

Report on a Survey of the Membership of the American Astronomical Society Concerning the UFO Problem: Part 1⁽¹⁾

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Abstract — Refereed journals, to which scientists turn for their reliable information, carry virtually no information on the UFO problem. Does this imply that scientists have no views and no thoughts on the subject, or that all scientists consider it insignificant? Does it imply that scientists have no reports to submit comparable with UFO reports published in newspapers and popular books? The purpose of this 1977 survey of American astronomers was to answer these questions.

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(¹Editor's Note: One important factor contributing to the founding of the Society for Scientific Exploration in 1982 was the outcome of the Sturrock survey of members of the American Astronomical Society, the principal professional organization of American astronomers, in the late 1970's concerning the issue of UFOs. This was issued as a Stanford University Institute for Plasma Physics report in 1977, but has never been published. This report is now being published for its historical significance and also to possibly serve as a catalyst for follow-on studies. Owing to its length it will appear in three parts in this and the following issues of JSE.

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Overview and Summary

Of 2,611 questionnaires mailed to members of the American Astronomical Society, 1,356 were returned, 34 anonymously. Only two members offered to waive anonymity. These facts and many comments (See Appendix) confirm that the UFO problem is a sensitive issue for most scientists. Nevertheless, only a few (13) respondents made critical remarks about the subject or the survey; 50 made encouraging statements, 34 offered to help, and 7 indicated that they are actively studying the problem.

Each respondent was asked to state his opinion on whether the UFO problem deserves scientific study: 23% replied "certainly", 30% "probably", 27% "possibly", 17% "probably not", and 3% "certainly not", which represents a positive attitude among 53% of the respondents, as against a negative attitude among 20%. Analysis of the returns shows that older scientists are markedly more negative to the problem than are younger scientists. One also finds that opinions correlate strongly with time spent reading about the subject. The fraction of respondents who think that the subject certainly or probably deserves scientific study rises from 29%, among those who have spent less than

one hour, to 68% among those who have spent more than 365 hours in such reading. It appears that popular books and publications by established scientists exert a positive influence on scientists' opinions, whereas newspaper and magazine articles exert negligible influence.

Respondents were asked to express their views on possible causes of UFO reports by assigning "prior probabilities" to four "conventional" causes [(a) a hoax, (b) a familiar phenomenon or device, (c) an unfamiliar natural phenomenon, and (d) an unfamiliar terrestrial device] and four "unconventional" causes [(e) an unknown natural phenomenon, (f) an alien device, (g) some specifiable other cause, and (h) some unspecifiable other cause]. There was a very wide spread of opinions on this issue. Averaging all returns gives the values: (a) .12, (b) .22, (c) .23, (d) .21, (e) .09, (f) .03, (g) .03, (h) .07. This average response is therefore quite open-minded, although many individual responses are not. Older people tend to give more credence to the possibility of a hoax and less to unconventional possibilities. By contrast, those who have studied the subject extensively attach less weight to the possibility of a hoax and greater weight to the unconventional possibilities.

Over 80% of respondents expressed a willingness to contribute to the resolution of the UFO problem if they could see a way to do so but, of those expressing this interest, only 13% could see a way. This is a notable consensus which may encapsulate the dilemma which this problem presents to scientists. Those who have studied the subject are more willing to help and more likely to see a way to help.

Most respondents consider that meteorology, psychology, astronomy/astrophysics and physics have relevance to the UFO problem and some consider that aeronautical engineering and sociology may also be relevant. Most respondents (75%) would like to obtain more information on the subject, but they express a strong preference for getting it from scientific journals rather than from books or lectures.

The returns identified 62 respondents who had witnessed or obtained an instrumental record of an event which they could not identify and which they thought might be related to the UFO phenomenon. The total number of events reported was larger (65) since some respondents reported more than one event. In addition, ten identified strange observations were mentioned, four investigations were described (including one detailed study of ground traces), and attention was drawn to a few strange events described in the scientific literature. It was found that these 62 respondents have spent longer than average studying the UFO problem, that they are more positive in their assessment of the scientific importance of the problem, and that they tend to be more open-minded about unconventional explanations. Only 18 (about 30%) of these respondents indicated that they had previously reported their observations; seven to the Air Force, Navy or NORAD, one to the police, two to airport authorities, seven to other scientists, and one to a newspaper.

Sixty-three percent (63%) of those reporting events were night-sky observers, as against 50% of respondents who did not report events.

Thirty-six (36) of the events comprised lights seen in the sky at night. Twelve (12) were of point lights which were more or less puzzling; four (4) were of formations of lights; and four (4) were of diffuse lights. Two respondents independently described what appeared to be a searchlight playing on a cloud when there were no clouds in the sky, and a third described a similar effect when the sky was partly cloudy. Four described disk-like objects, and five described objects with different shapes. Three cases concerned objects which appeared to emit smaller objects or "sparks". One case described apparent interference with an automobile electrical system (as did also a daylight case).

There were sixteen accounts of strange objects seen by day. Five were of small objects, seven were of disk-shaped objects, and four described other miscellaneous observations.

Seven respondents described photographic records of strange phenomena, and three were kind enough to provide me with copies of the photographs or film. (With help, I was able to make plausible interpretations of two of these.) One respondent recalled a radar observation he had made, another described two strange radio records, and a third described puzzling records obtained by a satellite tracking station.

