

A SURVEY OF THE ATTITUDES OF UNIVERSITY STUDENTS TO ASTROLOGY AND ASTRONOMY

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ABSTRACT

A survey of more than 1500 first-year university students has been carried out to determine their attitudes towards astrology and to establish whether they are able to distinguish between astronomy and astrology. Results indicate that more than 45% of Arts students and 37% of Science students subscribe at least somewhat to the principles of astrology, that 55% of Arts students and nearly 44% of Science students are unable to distinguish between astronomy as the science and astrology as the pseudoscience, and females are more likely to subscribe to pseudosciences than males from the same faculty and with the same mathematics background. In general, Science students are more sceptical than Arts students, although the differences are not that marked. Other correlations are also described.

It is suggested that these findings, along with results from other recent surveys, could indicate that there is a serious problem with science literacy in Canada. Some possible solutions to this problem, chiefly involving an improved mathematics and science curriculum in primary and secondary schools, are briefly discussed.

RÉSUMÉ

Une étude des réponses de plus de 1500 élèves de la première année universitaire a été faite afin de déterminer l'attitude des élèves envers l'astronomie et l'astrologie. Les résultats indiquent que plus de 45% des élèves du cours des arts, et 37% des élèves du cours des sciences se souscrivent, au moins un peu, aux principes de l'astrologie; et que 55% des élèves du cours des arts et presque 44% de ceux du cours des sciences ne peuvent distinguer entre l'astronomie comme science et l'astrologie comme pseudoscience; et que les femmes sont plus sujets à croire à la pseudoscience que les hommes de la même faculté et du même expérience. En général, les étudiants des sciences sont plus sceptiques que ceux des arts, mais les différences ne sont pas très marquées.

On suggère que ces trouvailles, aussi bien que ceux d'autres études récentes, indiquent qu'il existe un problème très sérieux vis-à-vis des connaissances en sciences au Canada. Quelques solutions possibles de ce problème y sont brièvement discutées – surtout ceux centrées sur un curriculum amélioré, en sciences et en mathématiques, dans les écoles primaires et secondaires.

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I. Introduction. Astrology currently enjoys a popularity in the western world unmatched since the seventeenth century. This is true not only for the adult population, but among teenagers as well. For example, Paulos (1988) and Fraknoi (1989) describe results from recent US Gallup polls which concluded that 50–55% of teenagers “believe in astrology.” Many scientists and educators are concerned by the level of popularity the pseudosciences have achieved in

modern society *vis à vis* science literacy. Although a number of surveys on astrology have been carried out in the past decade, there is very little information on the prevailing attitudes of university students, especially in Canada.

In a similar vein, professional and amateur astronomers alike are acutely aware of the confusion that exists in the general population when it comes to distinguishing astronomy from astrology. It would be interesting to know whether this confusion exists in the minds of university students, the more highly educated members of society.

It therefore seemed appropriate to carry out a survey of first-year university undergraduates in order to sample their opinions on astrology, and to ascertain whether they are able to distinguish between astronomy and astrology. Apart from its obvious sociological interest, if properly carried out and interpreted, such a survey could be used to help assess the quality of science education at the pre-university level and to determine whether extraordinary efforts may be required to combat “science illiteracy.” Given that many of this nation’s leaders are university educated, the survey’s results may also provide an indication of how “science” is likely to be perceived by business and government in the near future.

Before discussing this survey and its findings, we begin in §II with a very brief outline of the part astrology has played in western history since readers will probably be familiar with the history of astronomy. In §III we shall describe the survey in some detail, including its findings. Finally, in §IV we shall briefly discuss the broader implications of these results in relation to the practice of pseudoscience and offer some suggestions to deal with this problem.

II. Astrology: a Brief History. It is believed that western astrology arose thousands of years ago in Mesopotamia in response to the needs of Sumerian religion which was very much concerned with the heavens (Olson 1982).¹ The importance of celestial phenomena to these religious practices grew as techniques in mathematics and astronomy became more sophisticated. Eventually astrology came to dominate all other forms of divination. In these early stages, astrology was very much an observationally based activity in that it sought correlations between celestial and terrestrial events.

