

Activities About Astrology

Activity K2

Grade Level: 7–12



Source: This activity was written by Andrew Fraknoi, Astronomical Society of the Pacific, 390 Ashton Avenue, San Francisco, CA 94112. <http://www.astrosociety.org> Copyright ©1993, 2010 by the Astronomical Society of the Pacific. (The activity incorporates suggestions and ideas by Diane Almgren, Daniel Helm, and Dennis Schatz.)

What's This Activity About?

These activities help students to understand the difference between science and pseudo-science by investigating some of astrology's claims. Letting students have a good discussion after working with these activities can be very effective. We encourage you to read "Your Astrology Defense Kit," found on *The Universe at Your Fingertips* disk, before leading these activities.

What Will Students Do?

Students test the validity of astrology by charting birthdates of U.S. presidents, and by comparing horoscopes in different newspapers. Finally, students attempt to identify their own sign from an unidentified list of daily predictions.

Tips and Suggestions

- Some of the activities need preparation, such as buying a variety of newspapers. Be sure to check the instructions in advance of doing the activity.
- To expand on Activity 1, you could make a table of birthdays and sun-signs for other famous people like U.S. senators, world leaders, or award-winning actors, who might be expected to have common personality characteristics.
- The final activity, where students try to identify their own sign from an unidentified group of signs, works especially well with larger groups of students. Perhaps you can get two or more classes together to increase the number of participants.
- For more resources for understanding and testing astrology, see the guide "Responding to Claims of Astronomical Pseudoscience" (5.12) on *The Universe at Your Fingertips* disk.

What Will Students Learn?

Concepts

- Astrology's basic ideas
- Testing a scientific hypothesis

Inquiry Skills

- Predicting
- Inferring
- Reasoning
- Recognizing bias
- Experimenting

Big Ideas

- Big Ideas
- Diversity and Unity
- Science versus pseudoscience

Activities About Astrology

by Andrew Fraknoi
(Foothill College & ASP)



Introduction

These activities help students to understand the difference between science and pseudoscience by investigating some of astrology's claims. Letting students have a good discussion around these activities can be very effective, since the ideas of astrology can be both appealing and controversial in the eyes of your students. We encourage you to read "Your Astrology Defense Kit" on *The Universe at Your Fingertips* disk before doing these activities, but if you want to distribute it to students, we suggest you wait until they have completed the activities so as not to prejudice their outlook.

Students can test the validity of astrology with three activities:

1. Charting birthdates of U.S. presidents
2. Comparing horoscopes in different newspapers
3. Attempting to identify their own sign from an unidentified list of daily predictions.

Activity Descriptions

Activity 1: Testing Astrology with the Birthdays of the Presidents

Astrologers will tell you that the Sun sign (which is the sign of the zodiac the Sun was in when a person was born) can't tell you everything about an individual's personality, but that is a crucial factor for the *occupation* a person chooses and a strong determinant of overall personality as it relates to one's job. This would not apply to a summer job a college student takes in a department store, but Sun sign is expected to be a factor in careers that are personality driven, such as a stage actor, police officer, or meditation teacher. As an example of how we can test such a hypothesis, students can examine the birthdates of the 43 men who have successfully run for the job of President of the United States.

After all, it takes a certain kind of personality to be President (outgoing, well-spoken, ambitious... students can make their own list). If personality and occupation are strongly affected by Sun sign, we should find that the birthdays of the Presidents are clustered in one (or a

few) signs. If Sun signs do not affect personality and occupation, the Presidents' birthdays should be randomly distributed among the zodiac signs.

Students will fill out a worksheet to determine the astrological signs of the Presidents and discuss their results. The bottom of the worksheet has the dates for the astrological signs. You will need to review the concept of random distribution before doing this activity. Ask them how many Presidents they expect to find under each sign if the birthdays of the 43 Presidents are randomly distributed among the 12 signs of the zodiac? Then have them figure out the answer, working together in small groups.