This study leads to the following answers to the questions initially posed. To judge from this survey of the membership of the American Astronomical Society, it appears that:

- (a) Scientists have thoughts and views but no answers concerning the UFO problem;
- (b) Although there is no consensus, more scientists are of the opinion that the problem certainly or probably deserves scientific study than are of the opinion that it certainly or probably does not; and
- (c) A small fraction (of order 5%) are likely to report varied and puzzling observations, not unlike so-called "UFO reports" made by the general public. As is the case with reports from the public, many may be unusual observations of familiar objects, but some seem to be definitely strange.

These results are consistent with the findings of an earlier but more limited survey of members of the American Institute of Aeronautics and Astronautics (Sturrock, 1974b), except that the opinions of astronomers (expressed in 1975) concerning the significance of the UFO problem were more positive than were the views of aeronautical engineers (expressed in 1973).

1. Introduction

Over the past thirty years, news media around the world have carried untold thousands of reports of observations of "unidentified flying objects" (UFO's). This topic has been the subject of study by at least three Air Force projects and by a team of scientists at the University of Colorado working under the direction of the late Professor Edward U. Condon. The report of the Colorado Project, usually referred to as the "Condon Report" (Condon and Gillmor, 1969),

was favorably reviewed by a panel of scientists of the National Academy of Sciences (Clemence et al., 1969) and has been very influential in shaping the opinions of scientists towards this problem. Condon's conclusions were expressed cautiously but were clearly negative. His recommendations led to the discontinuation of the Air Force project Blue Book (Jacobs, 1975). However, subsequent more leisurely study of the Report (Kuettner et al., 1970; Sturrock, 1974a, [subsequently published as Sturrock 19871) brings to light serious discrepancies between Condon's assessments and those of his staff. This unfortunately leaves hanging the crucial question: To what extent do the conclusions of the Report represent initial prejudice, and to what extent do they represent a distillation of the evidence?

Whether or not Condon's assessments prove ultimately to have been justified, it is clear that the arguments concerning the reality and possible nature of the UFO phenomenon have not been settled. The publications of two senior members of the American Astronomical Society, Professor Donald H. Menzel (Menzel, 1953; Menzel and Boyd, 1963) and Professor J. Allen Hynek (1972), present completely different pictures of the phenomenon. Moreover, the proceedings of the symposium sponsored by the American Association for the Advancement of Science (Sagan and Page, 1972), presenting the positions of some of the concerned scientists, show that there was no consensus on these questions in 1972, and it is safe to assert that there is no consensus now. Hence the principal objective of science which, according to Ziman (1968), is "a *consensus* of rational opinion", has not been attained in this area.

One may also note the fact that, whereas there is very little known research on the UFO problem going on in United States universities and other private research organizations, many scientists support and contribute to the activities of organizations dedicated to UFO research such as APRO (Aerial Phenomena Research Organization), CUFOS (Center for UFO Studies), MUFON (Mutual UFO Network) and NICAP (National Investigating Committee for Aerial Phenomena). One national scientific organization (the American Institute of Aeronautics and Astronautics) has demonstrated some interest in the subject by setting up first a subcommittee (see Kuettner et al., 1970) and more recently a study group to study the problem.

One of the many difficulties facing scientists in approaching the UFO problem is that the bulk of the evidence is narrative in nature. Quite apart from the difficulty of processing narrative evidence, one faces the difficulty that the significance of a report must depend sensitively on the training, honesty and other attributes of the person making the report. In most scientific work, this problem either does not arise or is greatly mitigated by the fact that scientists deal almost exclusively with material furnished to them by other scientists.

If scientists are to contribute to the resolution of the UFO problem, it is essential that they begin an exchange of relevant information. Since the UFO phenomenon deals primarily with reports of things seen in the sky, most often at night, it seems reasonable to look for a way to promote such an exchange of information among members of an astronomical organization.

One of the difficulties involved in promoting such an exchange is that scientists (along with most other professions) are very reluctant to publicize any UFO-related observations which they may have made. However, an earlier survey of a small group of scientists and engineers comprising the San Francisco Chapter of the American Institute of Aeronautics and Astronautics (Sturrock, 1974b) showed that scientists are willing to share their information if they can do this anonymously.

In May 1974, I asked permission of a regional astronomical organization to carry out a survey of their membership concerning the UFO problem. This request was denied. In December 1974, I addressed the same request to the Council of the American Astronomical Society. The Council kindly advised me that I was entitled to pursue the survey and that the Council had no objection to this proposed action.

Although this report is based on a survey of the American Astronomical Society, it must be emphasized that the Council and Society have no responsibility for either the survey or the report. The responsibility for both rests entirely with the author.

2. Mailing and Responses

The first questionnaire (Q1) and the letter which accompanied it (L1) are attached as appendices. These were mailed out early in May 1975 to the 2,611 paid-up members of the AAS in the U.S. and abroad. Of these 2,611 questionnaires, 1,356 were returned with no further prompting, an initial response of 52%. These 1,356 returns are subsequently referred to as "Group 1". This group comprises two subgroups: Group 1S (1,322 reports) which were signed, and Group 1A (34 reports) which were returned anonymously. Group 1A represents 2.5% of Group 1.

