie, 2009, 2014, 2016). In one study where the test data was published (Carlson, 1985), re-analyses by Ertel (2009), who did the heavy lifting, and Currey (2011), who made further refinements, claim to reverse the results as evidence that supports astrology. Currey's re-analysis found the results to favor the astrologer participants ($N = 115$, $p = 0.037$, $r = 0.1$). Ertel's and Currey's claims of positive results have remained unchallenged. For readers who are interested, the articles published by both sides of the chart-matching controversy are freely available and can be examined and judged in detail.

Having said that, chart-matching tests have recently made an important advance. Astrology software and automated protocols have been developed to make matching tests much bigger and objectively more accurate. The latest evidence suggests that the previous controversies may be moot.

Automated Chart-Matching

Of prominent interest are the automated chart-matching tests of Canadian mathematician Vincent Godbout

(2020) that use an expert astrology software system designed for keyword analysis, called Mastro Expert, and a programmed utility he calls a "Semantic Proximity Estimator" that is similar in function to a "machine scientist" or a *symbolic regression algorithm* (Wood, 2022). Godbout's regression algorithm evaluates chart matches semantically in a blind protocol with samples that are much larger than humans have a capacity to analyze. In principle, this design approach would be the same as a multifactor experiment except it tracks "all" the factors in the sample charts and does not try to discriminate any signature feature or characteristic that the subjects may share in common.

To make the matches, the machine uses the possible instances of about 3,000 keywords drawn from more than 5,000 chart factors that Godbout sourced from the publications of 25 modern international astrology cookbook authors (American, French, British, German, and Canadian). By removing human limitations, the experiments surpass all previous matching tests in terms of safety, size, and difficulty of challenge. The automation also quashes the otherwise hard-to-falsify claim (Dean et. al., 2016) that successful chart-matchings may be due to ESP ability.

In Godbout's (2020, 2021) first automated chart-matching experiment, the machine had to match two separate samples (experimental, $N = 41$, and verification, $N = 32$) of natal charts of famous people by using characteristic keywords (in noun form) drawn from the natives' biographies sourced from *Le Monde* (Subtil & Rioux, 2011). All the biographies were used for which accurately timed birth data could be obtained, which provided the total study sample of $N = 73$ out of the 100 subjects listed in the source book. The only part of the protocol that requires human involvement is the extraction of keywords from the biographies, which is done blindly without knowledge of the astrological charts.

The matches are evaluated by 8 binomial distributions that account not only for the correct identification of a subject's chart as the top-scoring choice but also for near misses where the correct chart is within the top 2 choices, within the top 3 choices, and so on up to the top 8 choices. Thus, for Godbout's combined sample of 73 subjects, the correct identification as the highest-scoring choice has a probability against chance expectancy of $1/73$; within the top 2 it is $2/73$; within the top 3 it is $3/73$, and so on to 8 places. In this manner, the 73 charts are matched against the 73 biographies to determine how many correct matches are found in each binomial bucket of the top 8 choices. The machine identified the correct charts much more frequently than chance expectancy for each bucket. For example (Godbout, 2021, p. 38), the "worst result" was for bucket 2 with 2 expected but 9 observed ($N = 73$, $p = 1.73 \times 10^{-4}$, $r = 0.42$). The best result was for bucket 7 with 7

expected but 24 observed ($N = 73, p = 3.97 \times 10^{-8}, r = 0.63$).

Given the high correlations of this original test to use as a benchmark, Godbout (2020, 2021) ran replications within the same study to test interventions against the astrological standards he used. This is the same approach mentioned earlier in the substitutions studied by Tarvainen. The standards Godbout interfered with are: standard orb settings based on the British Faculty of Astrological Studies (Tompkins, 1989, p. 66); accurate birth times; major midpoints; and the tropical zodiac. The substitution of the most widely used non-tropical zodiac (*Lahiri ayanamsha*) failed to achieve significance. The substitution of tighter than standard orb settings, of rounded birthtimes, and of tests without midpoints resulted in lowered significance. These results suggest not only that the tested existing standards are good but that the method of experimental interventions in whole-chart testing can provide evidence capable of extending and improving the reach of astrological theory in detail.

