

## Astronomy and Astrology

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**Abstract:** Astrology meets a large success in our societies, from the private to the political sphere as well as in the media, in spite of the demonstrated inaccuracy of its psychological as well as operational predictions. We analyze here the relations between astrology and astronomy, as well as the criticisms opposed by the latter to the former. We show that most of these criticisms are weak. Much stronger ones emerge from the analysis of the astrological practice compared to the scientific method, leading us to conclude to the non-scientificity of astrology. Then we return to the success of astrology, and from its analysis we propose a renewed (and prophylactic) role for astronomy in the society.

### 1. Introduction : what is astrology ?

The influence of celestial bodies on Earth has several obvious manifestations : life on Earth depends on the Sun, seasons are linked to its position in the sky (due to the non-perpendicularity of the Earth's rotation axis with respect to the ecliptic plane), ocean tides are controlled by the position of the Moon (via its differential gravitation) and of the Sun, and eclipses are due to Sun–Moon–Earth alignments. Astrology extrapolates these factual influences by postulating that the positions of the Sun, Moon and 8 planets other than Earth (hereafter called the « luminars » following [1]) with respect to the sky background, as well as with respect to each other, influence terrestrial events and human psychology and destiny. Note that this postulate, although very speculative, is not a priori absurd, nor supernatural, metaphysical, religious or anti-scientific. The central role granted to the luminars comes from the fact that they are the only celestial bodies accessible to unaided view (for most of them) which present a discernible and periodic motion on timescales compatible with human life. Stars and galaxies look forever immobile, while comets and shooting stars (meteoroid showers) appear largely unpredictable.

The position of luminars is considered relative to the tropical zodiac<sup>1</sup> (12 « signs » dividing in 30° sectors the band of constellations upon which the motions of the Sun and planets are projected during the year, with an arbitrary origin at the vernal – spring – equinox) and to the « houses » (a local reference frame dividing the local sky in 12 sectors of unequal extent). The position of luminars at a given time and place can be calculated through celestial mechanics, and their graphical – and objective – display is the « horoscope » (from the greek hora+skopein = hour+examine). The horoscope, which reveals astral conjunctions at a given

<sup>1</sup> defined by Hipparchus (father of western astrology, who rediscovered the precession of equinoxes about 130 BC).



time and place, is the basic tool of astrology. It allows to define the solar sign (sign « containing » the Sun at the considered time), the ascendant (rising sign at eastern horizon) and descendant (opposite), the middle of the sky, the positions of luminars in signs and houses, the « aspects » (angles formed by triplets of luminars), the transits (a luminar passing over another one or over a former particular position), etc. The interpretation of the horoscope is the subjective part which truly characterizes the astrological practice. It is also the point from where Astrology divorces Astronomy.

Since the 1930's, astrology meets a large success in the media and politics. It benefits from a widespread public belief revealed in public inquiries where 41% believe in astrological characterology, 26% believe in predictions, and 13% have consulted at least one astrologer. These percentages are stable since the 1980's [3,4]. Many astrology « schools » exist, from esoteric to rational, the latter assuming material influences from the celestial bodies. The so-called « scientific » astrology strongly opposes commercial practice and claims for academic recognition, which would give it access to public funding and academic positions (professorship, researcher...) and at the same time would considerably reinforce its legitimacy and the adhesion from the public. But most scientists as well as researchers in humanities (sociologists...) are strongly opposed to all forms of astrology. Does this result from some kind of corporatism or protectionism of « official science », or from ethical reasons ? An astrological knowledge undoubtedly exists, as shown by the plethoric litterature on the subject. Is that enough to make it Science ?

## 2. Astrology and Astronomy

Astronomy (writing the heavens) and Astrology (studying the heavens) have a common history, from antiquity to the end of Renaissance (16<sup>th</sup> to 17<sup>th</sup> century). Tycho-Brahé (1546–1601) hoped to improve astrological predictions via better observations. Kepler (1571–1630) was selling horoscopes (albeit without conviction). But at the turn of the 17<sup>th</sup> century, new instruments were invented (such as the telescope), permitting the birth of an observational science of the sky. At the same time, the scientific method was adopted, based on the separation between subject and object, the deny of authority (such as that of Ptolemy), and the abandon of Aristotle's « correspondence principle » (which postulated links between the Earth and Heavens). With Isaac Newton (1642–1727) the cosmos became infinite ... In parallel, astrology was evicted from the Faculty (by Colbert in 1660).

At first sight, Astronomy and Astrology appear as 2 « disciplines » dealing with the sky. The horoscope is an objective sky map, and « researchers » in astrology postulate the existence of physical (material) influences. This generates a frequent confusion between these 2 disciplines in the public, and the strong opposition of astronomers, frequently based on arguments such as :

- (1) the constellations, from which signs are named, are 3D structures ; the figures formed by their stars by projection on the plane of the sky are thus mere illusions.
- (2) the zodiacal constellations have very diverse widths along the ecliptic, while the signs all have a 30° width.