In each group, about one third of the respondents added comments, which ranged widely in subject, opinion and style. For instance, there were four positive statements about the Condon Report and five negative ones. A small sample of these comments, which are well expressed (sometimes forcefully expressed!) and fairly typical, are collected as Appendix C. Of Group 1S, 13 made negative statements about the UFO problem and the survey, but 50 made positive statements; 7 stated that they were actively studying the UFO problem, and 34 offered to help investigate the problem. Of Group 1A, three made negative comments and two made positive ones.

The fact that 34 respondents completed and returned Q1 but declined to identify themselves provides some confirmation of the expectation that the subject is a sensitive one. (On the other hand, two respondents of Group 1S offered to waive their anonymity; they belonged to subgroup 1SN, not 1SY. See p. 8 for definition of "1SN" and "1SY.") The fact that they returned Q1 indicates some level of interest. A comparison of the levels of interest of Groups 1S and 1A may be made by comparing the distributions according to the number of hours spent studying the UFO problem. The comparison is given in Table 2.1, and it is seen that the difference is not significant ($\chi^2 = 3.2$).

TABLE 2.1

Comparison of H, number of hours respondent has spent reading or otherwise informing himself about the UFO problem, for Group 1S, who signed Q1, and Group 1A, who returned the questionnaire anonymously.*

H	≤1	2-7	8-50	51-365	>365
Group 1S	78 (6%)	458 (35%)	595 (46%)	142 (11%)	29 (2%)
Group 1A	4 (12%)	13 (38%)	13 (38%)	4 (12%)	0 (0%)

* The number of respondents contributing to a given table will be less than the number quoted for that group for two reasons: (a) a few returns came in after the computations were made; and (b) some respondents failed to reply to any given question.

We may also compare the opinions of the two groups by studying their responses to Question 4 of Q1. The comparison is shown in Table 2.2.

Whereas 53% of Group 1S believe the problem certainly or probably deserves scientific study, against 20% who think it certainly or probably does not, the corresponding figures are 24% and 44%, respectively, for Group 1A. Hence the anonymous group are more negative in their views than are those who gave their names ($\chi^2 = 15$, 2 degrees of freedom, 0.1% significance).

The reasons that respondents declined to give their names would be interesting but they are not clear. The perceptive reader may be able to draw some inference from the only three comments which bear on this issue. Concerning the request for a signature, one anonymous respondent wrote "Still reluctant to sign with the present atmosphere". Another wrote "... I am too close to the UFO cross fire to (reveal my identity)". The third pointed out that he is "very senior and potentially influential".

Although a 52% return is a good response for a survey, one would like to have some information about the reasons the other 48% did not respond. For this reason, I randomly selected 100 names from those who had not returned Q1 (except that, for convenience, I selected only members living in the U.S.) and mailed to them, in July 1975, the letter L3 and questionnaires Q1 and Q3 (attached as appendices). Of this group (Group 2), 2 respondents could not be located by the mail service and the letters were returned. From the remaining 98 (Group 2R), 55 replies were received. These are broken down in response to their indication that their failure to return Q1 was intentional (Group 2I, with

TABLE 2.2

Comparison of opinion on whether the UFO problem deserves scientific study between Group 1S, who signed Q1, and Group 1A, who returned the questionnaire anonymously.

	Certainly	Probably	Possibly	Probably Not	Certainly Not
Group 1S	301 (23%)	383 (30%)	350 (27%)	227 (17%)	35 (3%)
Group 1A	2 (6%)	6 (18%)	11 (32%)	14 (41%)	1 (3%)

TABLE 2.3

Comparison of opinion on whether the UFO problem deserves scientific study between Groups 21 (who intentionally did not return Q1), Group 2U (who unintentionally did not return Q1) and Group 1S (who returned Q1 and gave their names). One respondent split his vote.

	Certainly	Probably	Possibly	Probably Not	Certainly Not
Group 21	3 (21%)	0 (0%)	4 (29%)	5 (36%)	2 (14%)
Group 2U	9 (23%)	8 (25%)	11½ (36%)	2½ (8%)	1 (3%)
Group 1S	301 (23%)	383 (30%)	350 (27%)	227 (17%)	35 (3%)

18 members), or unintentional (Group 2U, with 36 members). (One person returned Q1 anonymously but did not return 43.) Since I was reluctant to impose further on those who had failed to respond to two inquiries, the views of 21% of the membership of the AAS (44% of 48%) remain unknown.

In order to obtain some calibration of the opinions of members who did not respond to Q1, I included Question 4 of Q1 in the questionnaire 43. Table 2.3 presents the replies of Groups 21 and 2U, together with the corresponding replies of Group 1S, which are included for comparison.

We see (1% significance level) that Group 21 is more negative to the problem than is Group 1S, whereas Group 2U is statistically indistinguishable from Group 1S. It seems that those with positive opinions (who think the subject deserves study) tend to respond to inquiries, whereas those with negative opinions tend not to.

Included in Q1 is the following question (Number 7): "Have you yourself witnessed or obtained an instrumental record of any event which you could not identify and which may be related to the UFO phenomenon? Yes () No ()? *If your answer is "yes", you will receive a second questionnaire, but please enclose with this form a narrative account of the episode.* Did you report the event? Yes () No (). If so, to which organization? _____" None of Group 1A made an affirmative reply to this question, 70 members of Group 1S (comprising Group 1SY) checked "Yes", and the remaining 1,252 (Group 1SN) checked "No". Group 1SY received a second questionnaire (Q2) with a covering letter (L2) which also are attached as appendices. Of these 70 respondents, 45 completed and returned 42. Case descriptions were obtained from information originally given on Q1 and from those questionnaires (Q2) which were returned, and these are compiled in Section IV.