What the Research Program Looks Like

By entering the walled garden of astrological research and regarding the work as a concerted program of tested models, methods, and data, an overall view of the program begins to take shape. Figure 1 is from a meta-analysis by

Robert Currey (2022) of experiments published between the years 2020 to 2022. It shows a distinctive, logarithmic trend of relationships between sample size (N), effect-size (r), and probability (p). Correlational results that are above the lower dashed curve are greater than the threshold (α -*pha*) of statistical significance, $p < 0.05$. The uppermost curved solid line is the regression trendline of the 10 research findings.

As the plot points in the graph show, single-factor experiments (for example, Westran’s Sun/Venus synastry study, Point 10) can produce very high probabilities given its large sample, although the effect-size for a single factor out of the many available in a natal chart is quite small. Multifactor experiments (for example, Currey’s SCOTUS study, Point 1) combine astrological factors and can produce stronger effect-sizes, a result that begins to suggest *emergent effects*. But the strongest evidence for emergent effects is from whole-chart matching experiments (for example, Godbout’s automated tests, Point 6) that can produce both a high probability and a large effect-size.

For some studies, the classification of whether a test is single-factor or multifactor is a bit loose at this stage as astrology is a complex system, but for this meta-analysis we will consider that the single-factor tests are: 4, 5, 7, 8, and 10; the multifactor tests are: 1, 2, and 3, and the whole-chart tests are 6 and 9. See Table 1 for further details.

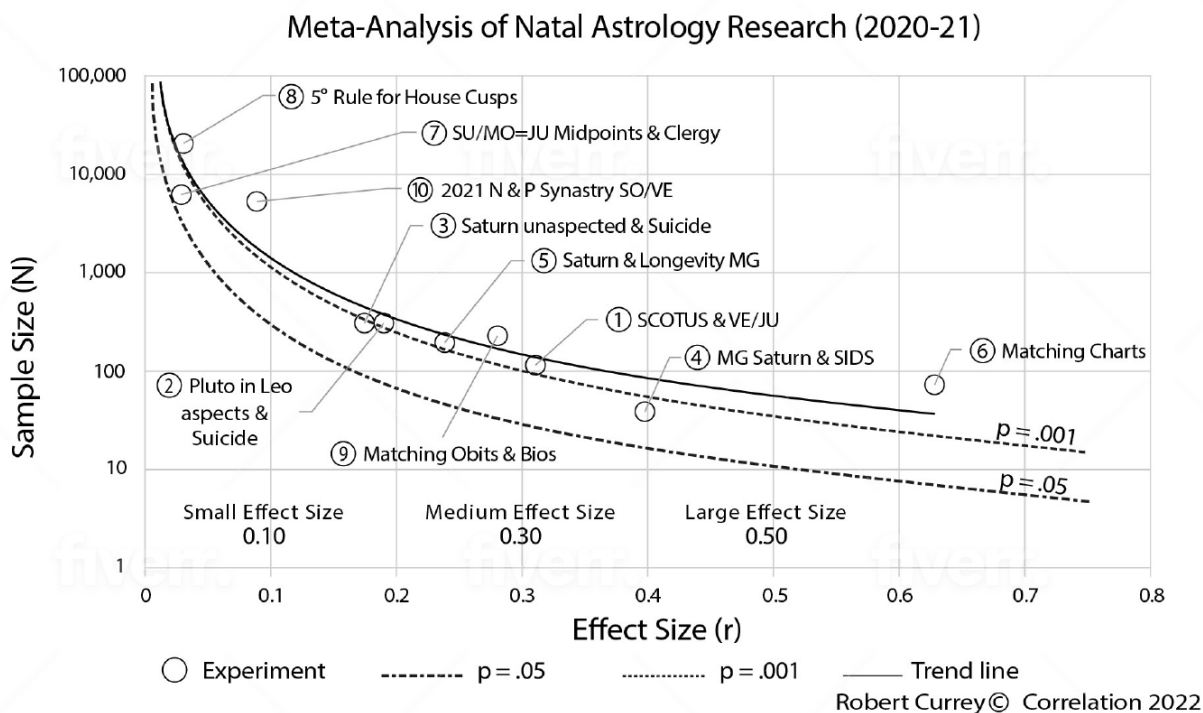


Figure 1. Meta-analysis of astrology research 2020-2021 with trendline (from Currey, 2022).