Answer: Since there are 43 Presidents, chance would classify (43 people divided among 12 signs = 3.6, rounded off to 4 people) into each of 12 random "bins." With only 43 data points, however, you might expect one or two fewer or one or two more Presidents in a given sign. This is just what students will find.

Students can answer the following specific questions:

1. Which sign has the largest number of Presidents? How many?
2. Which sign has the smallest number of Presidents? How many?
3. Looking at your results, do you see any pattern?
4. Would you say the birth dates of the Presidents are strongly clustered in one or a few signs?
5. What do your results say about whether sun sign has any effect on the likelihood that a person will be elected President of the U.S.?

Extending the Activity: Encourage students to discuss other ways to test this idea. What occupations are also personality-driven but have more than 43 people in them? (As discussed in *Your Astrology Defense Kit*, one group of statisticians tested all the men who re-enlisted in the Marine Corps — definitely a personality related career choice!)

Activity 2: Horoscopes from Different Astrologers

In this activity, students compare horoscopes in dif-



ferent newspapers from the same day. Ask students to bring in newspapers or buy them yourself. It's especially helpful to have newspapers from different cities in the same area. You can also copy newspapers from a local library, although using photocopies reduces the psychological impact of the activity somewhat. The more newspapers you have, the better the activity.

Cut the horoscope sections out of the papers and distribute each of them to a group of students. If possible, cut out the horoscopes in full view of the students for greater impact. Ask several students to read aloud the different horoscopes of one or more selected students from the various newspapers. Discuss the following questions:

1. How well do the predictions of different astrologer agree for that student's sign?
2. How specific are the newspaper statements?
3. In what ways could the statements apply to different people?

Have the students discuss some reasons why the predictions in astrology columns might be so general and vague. Remind them that in science, if you do the same experiment a number of times, you always get the same result. Why might horoscopes for the same signs disagree so much? If there is time, continue the discussion by bringing up some of the "embarrassing questions about astrology" in *Your Astrology Defense Kit*.

Activity 3: Mixed-up Horoscopes

In this activity, students try to find their own sign from a variety of unidentified signs in a horoscope column. Use

an astrology column from a recent newspaper (today, yesterday, or last weekend). It is best to use an out-of-town newspaper so students are not likely to have seen it. Cut out the horoscopes and remove the dates, signs and any telltale references to the sign, like "you're a real lion at times (for Leo)." Be sure to make a copy of the full column for yourself and put it aside. Mix up the order of the descriptions, and give each one a number from 1 to 12. Transfer these numbers to your copy for future reference.

Have each student write down his or her name and birthday on a piece of paper. Distribute copies of the sheet with all the mixed up and numbered (but otherwise unlabeled) horoscopes to the students and have them select the one description that best fits the day in question. (Be sure you remind them of the day the horoscopes apply.) Make sure students write down their selection.

Ask the students to predict how they think this experiment will turn out. To prevent sudden changes of answers, ask students to exchange papers at this point. Then put the signs and birthdates associated with each numbered paragraph on the board. Have the class count how many students picked their own sign among the 12 and how many did not.

If Sun sign astrology predicts one's day pretty well and everyone remembers the day in question clearly (the astrologer's hypothesis), students should in general be able to find their own paragraph. But if chance instead of the stars governs the composition of those descriptions (the skeptic's hypothesis), we would expect that only one out of 12 of the students would have selected the description for their own signs.

Warning: With small numbers of students in one class, it often happens by chance that there are a few more correct picks than one would expect by chance. With older students, this can give you a chance to discuss the need for large samples in good statistical studies. If students get intrigued by such extra hits, one way to check is to extend the test to other students or school staff.