Of the 70 members of Group 1SY, only 18 (26%) indicated that they had previously reported their observations. Of these 18, seven were reported to the Air Force, Navy or NORAD; one to the police; two to the local airport or FAA; seven to other scientists or to investigating groups such as APRO and the Colorado Project; and one to the local newspaper.

In this context, an AAS member who grew up in Eastern Europe had an interesting comment to make:

I know of several unreported observations of UFOs. In [Eastern Europe] and in Russia people are generally not willing to report UFO events. They are afraid of official investigations performed by security agents. Nobody wants to be ridiculed or brain-washed by KGB agents. I suppose that in this country also some observations remain unreported and something should be done to encourage observers.

Two respondents were kind enough to enclose cartoons with their returns. One was a *New Yorker* cartoon showing a group of primitive warriors staring with wonder at an airplane, while the medicine man pronounces "Swamp gas!" The other cartoon is an original and is here reproduced.

The Unbiased Scientist



"Now, in summary, we should recall that the truly objective scientist will always demand that unfamiliar events such as UFOs, so-called, first be explained in terms of established, or if necessary, newly elucidated physical phenomena, applicable to the earth itself, before invoking such unlikely hypotheses as extraterrestrial visitations."



"Er, ... uh ... excuse me sir, would you be so kind as to tell us what kind of natural terrestrial phenomenon you represent?"

Cartoon Submitted by Respondent

3. Statistical Analysis

3.1 Variables

Most of the information provided by respondents on Q1 may be coded and subjected to statistical analysis. Assistance in this part of the study was kindly provided by Keith Marzullo. Much of the analysis was performed by means of the Statistical Package for the Social Sciences (SPSS).

The "variables" "measured by" the replies to the various questions of Q1 tend to break down into two groups which may be regarded as "primary variables" and "secondary variables".

The "primary variables" were taken to be the following:

- Age,
- Whether or not Observer (Question 1),
- Highest Degree (Question 1),
- Field of Degree (Question 1),
- Hours of Study (Question 2),
- Sources of Information (Question 3),
- Discussion with Witness (Question 6), and
- Witnessing of Event (Question 7).

The "secondary variables" were taken to be the following:

- Opinion concerning UFO Problem (Question 4),
- Opinion of Relevant Fields (Question 5),
- Prior Probabilities of Possible Causes (Question 8),
- Desire for More Information (Question 9), and
- Desire to Contribute to Problem (Question 10).

The primary variables are certainly not independent of each other. For instance, when one studies the cross tabulation of highest degree (BS, MS, PhD or none) versus age (21-30, 31-40, 41-50, 51-60, and ≥ 61), one finds that there is an excess of BS and MS degrees and a deficit of PhD and no degrees in the 21-30 age bracket; there is also a deficit of BS and MS degrees and an excess of PhD degrees in the 31-40 age bracket. Otherwise the relationship is not remarkable.

Similarly, one may examine the distribution of respondents in hours of study for each age group. The result is shown in Table 3.1, and we find that there is only a weak trend, in the sense that older scientists tend to have read more, as may have been expected.

3.2 Comparison of Witnesses and Non-Witnesses

Of the 70 respondents (Group 1SY) replying "Yes" to Question 7, 8 in fact decided that they could identify their observations. These respondents have therefore been deleted from the list of "witnesses" to be discussed in this section. The remaining two identified observations given in Section IV came from a respondent who also had an unidentified observation to report. This re-

TABLE 3.1

Breakdown of each age group into range of hours of study (shown as percentages). Actual numbers given in parentheses.

Hours	21-30	31-40	41-50	51-60	261
≥ 1	5.2 (17)	7.2 (38)	6.2 (14)	4.7 (5)	3.6 (3)
2-7	31.1 (102)	37.4 (197)	36.7 (83)	29.0 (31)	30.1 (25)
8-50	49.7 (163)	43.6 (230)	44.7 (101)	46.7 (50)	50.6 (42)
51-365	13.1 (43)	9.1 (48)	11.5 (26)	16.8 (18)	7.2 (6)
> 365	0.9 (3)	2.7 (14)	0.9 (2)	2.8 (3)	8.4 (7)

dent is therefore kept in the list of "witnesses". This yields a list of 62 witnesses to compare with Group 1SN (1,250), referred to as "non-witnesses".

It is interesting to determine whether the classification of respondents into "non-witnesses" and "witnesses" is correlated with the other "primary" variables. On studying the distributions of the two groups in age, we find there is no significant difference. On studying the distribution according to whether or not they are observers, we obtain the results shown in Table 3.2. There are noticeably more night-sky observers among witnesses than among non-witnesses. On examining the distributions of the two groups according to degree and according to field of degree, we find that there is no significant difference between the groups.

When we compare the distributions of the two groups according to numbers of hours of study of the UFO problem, we obtain the results shown in Figure 3.1. In this case, the difference is significant: those who report witnessing an event tend to have spent more time studying the UFO problem. There are two possible interpretations: it is possible that a real event led to an increased interest in the subject; it is also possible that a preoccupation with the subject led the respondent to misinterpret a normal phenomenon as something unusual. It is not clear whether one can distinguish these two possibilities on the basis of the available data.