TABLE 1. Details of the Figure 1 Meta-Analysis (Currey, 2022). For the 10 studies, mean $r = .24$, median $r = .21$

Author (Year)	Hypothesis	Factors	N	p	ES: r
④ Douglas (2021a)	Saturn in MG Sectors & SIDS	single	38	0.007	0.40
⑤ Douglas (2021b)	Saturn & Longevity MG	single	197	4×10^{-4}	0.24
⑦ Tarvainen (2021a)	SU/MO = JU Midpoints & Clergy	single	6,285	0.01	0.03
⑧ Tarvainen (2021b)	5° Rule for Koch & Equal Houses	single	20,394	4×10^{-7}	0.03
⑩ Westran (2021)	N & P Synastry SU/VE	single	5,200	4.76×10^{-11}	0.09
① Currey (2021b)	SCOTUS & VE/JU theme	multi	115	4×10^{-4}	0.31
② Currey (2021c)	Pluto in Leo aspects & Suicide	multi	311	4×10^{-4}	0.19
③ Currey (2021c)	Saturn unaspected & Suicide	multi	311	0.001	0.18
⑥ Godbout (2020)	Automated Matching Charts	whole	73	3.9×10^{-8}	0.63
⑨ Tarvainen (2021c)	Matching Obituaries & Bios	whole	233	1×10^{-5}	0.28

JU = Jupiter; MG = Michel Gauquelin data; MO = Moon; N = Natal; P = Progressed; SIDS = sudden infant death syndrome; SU = Sun; VE = Venus.

As a practical aid for research design, Currey’s meta-analysis helps estimate the minimum sample sizes needed for tests to have a reasonable chance of significance. This is useful because data privacy laws have made accurately timed birth data very difficult to obtain. For well-designed tests, Currey’s (2022, p. 55) recommended minimum sample sizes—based on Cohen’s (1988) guidelines—are: for single-factor tests, 350 subjects (600 to 1000 for Sun-sign experiments); for multifactor tests, 70 subjects; and for whole-chart tests, 25 subjects. To ensure safety, most studies will need enough subjects for two separate tests: an experimental test and a verification test. This would double the size of Currey’s recommendations, as the data would be randomly distributed between the two tests.

Seeing that the use of combined cookbook factors appears to boost effect-size, one must wonder whether, given a sufficient number of properly interpreted factors in whole-chart experiments, effect-size could not extend all the way to 1 (perfect correlation) with every chart tested making a correct first-choice match. There is room for improvement in several areas. Godbout (2020, p. 24) identifies three types of losses that are sources of experimental “entropy”: the loss of accuracy when recording birthtimes; deficiencies and inconsistencies in the described personality traits present in the biographies or personality test scores; and deficiencies in astrological semantics.

With regard to reducing informational losses and

building more complete semantic models, Godbout’s already impressive best effect-size of 0.63 does not include the positions of planets in the diurnal houses that are the entire basis of the Gauquelin findings. This is because Godbout (p. 14) could not establish a consensus among authors on keywords for houses. The lack of consensus suggests that eminence effects (or skills and aptitudes in general) and the departments of life to which they apply (as houses are described in the older texts) have been mistakenly “updated” by modern humanistic authors, such as Dane Rudhyar (1936), who have tried to psychologize everything in a chart. Research can possibly correct this. Additionally, there is the enormous task of testing and evaluating the plethora of “advanced” and esoteric techniques that astrologers have dreamt up over the centuries, as we find in most astrology software programs as options. The question is what, if anything, these techniques contribute to the accuracy of astrological interpretations.

DISCUSSION

In my opinion, the greater goal of astrological research, beyond demonstrating its validity, is to improve its applications and to explain theory. Astrological textbooks cover theory *descriptions* but provide few details on *process*. To use the cooking metaphor, the cookbooks are heavy on ingredients (properties), but do not say enough about proportional recipes (combinations) or the relational steps and settings for how the cooking (evaluation) is ac-

tually done.

In a more transdisciplinary approach, it may seem odd but astrology is not the only discipline to use the recipe metaphor to describe the analysis of complex systems and emergent effects. For example, computer scientist Judea Pearl (Pearl & Mackenzie, 2018, p. 12) maps out what he calls an *inference engine* that tests presumed knowledge with “recipes” to evaluate emergent effects.

In my interpretation of Pearl’s inference engine, existing knowledge assumptions (theories) that have been *modelled* by scientists (with relevant single-factor or multifactor constituents) are subjected to a query of interest. Different *recipes* or *estimands* for answering the query are then applied to critically transform the model (as experimental interventions or treatments). The model is then tested with input *data* to obtain a statistical estimation of emergent effects. The resultant evaluations are then used to improve the starting assumptions and further modeling. In a more simplified description of eliciting inferences, Pearl (pp. 130–131) describes piecemeal interventions as “wiggling” one piece (either a supposed source A, or a supposed mediator B) while holding the other pieces steady and observing the emergent effects on C.