- (3) 13 constellations actually intersect the zodiacal band (which has a  $\pm 8.5^\circ$  extent around the ecliptic) : the usual 12 plus Ophiuchus.
- (4) the slow precession of equinoxes, which results from the precession of the Earth's polar axis due to combined Solar and lunar gravitational attractions, causes the constant shift of signs with respect to background constellations ; as a consequence, the vernal point, which defines the origin of the « Aries » sign, also corresponded to the edge of the Aries constellation at the origins of astrology, while today it points at the constellation « Pisces », and will soon enter « Aquarius ».
- (5) the horoscope cannot be fully drawn beyond the polar circles, as there is no more diurnal cycle allowing to define the « houses »<sup>2</sup>.
- (6) the slow motions of luminars imply that many people share the same horoscope.

Most of these criticisms are easily answered by astrologers :

- to the arguments (1–4), astrologers simply respond that the tropical zodiac, in which seasons always return at the same position, is a mere reference frame along the ecliptic (divided in 12 slices of  $30^\circ$  longitude), formerly used by astronomers themselves !
- to argument (5), it is responded that the fact that the « local » part of the horoscope – related to the houses – is undefined does not prevent to use the rest of the information presumably conveyed by the horoscope.
- in response to (6), it is noticed that 10 luminars distributed in 12 houses imply  $\sim 120$  different horoscopes per day, a number quite large compared to the birth rate at any given place, even in big cities. However, this problem is real in case of twins.

But, even if partly justified, the above criticisms and their rebuttals are perceived by the public as debates reserved to specialists. As a consequence, these common objections are very weak and have no influence on the public's opinion about astrology [1,2].

A few other astronomical objections to astrology, less often used, are nevertheless stronger [1]:

- (7) the late integration of Uranus, followed by Neptune and Pluto to the astrological discourse was quite artificial and justified by the fact that they would probably solve remaining inaccuracies in the predictions. But what to do with the new status of Pluto, that is no more recognized as a main planet but as a Kuiper belt object ? Should astrologers remove it from the list of luminars and confess that it did not actually bring any improvement ? If to keep it, what about the growing list of other recently discovered similar bodies (Sedna, Quaoar...), some of which even have satellites (Xena, 2003EL61) ?
- (8) What about asteroids, some of them nearly as large as planetary bodies (Cérès, Vesta) ? And what about comets ? Although much less massive than planets, these bodies can be very extended (with a coma and a tail much larger than planets) and sometimes pass very close to Earth.

<sup>2</sup> at least in the system of Placidus de Titius, inherited from Ptolemy, and used by « modern » astrology.

- (9) An obvious inconsistency of the astrological discourse is the frequent mention to the future « era of Aquarius », which will start when the vernal point will enter the Aquarius constellation due to the precession of equinoxes. As astrologers evacuate the precession problem by considering the tropical zodiac only, independent of the precession, they should not refer again to it and to the zodiac of constellations to announce an Aquarius era !
- (10) Finally, astrology deliberately ignores the physical nature of luminars, reduced to geometrical points entitled with symbolic concepts only. For example, the symbolic chain : Mars→red→blood→war→death is totally incompatible with the causal chain revealed by space planetary exploration : Mars→red→iron oxydes→water→life !

This last remark reveals clearly the fundamental hiatus between Astronomy and Astrology : these 2 « disciplines » deal with the sky, but not with the same sky ! The astronomical sky is physical while the astrological one is symbolic.

### 3. Astrology and Science

Astronomical objections do not suffice to claim that astrology is not a science. Let us examine the question from a broader perspective. It is not questionable that celestial influences do exist, at least due to the Sun and Moon as noted in section 1. But what is the nature of the astrological influence that could justify its basic postulate, and in particular the role attributed to the luminars ? One problem is that none of the presently known physical forces (or interactions) or of any reasonable extrapolation of them can explain the presumed astrological influence. Furthermore, this influence cannot depend on any power of the luminar's distance : with a  $1/R^2$  law, stars, galaxies and actually the whole Universe should be taken into account as well. Changing the exponent of R doesn't help. Some astrologers have invoked subtle effects such as a specific human sensitivity to gravitational waves whose periods correspond to planetary revolutions, but their intensities are much weaker than those produced by massive binary stars or supernovae explosions. Others speculate on the physics of chaos and of « phenomena sensitive to initial conditions » to pretend that very weak influences could resonantly interact with such a complex system as Man, but in that case the horizon of predictions is very limited because the effects quickly become unpredictable.

Nevertheless, a true (material, non symbolic) influence requires a causal relationship ... not elucidated since 2500 years ! But does such an influence actually exist ? It can be easily checked that astrological predictions are often wrong, or – worse – neither wrong nor right because too ambiguous. But the final conclusion cannot rely upon particular examples, successful or unsuccessful. In the absence of any theoretical framework, the operational efficiency of astrology can only be tested by statistics : for many realizations of an experiment, it must be tested if the results can be attributed to random occurrence only, or if they suggest the existence of a law. In order to be reliable, statistical tests must fulfill 3 fundamental conditions :

- (1) define precisely the experimental protocole before the experiment and stick to it ;
- (2) check the significance of obtained results (confidence tests, analysis of possible biases, etc.) ;
- (3) commit to publish all obtained results, clearly and under control.