The results of an examination of the cross-tabulation of non-witness/witness versus source of information is rather complex and will be presented in two ways. For each group, we may examine the percentage of those who claim to use a given source. The results are given in Table 3.3. It is clear that witnesses

TABLE 3.2

Percentages of each group by category. "Night observers" may also observe sun. "Others" observe sun but not night sky.

	Non-Witnesses	Witnesses
Not Observers	35	16
Professional Night Observers	50	63
Amateur Night Observers	8	16
Other Observers	7	5

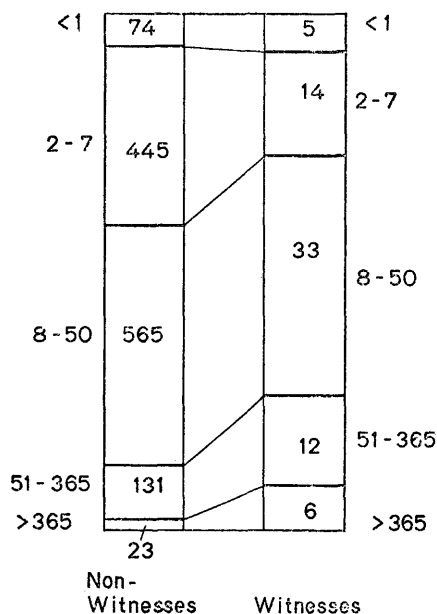


Fig. 3.1 Comparison of breakdowns of the two groups, non-witnesses and witnesses, according to number of hours of study of UFO problem.

tend to make more use of case material, first-hand investigations, and other sources.

One can also compare the two groups according to the percentages claiming a given source as their primary source of information, and the results are shown in Table 3.4. It is interesting to note that witnesses tend to rely less on newspapers and magazines, and more on publications by scientists, case material and first-hand investigations. Once again, this may be a consequence of a real experience, or a factor predisposing the respondent to imagining an experience.

It is interesting also to consider responses to Question 6 for these two groups. The results are shown in Table 3.5. We see that a significantly larger fraction of witnesses than of non-witnesses have discussed a UFO report with a person reporting a UFO event. When such discussion took place, there was

TABLE 3.3
Percentages of each group using each specified source of information.

	Non-Witnesses	Witnesses
Newspapers and magazines	79 (988)	77 (54)
Popular Books	45 (561)	54 (38)
Publications by Scientists	75 (932)	84 (59)
Case Material	17 (206)	29 (20)
First-hand Investigation	10 (129)	23 (16)
Other Sources	14 (172)	26 (18)

TABLE 3.4

	Non-Witnesses	Witnesses
Newspapers and Magazines	35 (441)	33 (23)
Popular Books	11 (140)	10 (7)
Publications by Scientists	40 (506)	49 (34)
Case Material	2 (29)	9 (6)
First-hand Investigation	1 (15)	4 (3)
Other Sources	6 (70)	4 (3)

only a 40% chance that the respondent would be satisfied, whether he was a non-witness or witness. There was a tendency, which is only marginally significant, for witnesses to be less successful in satisfying the person reporting than were non-witnesses.

3.3 Opinions in Relation to Other Variables

Question 4 of Q1 invites each respondent to state his opinion on whether the UFO problem deserves scientific study, the possible answers being "certainly", "probably", "possibly", "probably not", "certainly not". It is interesting to see how the replies depend on the so-called primary variables.

The dependence of opinion on age is shown schematically in Figure 3.2. This figure shows a strong trend: younger scientists tend to regard the problem as deserving study, and older scientists tend to regard it as undeserving of study.

The distribution of opinions according to degree are shown in Figure 3.3. We note that respondents with BS or MS degrees assign the problem more importance than do those with PhD degrees or no degree. Table 3.1 suggests that this trend is partly or totally a reflection of the age effect evident in Figure 3.2.

I have examined opinions on the UFO problem according to the field of degree, considering explicitly only astronomy/astrophysics, physical sciences and mathematics. In terms of this breakdown, the only obvious trend is that

TABLE 3.5

Percentages of each group indicated who have/have not discussed a UFO report with a credible witness.

	Non-Witnesses	Witnesses
Have not discussed case with (another) witness	67.7 (847)	42.9 (30)
Have discussed case with (another) witness	32.3 (404)	57.1 (40)
Neither Satisfied	39.4 (159)	55.0 (22)
Respondent Satisfied	2.5 (10)	7.5 (3)
Person Reporting Satisfied	20.5 (83)	5.0 (2)
Both Satisfied	37.6 (152)	32.5 (13)