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Worksheet: Birthdates of U.S. Presidents

NAME	BIRTHDAY	SIGN
1. George Washington	Feb 22, 1732	
2. John Adams	Oct 30, 1735	
3. Thomas Jefferson	Apr 13, 1743	
4. James Madison	Mar 16, 1751	
5. James Monroe	Apr 28, 1758	
6. John Q. Adams	Jul 11, 1767	
7. Andrew Jackson	Mar 15, 1767	
8. Martin Van Buren	Dec 5, 1782	
9. William Harrison	Feb 9, 1773	
10. John Tyler	Mar 29, 1790	
11. James Polk	Nov 2, 1795	
12. Zachary Taylor	Nov 24, 1784	
13. Millard Fillmore	Jan 7, 1800	
14. Franklin Pierce	Nov 23, 1804	
15. James Buchanan	Apr 23, 1791	
16. Abraham Lincoln	Feb 12, 1809	
17. Andrew Johnson	Dec 29, 1808	
18. Ulysses Grant	Apr 27, 1822	
19. Rutherford Hayes	Oct 4, 1822	
20. James Garfield	Nov 19, 1831	
21. Chester Arthur	Oct 5, 1830	
22. Grover Cleveland	Mar 18, 1837	

23. Benjamin Harrison	Aug 20, 1833	
24. William McKinley	Jan 29, 1843	
25. Teddy Roosevelt	Oct 27, 1858	
26. William Taft	Sep 15, 1857	
27. Woodrow Wilson	Dec 28, 1856	
28. Warren Harding	Nov 2, 1865	
29. Calvin Coolidge	Jul 4, 1872	
30. Herbert Hoover	Aug 10, 1874	
31. Franklin Roosevelt	Jan 30, 1882	
32. Harry Truman	May 8, 1884	
33. Dwight Eisenhower	Oct 14, 1890	
34. John Kennedy	May 29, 1917	
35. Lyndon Johnson	Aug 27, 1908	
36. Richard Nixon	Jan 9 1913	
37. Gerald Ford	Jul 14, 1913	
38. Jimmy Carter	Oct 1, 1924	
39. Ronald Regan	Feb 6, 1911	
40. George Bush	Jun 12, 1924	
41. William Clinton	Aug 19, 1946	
42. George W. Bush	Jul 6, 1946	
43. Barack Obama	Aug 4, 1961	

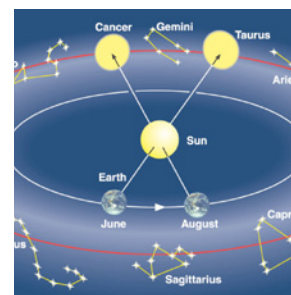
* Note: If you look it up, these numbers seem off by one. Barack Obama is the 44th President of the U.S. because Grover Cleveland served two terms, separated by Benjamin Harrison's term.

The Astrological System of Signs and Dates

Sign	Symbol	Dates
Aries	Ram	March 21–April 19
Taurus	Bull	April 20–May 20
Gemini	Twins	May 21–June 20
Cancer	Crab	June 21–July 22
Leo	Lion	July 23–August 22
Virgo	Virgin	August 23–September 22
Libra	Balance	September 23–October 22
Scorpio	Scorpion	October 23–November 21
Sagittarius	Archer	November 22–December 21
Capricorn	Goat	December 22–January 19
Aquarius	Water Bearer	January 20–February 18
Pisces	Fish	February 19–March 20

Your Astrology Defense Kit

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Sometimes, when astronomers or astronomy hobbyists tell someone about their interest in the heavens, they quickly get drawn into a debate about astrology. For many, it's hard to know how to respond politely to someone who takes this ancient superstition seriously. Yet, many well-meaning people develop an interest in astrology because of its constant play in the media and simply don't have the background in science to know the problems with it.

The revelation in the 1980's that daily schedules in the Reagan White House were arranged and rearranged based on the predictions of a San Francisco astrologer focused new attention on astrology's widespread public acceptance and people wondered whether there could be something to the claims of astrologers. Here, then, is a quick guide to some of the responses you can make to astrologers' claims.