Brought to Europe by Alexander the Great, astrology exerted a powerful cultural influence in ancient Greece as well as the Roman Empire. It was in Greece that astrology’s attention began to focus more on the temperament and moral qualities of individuals – the development of horoscopic astrology. Ptolemy’s *Τετράβιβλος* is the best known compendium of astrology’s principles and prac-

¹Although there are other forms of astrology, for example eastern astrology, we have chosen to deal only with the branch which has the largest following in the western world.

tices and was written in the second century AD. This work is still regarded as a fundamental textbook of western astrology (Thagard 1980).

Astrology was widely practised in Europe in the late Middle Ages and Renaissance well into the seventeenth century (Cohen 1985), despite severe criticism from the Church, which claimed that it did not admit the exercise of free will. Without doubt, astrology acted as a driving force behind many of the astronomical advances made during the Renaissance. And although Bacon deplored its practice and Copernicus may not have been significantly influenced by it, the same cannot be said for Brahe, Galileo, and Kepler. Indeed both Kepler and Galileo cast horoscopes for European heads of state (Cohen 1985). Astrology retained its popularity among intellectuals and with the public until the end of the seventeenth century. With the establishment of the Enlightenment in the eighteenth century, astrology's popularity waned (Thagard 1980).

Widespread interest in astrology was rekindled in the 1930s in the west where it has continued unabated (Thagard 1980). In the 1990s in the western world, astrology's presence is ubiquitous and its advice is sought for a wide variety of questions or problems by the general population.

III. The Survey. As noted in §I, this survey was designed to sample the attitudes that first-year university students have towards astrology, as well as to test whether they are aware of the distinction(s) between astrology and astronomy.

We begin first with practical considerations. Our budget was very limited. This imposed rather severe constraints on the survey: that is, it had to be brief, easy to administer and reduce, and simple to interpret. Curriculum requirements in place within the Faculties of Arts, Fine Arts, and Pure and Applied Science at York University, Canada's third largest university, gave us access to a large, homogeneous sample of "typical" university students. All Faculty of Arts and Fine Arts students are required to take one science course from the Division of Natural Science (NATS) at York. An overwhelming majority of these students take a NATS course in their first year. Enrolments in these classes tend to be very large, making them ideal for our purposes. (Five Natural Science classes containing about 40% of the total number of students in the programme took part in the survey. There is no *a priori* reason to believe that these classes were not representative of the general first-year population of Arts and Fine Arts students. One class of 86 Arts students from Trent University was also included with this group.) We were also able to obtain a reasonably sized sample of science students since they are all required to take the same first-year Chemistry course. This sample was supplemented by 66 students from a second-year Classical Physics course.

The course designations and titles which were included in the survey, as well as the number of respondents in each class are provided in Table Ia. Table Ib is

TABLE Ia
COURSES PARTICIPATING IN THE SURVEY

Course Designation	Course Title	Number of Respondents
NATS 1710.06	The Nature and Growth of Scientific Thought	119
NATS 1720.06	Light and Sound	139
NATS 1740.06	Astronomy	315
NATS 1770.06	Technology and the Environment	344
NATS 1830.06	Matter and Structure	119
PY 150	Introduction to Astronomy for Nonscientists	86
Total Number Arts:		1122
SC 1010.06	Chemistry	317
SC 2010.03	Classical Physics	66
Total Number Science:		383

TABLE Ib
BIOGRAPHICAL INFORMATION

Category	Nonscience Courses	Science Courses
Faculty:		
Arts	1011	12
Fine Arts	87	1
Science	7	368
Other	12	1
No Answer	5	1
Sex:		
Female	591	137
Male	504	241
No Answer	27	5

a breakdown of the survey by Faculty and sex. In total, the sample consists of 1122 students taking a science course for nonscience majors (hereafter referred to as "Arts students") and 383 students taking courses from the Faculty of Pure and Applied Science (hereafter referred to as "Science students"). The survey was carried out in the first week of the fall 1991 semester. No mention had been made of astrology in any of the courses, at least up until the time of the survey.

Survey on Astrology & Astronomy – September 1991

This is a voluntary survey initiated by the Department of Physics and Astronomy at York University. We would appreciate it if you would take 5 minutes to fill it out. No names or student numbers please.