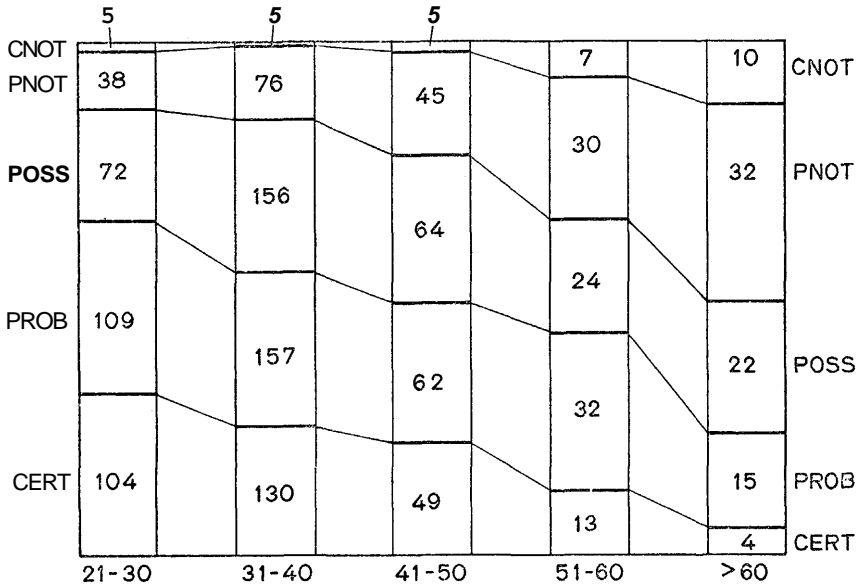


Fig. 3.2 Comparison of breakdowns of age groups according to opinion on whether UFO problem deserves scientific study:

- CNOT = Certainly not
- PNOT = Probably not
- POSS = Possibly
- PROB = Probably
- CERT = Certainly

mathematicians have a lower estimation of the importance of the subject than do astronomers, astrophysicists and physical scientists.

In cross-tabulating opinions with number of hours of study, a clear trend emerges, as shown in Figure 3.4. There is a strong correlation between studying the subject and regarding it as deserving of study. Once again, we cannot know from this chart alone whether the study is responsible for the opinions or the opinions are responsible for the study. One might suppose that this trend is really a reflection of amount of study as a function of age. For each age group, Table 3.1 gives the distribution according to hours of study; on combining this information with that of Figure 3.4, we may compute the expected opinions as a function of age, on the assumption that hours of study is the only link. This computation leads us to expect a trend opposite to that found: the amount of study is expected to make older scientists more sympathetic to the UFO problem, whereas in fact they are less sympathetic.

Figure 3.5 shows schematically the dependence of opinions on whether or not a given source of information is used. There is a strong correlation of a positive opinion on the subject with study of popular books and of scientific sources, and a weaker dependence on case study and first-hand investigation.

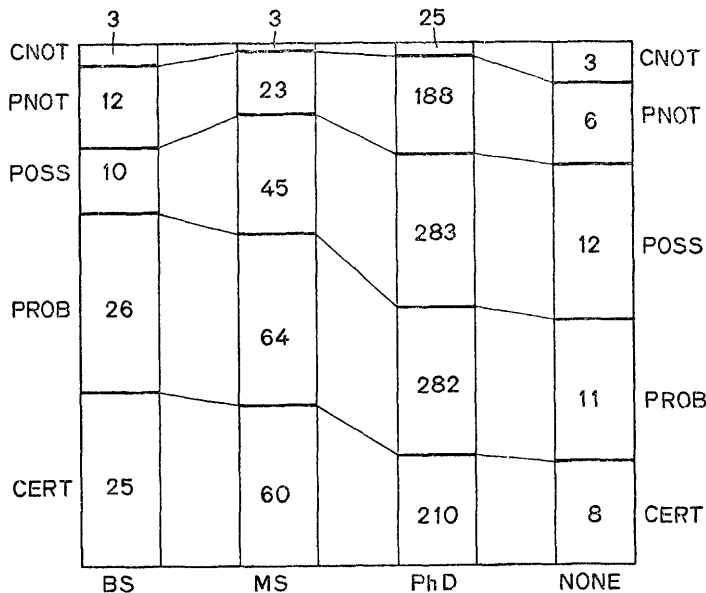


Fig. 3.3 For each degree category, breakdown according to opinion on whether the UFO problem deserves scientific study:

- CNOT = Certainly not
- PNOT = Probably not
- POSS = Possibly
- PROB = Probably
- CERT = Certainly

It is interesting to compare the opinions of non-witnesses and witnesses, and this comparison is shown schematically in Figure 3.6. We see that witnesses assign significantly more importance to the subject than do non-witnesses. We may again test the assumption that witnesses spend more time studying the subject and this is responsible for their more favorable opinions. By combining the information of Table 3.1 with that of Figure 3.4, we may compute the expected opinions of non-witnesses and of witnesses. This expectation is compared with the actual data in Table 3.6. We see that the opinions of witnesses are more strongly favorable than we would expect simply from knowledge of their hours of study; in fact, they are stronger than we obtain from the sample of non-witnesses who have spent over 365 hours in study of the UFO problem.