Although Pearl is concerned mainly with tracing causal effects and mediators, the same reasoning would seem to apply to firming up correlational effects in astrology. Presumably, there are no causal astrological effects in the accepted physical sense but there are inferred correlational effects. As explained by the early modern leader of scientific empiricism, Francis Bacon (1857, p. 351), “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.” Note carefully that Bacon’s rule suggests that astrological inclinations are actually beyond empirical observation. They are inferred tendencies that the native might or might not follow. The native may buck the influences that other natives—other worlds or other parallel universes, so to speak—may have on their own world.

Regardless of what the native does, astrology must assume emergent patterns of prevailing trends that are responsible for its statistical inferences and its truth values. The researched truths depend on the statistical models not only to correlate *astrological properties* but also to correlate the so-called *astrological influences*, as neither of these effects can be empirically perceived but are rather inferred from the models and the evidence.⁹ As astrology presumes to already know a great deal about its own trend-inducing configurations, as documented in the cookbooks, the research effort is partly a question of how to isolate and corroborate the complex, interrelated taxonomies from the statistical data as evidence.

Astrology research must deal with problems of overdetermination and underdetermination because its keyword constituents are difficult to disentangle from the keyword aggregations where the correlational results are observed to emerge. The same burden of isolating constituent properties also appears in other disciplines of inference. If one were to think more analytically about the problem of constituents, each descriptive keyword of the applied theory is what astrologers call a *potential*, which means a potential instance or potential fact, or more precisely, a *counterfactual property* that, in some combination with other counterfactual properties, might or might not manifest—but tends to manifest—certain *emergent properties* as resulting instances. This analysis is consistent with Oxford theoretical physicist Chiara Marletto’s (2021) definition of counterfactuals as “meta-statements about what can or cannot be made to happen” within the limitations of natural laws.

In a natural, biological context, combinations of counterfactual properties are what Marletto (p. 13) calls “abstract catalysts.” These catalysts, she explains, are naturally selected “recipes” that codify copyable facts about the environment as constituents of a generative process that gives lifeforms an entropy-resistant “resilience” capable of “keeping themselves in existence” well beyond the rapidly degrading impermanence of non-living things. The recipes represent a sort of informational “knowledge” in the sense that it is reproducible and transferrable. In my interpretation, this knowledge of counterfactual would-have-been adaptations results in emergent characteristics that can operate well below the threshold of consciousness, as Marletto says this knowledge “does not have to be known to anyone.”

In a laboratory research context, Pearl and Mackenzie (2018, pp. 9–10) describe the language of counterfactuals as the “building blocks of scientific thought” that reaches beyond empiricism by inference. They say that “whereas regularities can be observed, counterfactuals can only be imagined,” and yet they are “not products of whimsy but reflect the very structure of our world model.” We make “very reliable and reproducible judgments all the time about what might be or what might have been.” Pearl and Mackenzie even extend the building blocks concept to say that the “algorithmization of counterfactuals invites thinking machines to . . . participate in this (until now) uniquely human way of thinking about the world.” Like human minds, a machine can represent possible counterfactual worlds and “compute the closest one” (p. 268). This almost sounds like a description of Godbout’s chart-matching machine that selects the nearest biography (closest world) among given natal charts according to a symbolic regression algorithm (machine scientist) that is modelled by the semantic tax-

onomies and rules of astrological knowledge.

These transdisciplinary considerations of emergent effects suggest that the process of creating and applying replicable, resilient counterfactual knowledge, as selectively modelled in codes or recipes, is available not only within the internal processes of organisms but also within human minds and thinking machines. As a comparable counterfactual process, it is hard to deny the resilience of astrological knowledge as it has been semantically codified, thought about, copied, and taxonomically refined with high fidelity since the beginnings of recorded history.

CONCLUSIONS

Effect-size is the new wrinkle in astrological research. There is no question that well-informed critics have played a crucial role in bringing attention to this important metric and, along with their other statistical contributions it is serving to sharpen the skills and shape the program of the small community of responsible researchers. With the help of effect-size metrics and meta-analysis, the contours of effective information in astrology are beginning to emerge. In this present article, I have considered the research program to be loosely organized in terms of single-factor, multifactor, and whole-chart methods that each provide different powers of study.