Place an 'X' in the ONE space which best describes your opinion/situation:

Faculty: Arts ___(1) Fine Arts ___(2) Science ___(3) Other ___(4)

Gender: Female ___(1) Male ___(2) Year of Birth: 19 ___

Highest level/year of Math completed:

Less than grade 10 ___(1) Grade 10-11 ___(2) Grade 12-13 ___(3) Post-Secondary ___(4)

Birthdate: Jan 20-Feb 19 ___(1) Feb 20-Mar 20 ___(2) Mar 21-Apr 19 ___(3)
 Apr 20-May 20 ___(4) May 21-Jun 20 ___(5) Jun 21-Jul 22 ___(6)
 Jul 23-Aug 22 ___(7) Aug 23-Sep 22 ___(8) Sep 23-Oct 23 ___(9)
 Oct 24-Nov 22 ___(10) Nov 23-Dec 21 ___(11) Dec 21-Jan 19 ___(12)

1. My astrological sign (Sun sign, sign of the zodiac) is:

Don't know ___(1) Aries ___(2) Taurus ___(3) Gemini ___(4) Cancer ___(5)
 Leo ___(6) Virgo ___(7) Libra ___(8) Scorpio ___(9)
 Sagittarius ___(10) Capricorn ___(11) Aquarius ___(12) Pisces ___(13)

2. In the past year I have paid attention to my horoscope:

Never ___(1) A few (1-9) times ___(2) Many (10-99) times ___(3) Almost daily ___(4)

3. I would say my horoscope is usually:

Inaccurate ___(1) Somewhat accurate ___(2) Very accurate ___(3) Doesn't apply ___(4)

4. In the past year I have made *conscious decisions* based on my horoscope:

Never ___(1) Once or twice ___(2) A few (3-10) times ___(3) More than 10 times ___(4)

5. Astrology holds that one's character and destiny can be understood from the positions of the Sun, planets and stars. I subscribe to these principles of astrology:

Not at all ___(1) Somewhat ___(2) Completely ___(3)

6. I would classify the following as a science:

Only astrology ___(1) Only astronomy ___(2) Both astrology and astronomy ___(3)

Neither astronomy nor astrology ___(4)

7. Astronomers can predict one's character and future by studying the heavens:

No ___(1) Don't know ___(2) Yes ___(3)

8. I believe in:

	Strongly	Moderately	Weakly	Not at all	Don't know
a) Fortune Telling	___(1)	___(2)	___(3)	___(4)	___(5)
b) Numerology	___(1)	___(2)	___(3)	___(4)	___(5)
c) Parapsychology/ESP	___(1)	___(2)	___(3)	___(4)	___(5)

FIG. 1

The authors were permitted to use a maximum of 5–10 minutes of class time to carry out the survey; hence the need for brevity.

A copy of the survey administered to the students is reproduced in figure 1. The first section contains relevant biographical information (while preserving anonymity) and the second section is concerned with attitudes and opinions.

A few comments on the nature of the biographical information requested: The “Faculty” option was included simply to double check the affiliation of each respondent in each class. Normally, one would expect only non-science students to take a Natural Science class and only science students to take Faculty of Pure and Applied Science courses. Indeed, this expectation is confirmed in Table Ib. Previous surveys, including Einsiedel’s Scientific Literacy survey (see §IV), found that a “scientific literacy index” seems to correlate strongly with sex as well as the level of science or mathematics education achieved. As a result, we asked students to identify not only their Faculty, but also their sex and the highest level of mathematics course completed. The birth date in conjunction with question 1 was required to determine whether the respondents *really* knew their Sun sign. In fact, more than 92% of those sampled knew their Sun sign, a clear indication of the pervasive nature of astrology in contemporary western society.

The questions themselves were designed to be simple, admit mutually exclusive and preferably quantitative answers where possible, to be unbiased with respect to the treatment of astrology and astronomy, and to be capable of a relatively simple interpretation. A number of iterations were required before the final survey (figure 1) was fit for administration.

Some comments on the nature of the questions are in order. Questions 2–5 are meant to sample the respondent’s opinions and attitudes towards astrology. Question 2, *the frequency of attention paid to one’s horoscope*, may be one indication of how interested a person is in astrology. It is true, however, that some people read their horoscope simply for amusement or entertainment, so conclusions based solely on this or any other single question may be misleading. One must really combine data from questions 2–5 to get a true indication of a student’s interest in astrology.²

Question 3, *the accuracy of horoscopes*, bears directly on the perceived believability of astrology, while question 4, *the frequency of conscious decisions based upon horoscopes*, is a quantitative indicator of how significant the influence of astrology is in a person’s life. Question 5, *subscription to the principles of astrology*, is perhaps the best measure of whether a person “believes” in astrology. (We did not use the term “believe in astrology” in the survey because we would not have used the same construction in connection with astronomy.)