3.4 Prior Probabilities and their Dependence on Other Variables

In Question 8 of Q1, each respondent is asked to consider that he (or she) undertakes to study a case submitted by one of his colleagues and that, as a first step, he assigns a "prior probability" to each of a set of possible causes on the basis of his existing knowledge. The list of causes is as follows:

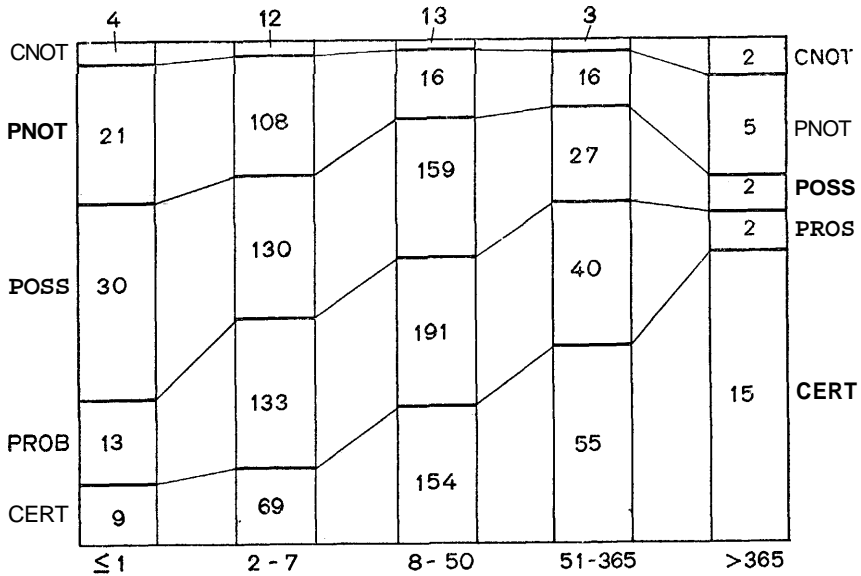


Fig. 3.4 For each group defined by numbers of hours of study, breakdown according to opinion on whether the UFO problem deserves scientific study.

CNOT = Certainly not
 PNOT = Probably not
 POSS = Possibly
 PROB = Probably
 CERT = Certainly

- a. Hoax,
- b. Some well established phenomenon or device,
- c. Some well established but unfamiliar natural phenomenon,
- d. Some unfamiliar terrestrial technological device,
- e. Some hitherto unknown natural phenomenon,
- f. A technological device not of terrestrial origin,
- g. Some other cause which you can specify, and
- h. Some other cause which you cannot specify.

There was a very wide variation in estimates of these probabilities, especially those assigned to e, f, g and h. However, the standard errors of the means are small enough to make discussion of averages meaningful. Some respondents gave the value zero to some of their assessments. According to the usual rules of scientific inference (Good, 1950), this means that they were absolutely certain that a particular cause was irrelevant and that no subsequent information could have changed their minds on that score. It is unlikely that the respondents really felt that strongly; it is more likely that, to many respondents, setting a probability as zero did not seem very different from setting it equal to,

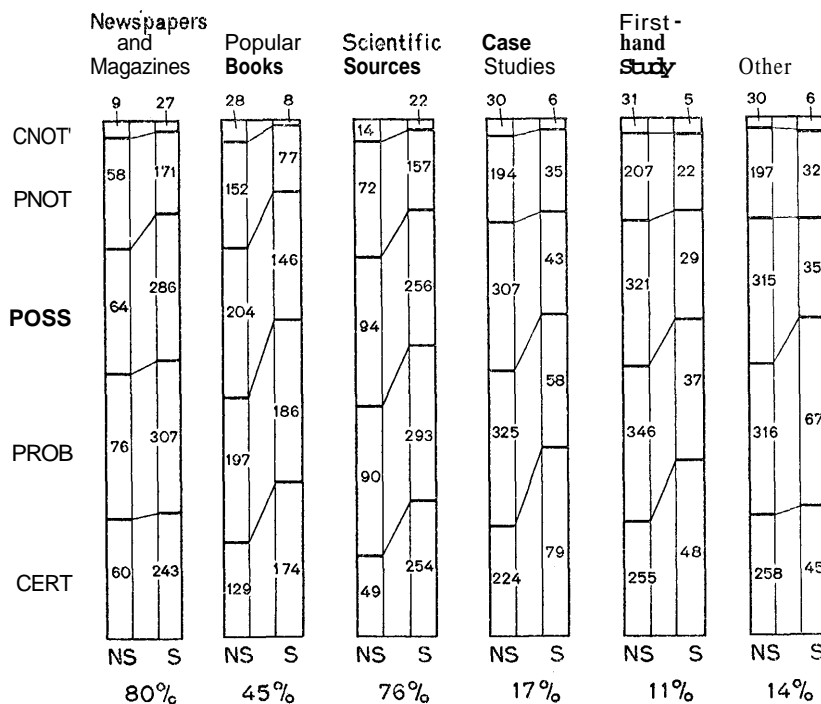


Fig. 3.5 For each information source category, breakdown by opinion on whether UFO problem deserves scientific study for respondents (NS) for whom it is not a source and respondents (S) for whom it is a source.

CNOT = Certainly not
 PNOT = Probably not
 POSS = Possibly
 PROB = Probably
 CERT = Certainly

The percentage of respondents using each source is shown (below S) at the foot of each column.

say, 10^{-10} whereas, according to the rules of scientific inference, the difference is profound.

Despite the difficulty just mentioned, it is possible to perform simple manipulations with the probabilities to search for any obvious trends. Figure 3.7 shows the average probability assigned to each possible cause as a function of age. We see that older scientists are somewhat less willing to entertain an exotic hypothesis, and somewhat more willing to entertain the hoax hypothesis, than are younger scientists, but the trend is not very pronounced.