The Tenets of Astrology

The basis of astrology is disarmingly simple: a person's character and destiny can be understood from the positions of the Sun, Moon, and planets among the pattern of the stars at the moment of his or her birth. Interpreting the location of these bodies using a chart called the *horoscope*, astrologers claim that they can predict and explain the course of life and to help people, companies, and nations with decisions of great import.

Implausible as such claims may sound to anyone who knows just what and how distant the Sun, Moon, and planets really are, a 2005 Gallup Poll revealed that one in four of Americans express a belief in the power astrology. And every day thousands of people around the world base crucial medical, professional, and personal decisions on advice received from astrologers and astrological publications.

The details of its precise origins are lost in antiquity, but astrology is at least thousands of years old and appears in different forms in many cultures. It arose at a

time when humankind's view of the world was dominated by magic and superstition, when the need to get some grasp on the patterns of nature was often of life-and-death importance.

Celestial objects seemed in those days to be either gods, important spirits, or, at the very least, symbols or representatives of divine personages who spent their time tinkering with humans' daily lives. People eagerly searched for heavenly signs of what the gods would do next.

Seen in this context, a system that connected the bright planets and "important" constellations with meaningful life questions was appealing and reassuring. (Astrologers believe that the important constellations are the ones the Sun passes through during the course of a year; they call these the constellations or *signs* of the zodiac.) And even today, despite so much effort at science education, astrology's appeal for many people has not diminished. For them, thinking of Venus as a cloud-covered desert world as hot as an oven is far less attractive than seeing it as an aid in deciding whom to marry.

Ten Embarrassing Questions

A good way to begin thinking about the astrological perspective is to take a skeptical but good-humored look at the logical consequences of some of its claims. Here are my 10 favorite questions to ask supporters of astrology:

1. What is the likelihood that one-twelfth of the world's population is having the same kind of day?

Proponents of newspaper astrology columns (which appear in more than 1,200 dailies in the United States alone) claim you can learn something about what's in store for you by reading one of 12 paragraphs in the morning paper. Simple division shows that this means more than 500 million people around the world will all have the same kind of day, every single day. Given the need to fill so many bills at once, it is clear why astro-

logical predictions are couched in the vaguest and most general language possible.

2. Why is the moment of birth, rather than conception, crucial for astrology?

Astrology seems scientific to some people because the horoscope is based on an exact datum: the subject's time of birth. When astrology was set up long ago, the moment of birth was considered the magic creation point of life. But today we understand birth as the culmination of nine months of steady development inside the womb. Indeed, scientists now believe that many aspects of a child's personality are set long before birth.

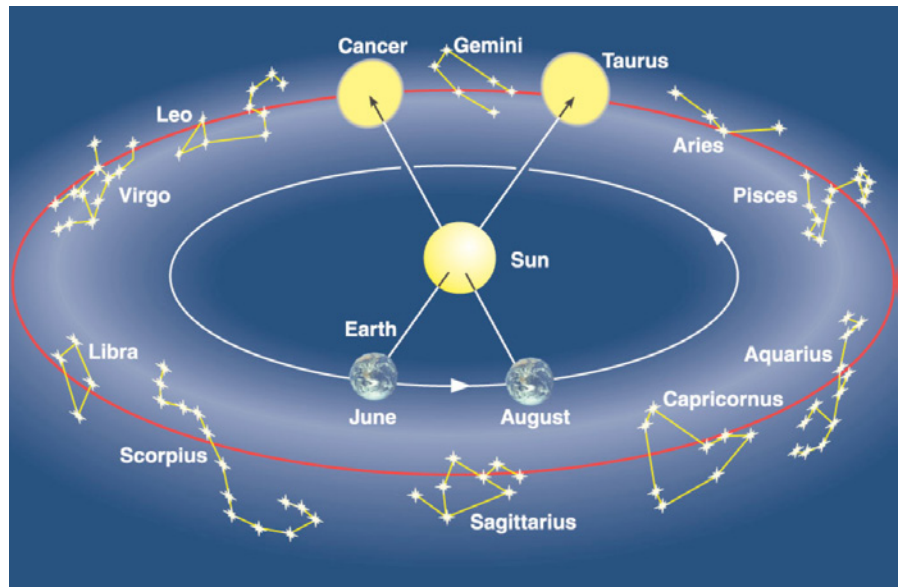
I suspect the reason astrologers still adhere to the moment of birth has little to do with astrological theory. Almost every client knows when he or she was born, but it is difficult (and perhaps embarrassing) to identify a person's moment of conception. To make their predictions seem as personal as possible, astrologers stick with the more easily determined date.