Questions 6 and 7 attempt to determine whether respondents not only think they know the difference between astrology and astronomy, but whether or not they really do. This is an important point given the inherent uncertainties associated with most surveys. Finally, to test how sympathetic a respondent is

²Even though astrology is more than just horoscopes, we feel that for the vast majority of the population, attitudes towards astrology may be uncovered through questions about horoscopes.

to other pseudosciences, we included question 8 to determine whether he or she is predisposed to other well known pseudosciences.

A summary of the integrated results of the survey is provided in Table II. As noted earlier, the total number of Arts students in the survey was 1122, while the total number of Science students was 383. It is not a simple matter to provide an estimate of the absolute accuracy for the individual entries. Numerical simulations carried out by us for a hypothetical survey of 1500 randomly chosen "people" from the general population for which the "true" response distribution was known, show that 19 times out of 20 the "observed" distribution differs from the "true" distribution by 2–3%. This then may be used as a good estimate for the accuracy of the entries. The designation "N/A" indicates the number of students who either did not answer the question or who answered invalidly. The number of "No Answer" responses is proportionally very small, between 0.3 and 3.7% per question. In question 8, the total number of responses in all three categories have been summed making the totals three times as large. It served no real purpose to report the pseudoscience results individually. We note, however, that numerology was not as well known as either fortune telling or parapsychology, that fortune telling and numerology had similar numbers of "strong" and "moderate" adherents, and that parapsychology received roughly 4–5 and 2–3 times as many "strong" and "moderate" responses than the other pseudosciences respectively for both Arts and Science students. In fact, a comparable number of students believed "strongly" or "moderately" in ESP (extra-sensory perception) than subscribed "somewhat" or "completely" to astrology.

While both Arts and Science students have similar feelings about the accuracy of horoscopes, Arts students are more likely to pay attention to their horoscopes, to have made conscious decisions based on their horoscopes, to subscribe to astrology, to confuse astronomy and astrology and to believe in other pseudosciences. But the differences are not that marked. For example, over 25% of Arts students have made at least one conscious decision in the past year based on their horoscope, compared with 21% of Science students. However, while only 1.9% of Arts students "completely" subscribe to astrology, 3.1% of Science students appear to, although the latter figure is based on only 12 students and so the difference is not significant.

Fully 45% of Arts students and 37% of Science students subscribe at least somewhat to the principles of astrology; more colloquially, "believe in astrology." Equally surprising was the degree to which astronomy and astrology are confused by undergraduates. Substantially fewer than half (44%) of Arts students knew that only astronomy was a science, compared with just over half (56%) of Science students. The responses to question 7 about the ability of astronomers to predict one's character and future support this interpretation.

Tables III–VII summarize the survey results based on specific criteria – the

TABLE II
SUMMARY OF RESULTS

Question		Arts		Science	
		No.	%	No.	%
2. Attention to Horoscope	Never	182	16.2	108	28.2
	Few	477	42.5	179	46.7
	Many	356	31.7	69	18.0
	Daily	104	9.3	24	6.3
	N/A	3	0.3	3	0.8
3. Horoscope accuracy	Inaccurate	234	20.9	73	19.1
	Somewhat	626	55.8	193	50.4
	Very	23	2.1	7	1.8
	Doesn't Apply	203	18.1	96	25.1
	N/A	36	3.2	14	3.7
4. Conscious decisions made	Never	829	73.9	302	78.9
	Once/twice	204	18.2	54	14.1
	Few times	69	6.2	19	5.0
	Often	14	1.3	3	0.8
	N/A	6	0.5	5	1.3
5. Subscribe to Astrology	Not at all	605	53.9	237	61.9
	Somewhat	482	43.0	129	33.7
	Completely	21	1.9	12	3.1
	N/A	14	1.2	5	1.3
6. Classify as Science	Only Astrology	32	2.9	17	4.4
	Only Astronomy	490	43.7	213	55.6
	Both	544	48.5	128	33.4
	Neither	35	3.1	20	5.2
	N/A	21	1.9	5	1.3
7. Astronomers predict future	No	524	46.7	205	53.5
	Don't Know	513	45.7	157	41.0
	Yes	69	6.2	18	4.7
	N/A	16	1.4	3	0.8
8. Belief in other pseudosciences	Strongly	239	7.1	54	4.7
	Moderately	681	20.2	170	14.8
	Weakly	838	24.9	248	21.6
	Not at all	1044	31.0	423	36.8
	Don't know	489	14.5	220	19.2
	N/A	75	2.2	34	2.9