At first, whole-chart methods had seemed like a game played against astrologers by their critics—until it became automated by a machine capable of semantically analyzing nearly all the important factors in many natal charts at once, a feat that is well beyond human limitations. As the implications are far-reaching for in-depth research into the nature of astrological factors as semantically interpreted potentials, Godbout's findings especially need independent replication.

The Solar System planets are the astrological symbols and emissaries of connections between each native's world of the people and events that truly influence their lives. The research suggests how to infer semantic properties by the emergence of distinctive patterns of character, behavior, and experience. The astrological design of experimental models and their corroboration with cookbook interpretations—which are in effect a corpus of its theory—cannot be a scientific mystery as it uses the same methods of inferring evidence of truth values.

IMPLICATIONS AND APPLICATIONS

The implication of astrological research, with its body of counterfactual knowledge, has always been that it reaches beyond the empirical limits of sense perception and yet the knowledge is intrinsic and discoverable by in-

ferences from data. Thus, it is unrelated to psychic perceptions, given that ESP can be defined as not the result of any means we know of (Phillipson, 2000, p. 139–140). This makes me wonder what could be learned by comparing astrological thinking with psychic thinking, as we would expect a difference.

Following Godbout's machine findings, it seems likely that astrological cookbooks are poised for a more complete knowledge transfer to automated systems that, assisted by machine scientists, can enable more accurate astrological descriptions of potential and emergent worlds than is humanly possible. For comparison, it might be interesting to match psychic abilities with such machines, for example, in blind tests to identify issues of character and events.

NOTES

¹ As language evolves by technology, borrowing, metaphor, and other influences, a succession of cookbooks have been semantically updated from earlier versions. This can be appreciated in early taxonomic models of character such as: hot; cold; wet; and dry, that we see extensively used by Hellenistic astrologers (Ptolemy, Valens, Maternus, and others). These descriptions have long been abandoned, in favor of more psychologically nuanced sentiments.

² The Hermetic maxim from antiquity, "As above, so below," presumes a sort of conservation principle between macrocosms and microcosms aligned relative to a fixed center, which in natal astrology is the microcosmic environment of each native's birth and life. The macrocosmic environment used in astrology is the Solar System centered on the native, which, by the same principle of cosmic symmetry, is itself a microcosm of increasingly larger macrocosms that ultimately entail the whole universe with the native at its center. The Solar System is the nearest shared cosmic environment or *correlative world* that is easily predictable, yet it is the macrocosmic environment of the whole universe that suggests astrology's universal explanatory power (McRitchie, 2004, 2006).

³ I defer to the custom of describing effects as "astrological influences," which are theoretical and not to be confused with physical influences. The influences act between astrological natives and the parallel, correlative worlds of their experience.

⁴ Ertel (1987) found that other professions associated with planetary eminence effects do not exhibit the same high degree of linear trend by rank as Mars athletes do. Mars appears to be a special case with a disproportionate effect as a single factor for athletes. The more easily measured orbital behavior of Mars and its pronounced

astrological urge of assertion have made it the leading observational subject for Johannes Kepler and Michel Gauquelin, respectively.

- ⁵ Where the ES of results are not mentioned in the sources I cite, I use, as recommended by Currey (2022), the simple model of: Significance Test = Effect Size x Study Size, according to Rosenthal and DiMatteo (2001, p. 63), from which Pearson's r can be evaluated (p. 72) by the formula $r = Z/\sqrt{N}$ where p has been converted to its associated one-tailed standard normal deviate Z .
- ⁶ A day-for-a-year progression is where the natal chart is compared to what it would have looked like one day later for each year of life. For example, if the native is 27 years old, then the progressed planetary positions are those at 27 days after birth. As the Moon completes an orbit around the Earth in 27.2 days, the Moon will have returned to approximately the same position it occupied at birth. The native's other planets progress more slowly.
- ⁷ Westran tested his 1300 couples for aspects in 4 dimensions of time (natal to natal, natal to progressed, progressed to natal, and progressed to progressed). Therefore, $N(4 \times 1300) = 5200$. Although Westran's results are only for the Sun/Venus aspect, which is single-factor as there can be only one aspect at a time, in this case the concept of what single-factor means is somewhat ambiguous because of the additional time dimensions.
- ⁸ In part because they live in different parts of the world and have little in-person contact.
- ⁹ I would submit that the presumption of both inferred properties and inferred influences is what largely contributes to the uncomfortable relationship between astrology and physical science. Inferred influences are the harder concept to accept than inferred properties, which are common in science, although an influence and its mechanism may, in fact, be a property.