3. If the mother's womb can keep out astrological influences until birth, can we do the same with a cubicle of steak?

If such powerful forces emanate from the heavens, why are they inhibited before birth by a thin shield of muscle, flesh, and skin? And if they really do and a baby's potential horoscope is unsatisfactory, could we delay the action of the astrological influences by immediately surrounding the newborn with a thin cubicle of steak until the celestial signs are more auspicious?

4. If astrologers are as good as they claim, why aren't they richer?

Some astrologers answer that they cannot predict specific events, only broad trends. Others claim to have the power to foresee large events, but not small ones. But either way, astrologers could amass billions by forecasting general stock-market behavior or commodity futures, and thus not have to charge their clients high fees.



As the Earth goes around the Sun in the course of the year, we see the Sun against different constellations. Astrologers call the star grouping which the Sun is in front of when you are born your "sun sign." (Illustration from *Voyages through the Universe* © 2004 Cengage/Brooks-Cole.)

Yet, how many astrologers actually foresaw recent stock market or real estate tumbles and warned their clients about it?

5. Are all horoscopes done before the discovery of the two outermost planets incorrect?

Some astrologers claim that the Sun sign (the location of the Sun in the zodiac at the moment of birth), which most newspaper horoscopes use exclusively, is an inadequate guide to the effects of the cosmos. These "serious" practitioners insist that the influence of all major bodies in the solar system must be taken into account — including the outermost planets Uranus and Neptune, which were not discovered until 1781 and 1846.

If that's the case, what happens to the claim many astrologers make that their art has led to accurate predictions for many centuries? Weren't all horoscopes cast before 1846 wrong? And why didn't the inaccuracies in early horoscopes lead astrologers to deduce the presence of Uranus and Neptune long before astronomers discovered them?

6. Shouldn't we condemn astrology as a form of bigotry?

In a civilized society we deplore all systems that judge individuals by sex, skin color, religion, national origin, or other accidents of birth. Yet astrologers boast that they can evaluate people based on another accident of

birth — the positions of celestial objects. Isn't refusing to date a Leo or hire a Virgo as bad as refusing to date a Catholic or hire a black person?

7. Why do different schools of astrology disagree so strongly with each other?

Astrologers seem to disagree on the most fundamental issues of their craft: whether to account for the precession of the Earth's axis (see the box below), how many planets and other celestial objects should be included, and — most importantly — which personality traits go with which cosmic phenomena. Read ten different astrology columns, or have a reading done by ten different astrologers, and you will probably get ten different interpretations.

If astrology is a science, as its proponents claim, why are its practitioners not converging on a consensus theory after thousands of years of gathering data and refining its interpretation? Scientific ideas generally converge over time as they are tested against laboratory

or other evidence. In contrast, systems based on superstition or personal belief tend to diverge as their practitioners carve out separate niches while jockeying for power, income, or prestige.

8. If the astrological influence is carried by a known force, why do the planets dominate?

If the effects of astrology can be attributed to gravity, tidal forces, or magnetism (each is invoked by a different astrological school), even a beginning physics student can make the calculations necessary to see what really affects a newborn baby. These are worked out for many different cases in Roger Culver and Philip Ianna's book *Astrology: True or False* (1988, Prometheus Books). For example, the obstetrician who delivers the child turns out to have about six times the gravitational pull of Mars and about two thousand billion times its tidal force. The doctor may have a lot less mass than the red planet, but he or she is a lot closer to the baby!