answers to individual questions. In each table, the total number of responses does not necessarily add up to the total number of students participating in the survey because the “N/A” responses have been ignored. That is, the corresponding percentages are based only on valid responses. Because the number of questions with invalid answers is so small, we feel this is a reasonable simplification. Note also that the percentages have been rounded to one decimal place and therefore the sums may differ from 100% by $\pm 0.1\%$. For clarity of presentation, some of the options have been grouped together. In question 2, a distinction was made between “little or no attention” (selections 1 and 2) and “much attention” to horoscopes (selections 3 and 4). In question 4, the first two answers (“never” and “once or twice”) became “few decisions” while the last two answers (“a few” or “more than 10”) became “many decisions.” In questions 6 and 7, the correct answer is distinguished from “all other answers.” Once again, in the final question, the “other” pseudoscience data are presented together. The total numbers reflect approximately three times the number of respondents as a result. (The factor will be actually less than three because there was a “don’t know” option in this question which is not reflected in these tables.)

Table III gives the results by sex. (Note that unlike the subsequent tables, the percentages here refer not to the total number of either Arts or Science responses per question, but rather the number of responses by sex per question. This makes it easier to see the corresponding trends.) There appear to be significant differences in the responses of females and males. Females are more likely to pay attention to their horoscopes, to make decisions based upon them, to subscribe to astrology, and to believe in other pseudosciences strongly. They are also unaware of the distinctions between astrology and astronomy significantly more often than males. This is true for both Arts and Science students. Unlike other surveys (e.g., see a discussion of Einsiedel’s survey below), the average mathematics (and presumably science) background of females for both the Arts and Science samples is the same. Indeed, more than 70% of female Arts students indicated their highest level of mathematics obtained was Grade 12–13, while this was true for only 67% of the males. (17% of females had less than Grade 12 mathematics, compared with 14% of the males.) In general, Science students seem to take a more sceptical approach to astrology, except that they appear to make conscious decisions based on their horoscope with the same frequency as Arts students.

Table IV gives the results based on the response to question 2, *attention paid to horoscopes* – “little” or “much”; Table V summarizes question 4, *conscious decisions based on horoscopes* – “never” or “sometimes”; Table VI lists the results from question 5, *subscription to the principles to astrology* – “never” or “sometimes”; and Table VII gives the results from question 6, *classification of astronomy and/or astrology as science(s)* – “only [astronomy]” and “other

TABLE IIIa
RESULTS BY SEX

	Arts		Science	
	Female	Male	Female	Male
Number	591	504	137	241

TABLE IIIb

Question/Options	Arts				Science			
	Female		Male		Female		Male	
	No.	%	No.	%	No.	%	No.	%
2. No/little attention	276	46.8	363	72.3	85	62.5	199	82.9
Much attention	314	53.2	139	27.7	51	37.5	41	17.1
3. Inaccurate	113	19.5	118	24.7	22	16.5	51	22.1
Somewhat accurate	381	65.5	227	47.5	90	67.7	100	43.3
Very accurate	15	2.6	8	1.7	2	1.5	4	1.7
Doesn't apply	72	12.4	125	26.2	19	14.3	76	32.9
4. Few decisions	536	91.0	472	94.4	126	92.0	226	95.4
Many decisions	53	9.0	28	5.6	11	8.0	11	4.6
5. Astrology not at all	256	43.8	331	66.7	72	53.3	161	67.7
Astrology somewhat	316	54.0	157	31.7	57	42.2	71	29.8
Astrology completely	13	2.2	8	1.6	6	4.4	6	2.5
6. Astronomy as science	193	33.3	287	58.0	66	48.9	144	60.5
All other responses	386	66.7	208	42.0	69	51.1	94	39.5
7. Astronomers cannot predict future	206	35.6	305	61.0	58	42.3	142	59.7
All other responses	373	64.4	195	39.0	79	57.7	96	40.3
8. Pseudoscience belief: Moderate/Strong	545	37.4	352	27.6	85	26.9	139	24.5
Pseudoscience belief: Weak/None	914	62.6	921	72.3	231	73.1	429	75.5