Condition (1) excludes blind searches for all kinds of correlations. Condition (3) intends to avoid the so-called publication bias. In all but one published analyses of astrology, condition (2) is generally fulfilled, but conditions (1) and (3) are not satisfied. As a consequence, all their results are invalid. The only exception concerns the double-blind test of Carlson, agreed by a panel of physicists and astrologers, and published in *Nature* in 1985 [5] : fulfilling scrupulously the above 3 conditions, it demonstrated that astrology definitely fails at characterizing somebody's personality from its birth horoscope.

Finally, to decide if astrology has some attributes of science, let us consider the nature of science. The scientific method is based on induction (which draws general conclusions from particular observations or experiences) and deduction (which draws specific conclusions or defines experiences or tests from a general law or knowledge). From observation facts, scientists induce a theory which aims at their interpretation. To be scientific, this theory should permit to deduce experiences and tests, and to make quantitative predictions about their results. Comparison with effective experimental results then confirm or refute the validity of the theory. This refutability or falsifiability is a key test of « scientificity » of the theory. Science is this method<sup>3</sup>, alternately inductive and deductive, plus the corpus of knowledge that constitutes its « database » (in permanent evolution). Other important characteristics include the key role of team work, communication (systematic publication after peer reviewing), search for consensus and universality (science transcends cultures and nationalities). Natural sciences have a strong mathematical background, which makes them quantitative and predictive. They have generated very efficient operational applications (modern technology).

By comparison, the astrological practice is built on a major original induction interpreting selected facts into a very (too) broad and general law (the correspondence principle relating man to the cosmos). From that point, astrology is purely deductive. Its domain of application is very broad (from natural and political predictions to individual ones and personality characterization), but its predictions and diagnostics are qualitative, fuzzy, and generally not falsifiable (as clearly seen when comparing several interpretations of the same horoscope). The basic postulate is never questioned, except in rare works by isolated people, more subject to biases than team works [7–9]. The notable exception is Carlson's test [5], where predictions were falsifiable ... and falsified ! Astrology does not possess any standard publication channel or procedure. Its knowledge has no universality : the various schools and cultures ignore or oppose each other, without consensus nor need for consensus. It is remarkable that the main consensual reference of western astrology remains Ptolemy's *Tetrabiblos*, which dates from 160 bc !

We can thus confidently conclude that the astrological practice is by no means scientific.

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<sup>3</sup> According to R. Pirsig in [6]: « *The true aim of scientific method is to be sure that we don't imagine that we know what in fact we don't know* »



#### 4. The success of Astrology and the role of Science

In these conditions, what ensures the long-standing success of astrology ?

Evacuation of the magical thinking preceded the development of a scientific apprehension of the world [10]. By deliberately focussing on the explanation of observational facts, science (since 19<sup>th</sup> century) has eradicated metaphysical speculations from its field of interest, letting man free of its interpretation beyond the scientific explanation, but at the same time abandoning the subject of human destiny. In the 20<sup>th</sup> century, via sociology of sciences, science carried a self-critical analysis of its activity, tools and results. Its rapidly growing complexity and specialization, and the lethal technology that it enabled (the bomb !) achieved to separate science from the public, who does not perceive anymore any global progress related to science. In other words this led to the « disenchantment » of science [11].

In parallel, the so-called « post-modern relativism » (not Einstein's one !) that developed in the 1980's with the support of numerous scientists (e.g. [12]) pretended to relegate any knowledge to belief, and to consider all beliefs of equal value. Together with the increasingly rational appearance of astrology (computer ephemeris, imitation of the scientific discourse), this contributed to attenuate the apparent differences between science and astrology, at least for the public.

But together with its rational appearance, astrology has the immense advantage to proposes a global, holistic approach for apprehending the world, via a link between man and cosmos. Astrological belief is not a paradox in a world of generalized belief in scientifico-technological « black boxes » (telephone, electricity ...). In addition, astrology seems to bring a psychological support to its believers, especially to « fragile » populations (unemployed, students, isolated people, ...) [1,13]. It also benefits from a political economical « tolerance », because it can be a tool in the hands of politicians, and its industry is prolific [1,14]. But most important, astrology speaks to and about Man, responding to its inescapable need to believe.

We have briefly shown here (and in more details in [1,2]) that, with a symbolic and esoteric discourse, astrology has none of the attributes of a true science. It has been shown elsewhere that it is neither a humanity, that its psychological use dangerous and that its exploitation is alienating and mostly criticable [1,2,10,11,13,14,15]. It could well be the price to pay for the disenchantment of science, the loss of global sense that it bears for the citizen. It is thus clear that science needs to be brought back into the public, by scientists themselves, aided by journalists, science writers, etc. In this huge but fascinating task, astronomy has a role to play, as its subject is particularly well adapted to re-enchanting science.



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