ACKNOWLEDGMENTS

I am grateful to Vincent Godbout, Robert Currey, Kyösti Tarvainen, Peter Marko, and anonymous *JSE* reviewers for their comments and suggestions. Author's website: www.astrologicalreviewletters.org.

REFERENCES

- Bacon, F. (1857). *The works of Francis Bacon: The advancement of learning, Vol. 4, De Augmentis*. Longman, Brown.
- Boxer, A. (2020). *A scheme of heaven: The history of astrology and the search for our destiny in data*. W. W. Norton.
- Carlson, S. (1985). A double-blind test of astrology. *Nature*, 318, 419–425.
- Clark, V. (1961). Experimental astrology. *Search* (Winter/

- Spring), 102–112.
- Clark, V. (1970). An investigation of the validity and reliability of the astrological technique. *Aquarian Agent*, 1(October), 2–3.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences, second edition*. Lawrence Erlbaum.
- Currey, R. (2011). Shawn Carlson's double-blind astrology experiment: U-turn in Carlson's astrology test? *Correlation*, 27(2), 7–33.
- Currey, R. (2017). Can extraversion [E] and neuroticism [N] as defined by Eysenck match the four astrological elements? *Correlation*, 31(1), 5–33.
- Currey, R. (2021a). Testing astrology based on practice rather than theory: A system for extracting themes in birth charts. *Correlation*, 33(2), 65–75.
- Currey, R. (2021b) Justice for the Supreme Court: Delving beyond a Sun Sign Test of 114 Justices. *Correlation*, 33(2), 77–86.
- Currey, R. (2021c). The New York suicide study: Reconsidered and reversed. *Correlation*, 34(1), 31–57.
- Currey, R. (2022). Meta-analysis of recent advances in natal astrology using a universal effect-size. *Correlation*, 34(2), 43–55.
- Dean, G. (1985a). Can astrology predict E and N? 1: Individual factors. *Correlation*, 5(1), 3–17.
- Dean, G. (1985b). Can astrology predict E and N? 2: The whole chart. *Correlation*, 5(2), 2–24.
- Dean, G. (1986). Can astrology predict E and N? 3: Discussion and further research. *Correlation*, 6(2), 7–52. Includes meta-analyses of astrological studies.
- Dean, G., Mather, A., Nias, D., & Smit, R. (2016). *Tests of astrology: A critical review of hundreds of studies*. AinO Publications.
- deVore, N. (1947). *Encyclopedia of astrology*. Littlefield, Adams.
- Douglas, G. (2021a). Replication of Ertel's result on Sudden Instant Death Syndrome and Saturn in key Gauquelin sectors. *Correlation*, 33(2), 87–94.
- Douglas, G. (2021b) Human longevity, the Gauquelin effect and Heliocentric Cycles. *Correlation*, 34(1), 59–76.
- Ebertin, R. (1940, Rev. ed. 1972). *The Combination of Stellar Influences*. American Federation of Astrologers.
- Ertel, S. (1987). Further grading of eminence: Planetary correlations with musicians, painters, writers. *Correlation*, 7(1), 4–17.
- Ertel, S. (1988). Raising the hurdle for the athletes' Mars Effect: Association co-varies with eminence. *Journal of Scientific Exploration*, 2(1), 53–82.
- Ertel, S. (1995). Randomizations furnish precise chance expectations. In M. Pottenger (Ed.), *Astrological research methods, Vol. 1*. Seek It Publications.
- Ertel, S., & Irving, K. (1996). *The tenacious Mars effect*.