TABLE IVa
RESULTS BY ATTENTION — QUESTION 2

	Arts		Science	
	Little	Much	Little	Much
Number	659	460	287	93

TABLE IVb

Question/Options	Arts				Science			
	Little		Much		Little		Much	
	No.	%	No.	%	No.	%	No.	%
3. Inaccurate	169	15.6	65	6.0	59	16.1	14	3.8
Somewhat accurate	274	25.3	349	32.2	120	32.7	72	19.6
Very accurate	4	0.4	19	1.8	1	0.3	5	1.4
Doesn't apply	181	16.7	22	2.0	94	25.6	2	0.5
4. Few decisions	643	57.8	387	34.8	282	74.8	73	19.4
Many decisions	11	1.0	72	6.5	3	0.8	19	5.0
5. Astrology not at all	425	38.5	179	16.2	193	51.3	43	11.4
Astrology somewhat	217	19.6	263	23.8	83	22.1	45	12.0
Astrology completely	8	0.7	13	1.2	7	1.9	5	1.3
6. Astronomy as science	342	31.2	147	13.4	163	43.5	49	13.1
All other responses	304	27.7	305	27.8	120	32.0	43	11.5
7. Astronomers cannot predict future	367	33.3	248	22.5	166	44.0	38	10.1
All other responses	287	26.0	201	18.2	119	31.6	54	14.3
8. Pseudoscience belief: Moderate/Strong	401	14.3	519	18.6	132	14.9	91	10.2
Pseudoscience belief: Weak/None	1202	43.0	674	24.1	534	60.1	132	14.9

[responses]”. In each case, “sceptical students” (those who do not subscribe to astrology) tend to pay little or no attention to their horoscopes, make few or no decisions based upon their horoscopes, do not subscribe to astrological principles or other pseudosciences, and acknowledge astronomy as the only science. “Believing students” (those who subscribe at least somewhat to astrology) have a far higher probability of paying attention to their horoscopes, making decisions based upon their horoscopes, subscribing somewhat or completely to astrologi-

TABLE Va
RESULTS BY DECISION — QUESTION 4

	Arts		Science	
	Never	Sometimes	Never	Sometimes
Number	829	287	302	76

TABLE Vb

Question/Options	Arts				Science			
	Never		Sometimes		Never		Sometimes	
	No.	%	No.	%	No.	%	No.	%
2. No/little attention	574	51.6	80	7.2	251	66.6	34	9.0
Much attention	253	22.7	206	18.5	51	13.5	41	10.9
3. Inaccurate	207	19.1	27	2.5	65	17.7	8	2.2
Somewhat accurate	394	36.3	231	21.3	132	36.0	60	16.4
Very accurate	5	0.5	18	1.7	1	0.3	5	1.4
Doesn't apply	193	17.8	10	0.9	94	25.6	2	0.5
5. Astrology not at all	527	47.7	76	6.9	213	56.8	24	6.4
Astrology somewhat	285	25.8	197	17.8	82	21.9	45	12.0
Astrology completely	8	0.7	13	1.2	5	1.3	6	1.6
6. Astronomy as science	403	36.8	83	7.6	183	48.9	29	7.8
All other responses	409	37.4	200	18.3	116	31.0	46	12.3
7. Astronomers cannot predict future	439	39.9	81	7.4	184	48.9	19	5.1
All other responses	381	34.6	200	18.2	117	31.1	56	14.9
8. Pseudoscience belief: Moderate/Strong	552	19.8	366	13.1	134	14.9	90	10.0
Pseudoscience belief: Weak/None	1505	53.9	368	13.2	579	64.4	96	10.7

cal principles, believing in other pseudosciences, and confusing astronomy and astrology.

IV. Discussion. From our perspective, it is certainly rather disquieting to find such a large fraction of undergraduates so favourably disposed to astrology. Given the relatively high level of education of these students – particularly in mathematics and science – we anticipated figures much less than the 50–55%