The Precession of the Earth: Are You Reading the Wrong Horoscope?

Our Earth moves through space in a variety of ways. In addition to rotating on its axis (giving us our day) and orbiting the Sun (giving us our year), Earth has another — more gradual — motion that few people know about. Our planet's axis tips around in a circle, very much like a child's top tends to tip around slowly as it spins. The Earth's tipping motion — called precession — is quite slow. Our planet's axis takes over 25,000 years to make a full circle.

As a result of precession, the Earth's axis will point in a different direction as time goes on. (The star right above our planet's north pole today, Polaris, was not always above our pole!) As we tip relative to the constellations (signs), the place where we see the Sun against the background of stars in a given month also changes. The band of constellations that the Sun appears to move through over 12 months is called the zodiac. If the full circle of precession takes roughly 25,000 years and the zodiac is divided into 12 signs, it follows that precession tips the Sun over by one sign every 2,000 years or so. Now it just so happens that the rules of modern astrology were codified just about 2,000 years ago (by Ptolemy in his great summary work *Tetrabiblos*.) This means that the constellations the Sun finds itself in month after month have shifted over by one.

Let's give a concrete example. Someone born on August 1 is considered by astrologers to have the Sun sign Leo. And, indeed, two thousand years ago, the Sun would have been in the constellation of Leo on August 1. But in the 21st century, the Sun is no longer in Leo on August 1 because of precession. Instead it is in the constellation of Cancer. The astrological signs and the real constellations from which they are derived are now "out of synch."

Since many of the personality characteristics associated with each sign are based on what the constellations (star patterns) looked like to the ancients — a fish in water or a bird in the air, for example — this misalignment certainly calls the whole system of astrology into question.

9. If astrological influence is carried by an unknown force, why is it independent of distance?

All the long-range forces we know in the universe get weaker as objects get farther apart. But, as you might expect in an Earth-centered system made thousands of years ago, astrological influences do not depend on distance at all. The importance of Mars in your horoscope is identical whether the planet is on the same side of the Sun as the Earth or seven times farther away on the other side. A force not dependent on distance would be a revolutionary discovery for science, changing many of our fundamental notions.

10. If astrological influences don't depend on distance, why is there no astrology of stars, galaxies, and quasars?

French astronomer Jean-Claude Pecker has pointed out that it seems very small-minded of astrologers to limit their craft to the influences of the bodies in our solar system. Billions of stupendous bodies all over the universe should add their influence to that of our tiny little Sun, Moon, and planets. Has a client whose horoscope omits the effects of the star Rigel, the Crab Nebula pulsar, and the Andromeda Galaxy really had a complete reading?

Testing Astrology

Even if we give astrologers the benefit of the doubt on

all these questions — accepting that astrological influences may exist outside our current understanding of the universe — there is a devastating final point. Put simply, astrology doesn't work. Many careful tests have now shown that, despite their claims, astrologers really can't predict anything.

After all, we don't need to know how something works to see whether it works. During the last few decades, while astrologers have somehow always been a little too busy to conduct statistically valid tests of their work, physical and social scientists have done it for them. Let's consider a few representative studies.

Psychologist Bernard Silverman of Michigan State University looked at the birth dates of 2,978 couples who were getting married and 478 who were getting divorced in the state of Michigan. Most astrologers claim they can at least predict which astrological signs will be compatible or incompatible when it comes to personal relationships. Silverman compared such predictions to the actual records and found no correlations. For example "incompatibly signed" men and women got married as frequently as "compatibly signed" ones.

Many astrologers insist that a person's Sun sign is strongly correlated with his or her choice of profession. Indeed, job counseling is an important function of modern astrology. Physicist John McGervey at Case Western Reserve University looked at biographies and

Jetology

One good way to get people to think about the validity of astrology is to suggest a similar "science" that is not so weighed down with tradition and history. I like to ask people to consider the new science of jetology, which contends that the positions of all the world's jumbo jets at the moment a person is born affect his or her personality and destiny.