- Urania Trust.
- Ertel, S. (2009). Appraisal of Shawn Carlson's renowned astrology tests. *Journal of Scientific Exploration*, 23(2), 125–137.
- Gauquelin, M. (1955). *l'influence des Astres: Étude critique et expérimentale*. Éditions du Dauphin.
- Gauquelin, M. (1975). Spheres of influence. *Psychology Today* (Brit.), 7(October), 22–27.
- Gauquelin, M. (1988). *Written in the stars*. The Aquarian Press.
- Godbout, V. (2020). An automated matching test: Comparing astrological charts with biographies. *Correlation*, 32(2), 13–41.
- Godbout, V. (2021). To use or not to use midpoints? *Correlation*, 33(2), 35–48.
- Helgertz, J., & Scott, K. (2020). The validity of astrological predictions on marriage and divorce: A longitudinal analysis of Swedish register data. *Genus*, 76(34).
- Hone, M. E. (1968). *The modern textbook of astrology*. L. N. Fowler.
- Houran, J., & Bauer, H. H. (2022). 'Fringe Science'—A tautology, not pariah. *Journal of Scientific Exploration*, 36(2), 207–217.
- Marko, P. J. (2017). *The lunar effect bibliography: A categorized, annotated, and indexed list of publications on how the Moon affects our lives*. CreateSpace.
- Marletto, C. (2021). *The science of can and can't: A physicist's journey through the land of counterfactuals*. Viking.
- McGrew, J. H., & McFall, R. H. (1990). A scientific inquiry into the validity of astrology. *Journal of Scientific Exploration*, 4(1), 75–83.
- McRitchie, K. (2004). *Environmental cosmology: Principles and theory of natal astrology*. Cognizance Books.
- McRitchie, K. (2006). Astrology and the social sciences: Looking inside the black box of astrology theory. *Correlation*, 24(1), 5–20.
- McRitchie, K. (2009). Support for astrology from the Carlson double-blind experiment: Review of 'A double-blind test of astrology.' *ISAR International Astrologer*, 40(2), 33–38.
- McRitchie, K. (2014). Cognitive bias in the McGrew and McFall experiment: Review of "A scientific inquiry into the validity of astrology." *ISAR International Astrologer*, 41(1), 31–37.
- McRitchie, K. (2016). Clearing the logjam in astrological research: Commentary on Geoffrey Dean and Ivan Kelly's article "Is astrology relevant to consciousness and psi?" *Journal of Consciousness Studies*, 23(9–10), 153–179.
- Nanninga, R. (1996/1997). The Astrotest: A tough match for astrologers. *Correlation*, 15(2), 14–20.
- O'Neill, M. (1995). Actual or generated control groups. In M. Pottenger (Ed.), *Astrological research methods*, Vol. 1. Seek It.
- Pearl, J., & Mackenzie, D. (2018). *The book of why: The new science of cause and effect*. Basic Books.
- Phillipson, G. (2000). *Astrology in the year zero*. Flare.
- Rosenthal, R., & DiMatteo, M. R. (2001). Meta-analysis: Recent developments in quantitative methods for literature reviews. *Annual Review of Psychology*, 52, 59–82.
- Rudhyar, D. (1936). *The astrology of personality*. Lucis.
- Ruis, J. (2008). Statistical analysis of the birth charts of serial killers. *Correlation*, 25(2), 7–36.
- Sakoian, F., & Acker L. (1973). *The astrologer's handbook*. Collins Reference.
- Subtil, M.-P., & Rioux, D. (2011). *Le Monde—Les grands portraits*. Éditions Les Arènes.
- Tarvainen, K. (2012). A test of overall validity of astrological statements in the handbook by Sakoian and Acker. *Correlation*, 28(1), 5–24.
- Tarvainen, K. (2013). Favorable astrological factors for mathematicians. *Correlation*, 29(1), 39–51.
- Tarvainen, K. (2021a). Statistical studies have started to advance astrological techniques. *Correlation*, 33(2), 55–64.
- Tarvainen, K. (2021b). Confirmation of Ptolemy's 5-degree rule for Koch and Equal Houses. *Correlation*, 34(1), 9–16.
- Tarvainen, K. (2021c). Guessing aspects from interviews and obituaries. *Correlation*, 34(1), 77–88.
- Tompkins, S. (1989). *Aspects in astrology*. Elements Books.
- Vaughn, R. B. (1985). *Astrology in modern language*. CRCS.
- Westran, P. (2021). Astrology using progressed synastry in 1,300 public cases: A validation study. *Correlation*, 33(2), 13–33.
- Wolchover, N. (2017). A theory of reality as more than the sum of its parts. *Quanta Magazine*. <https://www.quantamagazine.org/a-theory-of-reality-as-more-than-the-sum-of-its-parts-20170601/>
- Wood, C. (2022, May 10). Powerful "machine scientists" distill the laws of physics from raw data. *Quanta Magazine*. <https://www.quantamagazine.org/machine-scientists-distill-the-laws-of-physics-from-raw-data-20220510/>