TABLE VIa
RESULTS BY ASTROLOGY SUBSCRIPTION — QUESTION 5

	Arts		Science	
	Never	Sometimes	Never	Sometimes
Number	605	503	237	141

TABLE VIb

Question/Options	Arts				Science			
	Never		Sometimes		Never		Sometimes	
	No.	%	No.	%	No.	%	No.	%
2. No/little attention	425	38.5	225	20.4	193	51.3	90	23.9
Much attention	179	16.2	276	25.0	43	11.4	50	13.3
3. Inaccurate	153	14.2	79	7.3	58	15.7	15	4.1
Somewhat accurate	273	25.3	350	32.5	91	24.7	102	27.6
Very accurate	1	0.1	21	1.9	0	0.0	7	1.9
Doesn't apply	157	14.6	44	4.1	81	21.9	15	5.1
4. Few decisions	596	53.9	427	38.6	237	63.2	116	30.9
Many decisions	7	0.6	76	6.9	0	0.0	22	5.9
6. Astronomy as science	340	31.2	145	13.3	162	43.2	49	13.1
All other responses	256	23.5	349	32.0	73	19.5	91	24.3
7. Astronomers cannot predict future	391	35.7	129	11.8	164	43.2	40	10.5
All other responses	208	19.0	366	33.5	72	19.0	104	27.4
8. Pseudoscience belief: Moderate/Strong	324	11.7	594	21.4	90	10.1	132	14.9
Pseudoscience belief: Weak/None	1202	43.3	657	23.7	471	53.0	196	22.0

reported for teenagers in the Gallup polls. While it is true that only a few per cent make conscious decisions based on their horoscopes, more than 45% of Arts students and 37% of Science students subscribe at least somewhat to the principles of astrology; that is, believe in astrology. There is a similar fraction who believe in other pseudosciences, especially parapsychology.

Equally troubling is the apparent inability of undergraduates to distinguish astronomy (the science) from astrology (the pseudoscience). Our results show

A Survey of the Attitudes of University Students

TABLE VIIa
RESULTS BY WHICH IS A SCIENCE — QUESTION 6

	Arts		Science	
	Only	Other	Only	Other
Number	490	611	213	165

TABLE VIIb

Question/Options	Arts				Science			
	Only		Other		Only		Other	
	No.	%	No.	%	No.	%	No.	%
2. No/little attention	342	31.2	304	27.7	163	43.5	120	32.0
Much attention	147	13.4	305	27.8	49	13.1	43	11.5
3. Inaccurate	127	11.9	102	9.5	42	11.5	30	8.2
Somewhat accurate	220	20.6	396	37.0	93	25.4	98	26.8
Very accurate	3	0.3	20	1.9	2	0.6	5	1.4
Doesn't apply	125	11.7	76	7.1	67	18.3	29	7.9
4. Few decisions	475	43.0	540	48.8	208	55.6	144	38.5
Many decisions	11	1.0	80	7.2	4	1.1	18	4.8
5. Astrology not at all	340	31.2	256	23.5	162	43.2	73	19.5
Astrology somewhat	143	13.1	330	30.3	47	12.5	81	21.6
Astrology completely	2	0.2	19	1.7	2	0.5	10	2.7
7. Astronomers cannot predict future	330	30.4	192	17.7	153	41.0	51	13.7
All other responses	157	14.5	407	37.5	60	16.1	109	29.2
8. Pseudoscience belief: Moderate/Strong	325	11.8	586	21.2	103	11.6	120	13.5
Pseudoscience belief: Weak/None	935	33.9	913	33.1	427	48.1	237	26.7

that more than 55% of Arts students and nearly 44% of Science students are unable to do so. Both numbers are startling, especially the Science figure. We believe the substantial differences between the responses of females and males is also a major cause for concern.

We emphasize, however, that we have surveyed primarily first-year and not upper-year students. It may be that university graduates on the whole are more sceptical, but there is no compelling reason to expect a dramatic shift of the

astrological opinions of this population because these views are not formally challenged in either the Arts or Science curriculum as far as we are aware.

Based on the results of this survey, two questions come to mind: Is there really a problem here?, and, if so, What can be done about it? The definition of “pseudoscience” is certainly not trivial (for example, see Thagard 1980). There are some philosophers such as Feyerabend (1975) who would argue that modern science is neither superior to nor distinct from astrology. But the majority of scientists and philosophers would agree that astrology is the archetypal pseudoscience and therefore that its belief or practice undermines the rational foundations upon which much of our society has been constructed. It is our opinion that scientists are not so much angered as frustrated by results such as these. How can a pseudoscience like astrology flourish in the midst of the most highly technological society in history? Thagard (1980) and Paulos (1988) offer a number of interesting possibilities. People may be interested in seeking the truth, but some do so with an anti-scientific bias perhaps because they identify science or scientists as something to be feared. Indeed, Einsiedel (1990) (see below) finds that 40% of adult Canadians agree that “because of their knowledge, scientists have a power that makes them dangerous.” A pseudoscience may offer an attractive shelter for such people. Others may find the “extra-rational” nature of the pseudosciences an appealing alternative to traditional religions. Certainly everyone is curious about the future.