To get the full benefit of a jetological reading, a customer must wait until the professional jetologist carefully analyzes the pattern of jet positions the world over. (Since a computer will help get the data and organize it, jetology must be a scientific discipline! This was, in fact, the claim made by President Reagan's astrologer — that the fact that she used computers made astrology scientific.)

But even when your jetological chart is finished, a person without advanced knowledge will not be able to make sense of it. Years of jetological training are required to interpret such a chart properly. Take that bunching of jumbo jets over San Francisco — its significance for the subjects' love life will require a great deal of study by an experienced jetologist.

As your listener begins to chuckle over the absurdity of this example, you can ask them what makes it amusing. Someone will surely ask WHY the position of those things in the sky should have anything to do with our lives — and then you can ask them the same question about astrology.

birth dates of some 6,000 politicians and 17,000 scientists to see if members of these professions would cluster among certain signs, as astrologers predict. He found the signs of both groups to be distributed completely at random.

To overcome the objections of astrologers who feel that the Sun sign alone is not enough for a reading, physicist Shawn Carlson of the Lawrence Berkeley Laboratory carried out an ingenious experiment. Groups of volunteers were asked to provide information necessary for casting a full horoscope and to fill out the California Personality Inventory, a standard psychologists' questionnaire that uses just the sorts of broad, general, descriptive terms astrologers use.

A "respected" astrological organization constructed horoscopes for the volunteers, and 28 professional astrologers who had approved the procedure in advance were each sent one horoscope and three personality profiles, one of which belonged to the subject of the horoscope. Their task was to interpret the horoscope and select which of the three profiles it matched.

Although the astrologers had predicted that they would score better than 50 percent correct, their actual score in 116 trials was only 34 percent correct — just what you would expect by guessing! Carlson published his results in the December 5, 1985, issue of the prestigious scientific journal *Nature*, much to the embarrassment of the astrological community.

Other tests show that it hardly matters what a horoscope says, as long as the subject feels the interpretations were done for him or her personally. Some years ago French statistician Michel Gauquelin sent the detailed astrological profile for one of the worst mass murderers in French history to 150 people and asked how well it fit them. Ninety-four percent of the subjects said they recognized themselves in the description.

Geoffrey Dean, an Australian researcher who has conducted extensive tests of astrology, reversed the astrological readings of 22 subjects, substituting phrases that were the opposite of what the horoscopes actually stated. Yet the subjects in this study said the readings applied to them just as often (95 percent of the time) as people to whom the correct phrases were given. Apparently, those who seek out astrologers just want guidance, any guidance.

Some time ago astronomers Culver and Ianna tracked

the published predictions of well-known astrologers and astrological organizations for five years. Out of more than 3,000 specific predictions (including many about politicians, film stars, and other famous people), only about 10 percent came to pass. Veteran reporters — and probably many people who read or watch the news — could do a good deal better by educated guessing.

If the stars lead astrologers to incorrect predictions 9 times out of 10, they hardly seem like reliable guides for decisions of life and affairs of state. Yet millions of people seem to swear by them.

Clearly, those of us who love astronomy cannot just hope that the public's infatuation with astrology will go away. We must speak out whenever it is useful or appropriate — to discuss the shortcomings of astrology and the shaky ground it is based on. Those of us working with youngsters can use these ideas to develop a healthy skepticism in the students and encourage an interest in the real cosmos — the one of remote worlds and suns that are mercifully unconcerned with the lives and desires of the creatures on planet Earth. Let's not allow another generation of young people to grow up tied to an ancient fantasy, left over from a time when we huddled by the firelight, afraid of the night.

For resources to explore scientific responses to astrology, further, see the guide to astronomical pseudoscience elsewhere in *The Universe at Your Fingertips*.

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