Whatever the reason, there is general agreement that there *is* a problem and that the embracement of astrology and other pseudosciences may be linked to the larger problem of science literacy. In the largest survey of its kind in Canada, Einsiedel (1990) conducted a study of 2000 adult Canadians to determine their level of “scientific literacy”.³ Many of Einsiedel’s findings are striking. For example in the basic knowledge section, one in five Canadians are not aware that the Earth goes around the Sun, and half of all Canadians do not know that the revolutionary period of the Earth around the Sun is one year. Similar ratios were found for the general population in British and American studies. She also asked two questions about astrology which are related to questions 2 and 6 in our survey. When asked “How often do you read a horoscope or your personal astrology report?” 23.2% said *quite often/everyday*, 32.2% replied *just occasionally*, 18.4% said *almost never*, and 26.3% claimed *never*. Because our question 2 is not identical with Einsiedel’s, a straightforward comparison is not possible. It may be, however, that a slightly smaller percentage of university students (combined Arts and Science) pays no attention to their horoscope than the general population. In answer to the question “Would you say that astrology is...”, 9.9% said *astrology is “very scientific”*, 34.9% responded *astrology is*

³Scientific literacy is certainly not an easy concept to define precisely, but its connotation is clear.

“sort of scientific”, and 48.8% claimed that *astrology is “not at all scientific”*. (The sum does not appear to add to 100%.) Again, comparison with our question 6 is not simple, but 47.5% of university students (combined Arts and Science) are aware that astrology is a pseudoscience and astronomy is a science. It may be that the responses of both populations for this question are similar. But what is interesting about Einsiedel’s survey in the present context is that she found that more “scientifically knowledgeable” Canadians displayed “a greater likelihood of infrequent or no attention to horoscopes and labelling astrology as not scientific.”

The dangers of widespread scientific illiteracy in a highly technological society range from severe economic repercussions when a work force is unable to meet the demands of high technology industry, to a threat to democracy itself. A populace which is unable to understand basic scientific concepts cannot contribute meaningfully to national science policy or deal in an informed way on a number of ethical or social issues.

Improved science education in the primary and secondary schools is seen by some as the best way to meet the challenges of science illiteracy and to combat widespread pseudoscientific practices. This is not to say that the efforts of individual scientists and organizations are not useful. On the contrary, we would do well to follow the lead of an Abell or Bok (two of the most prominent astronomers of this century who devoted much of their lives to educating the public about astrology). But the magnitude of the problem is so large that it must be addressed by the educational system itself. To this end, Nappi (1990) has recommended that mathematics and science education should begin as early as possible in school, be compulsory rather than optional throughout high school, and be taught each year. She criticizes the “shotgun” approach to mathematics and science teaching familiar in North American high schools – a heavy dose for one semester and then nothing for a few semesters – as well as the possibility for students to opt out of mathematics and science courses early on in secondary school. According to Nappi, this approach is counterproductive to learning mathematics and science, and discourages women and minorities from participating. Her suggestions seem very reasonable and ought to be seriously considered.

But those who think that more mathematics and science courses are *all* that is required to solve the problem of pseudoscience should consider the figures once again. The responses from Science students who presumably have had larger doses of mathematics and science throughout secondary school are not dramatically different from the Arts students. Perhaps we should not underestimate the part “belief” or a “need to believe” has in this matter. It may even play the dominant role. Consequently, if this aspect of the problem is to be addressed at all in the mathematics or science classroom – and we believe that this is entirely

appropriate – it may mean that part of the curriculum will have to be devoted to a critical analysis of the pseudosciences.

Yet even with the full participation of the school system, the media must share some of the responsibility for the popularity of pseudosciences and widespread science illiteracy in North America. Horoscopes are ubiquitous, even in the most respected newspapers, as are stories on the paranormal and occult. These “features” may have immediate financial rewards but they are ultimately detrimental, at least to the scientific and technological health of this nation. It is in everyone’s best interest that the media take some interest and responsibility for science education of the general public for without their help it will be very difficult to overcome science illiteracy and its many undesirable and yet inevitable consequences.

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