There is no strong dependence of these prior probabilities on either degree or field of degree. However, there is some dependence on hours of study, as shown in Figure 3.8. Those who have studied the subject longest tend to give less weight to items (a) (hoax), (c) (unfamiliar natural phenomenon), and (d) (unfamiliar terrestrial technological device), but give more weight to the "ex-

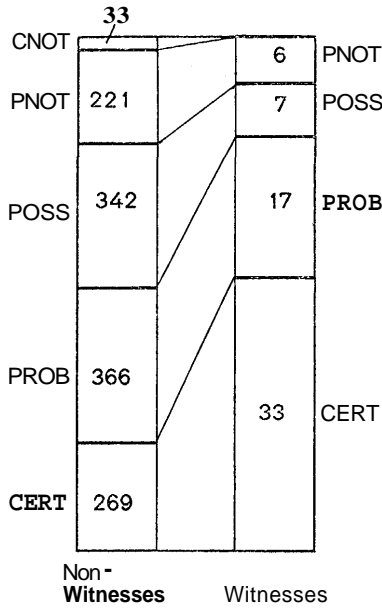


Fig. 3.6 Comparison of opinions of witnesses and non-witnesses on whether UFO problem deserves study.

- CNOT = Certainly not
- PNOT = Probably not
- POSS = Possibly
- PROB = Probably
- CERT = Certainly

otic” hypotheses (e) (hitherto unknown natural phenomenon), (f) (alien technological device), and (h) (unspecifiable other cause). This trend becomes apparent only for respondents who have spent more than 50 hours studying the problem.

The dependence of prior probabilities on information source is complex and will not be presented in detail. The probabilities which depend most sensitive-

TABLE 3.6

Comparison of actual opinions of non-witnesses and witnesses (shown as percentages giving each possible opinion) with expected opinion data (given in brackets), if opinions are determined primarily by hours of study.

	Non-Witnesses	Witnesses
Certainly	23.3 (21.9)	28.0 (53.2)
Probably	29.7 (29.7)	28.3 (27.2)
Possibly	27.2 (27.8)	25.2 (11.3)
Probably Not	17.5 (18.0)	14.5 (8.1)
Certainly Not	2.2 (2.7)	2.4 (0)

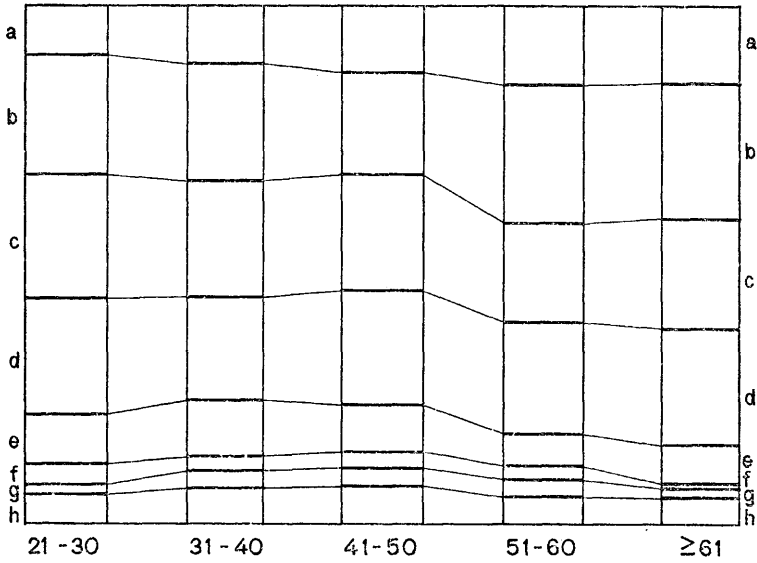


Fig. 3.7 Prior probabilities assigned to possible causes as a function of age. Probabilities sum to unity. (a), etc., defined in text; see Section 3.4.

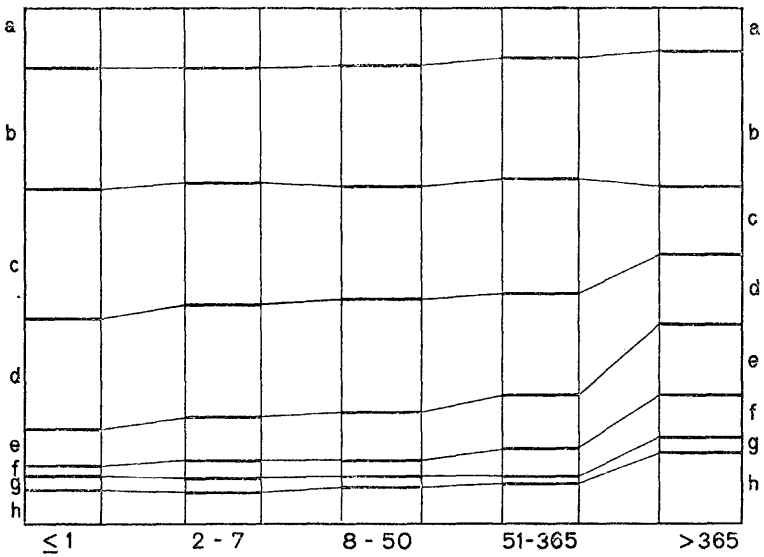


Fig. 3.8 Prior probabilities assigned to possible causes as a function of hours of study of UFO problem. Probabilities sum to unity. (a), etc., and defined in text; see Section 3.4. See also representation in Figure 3.9.

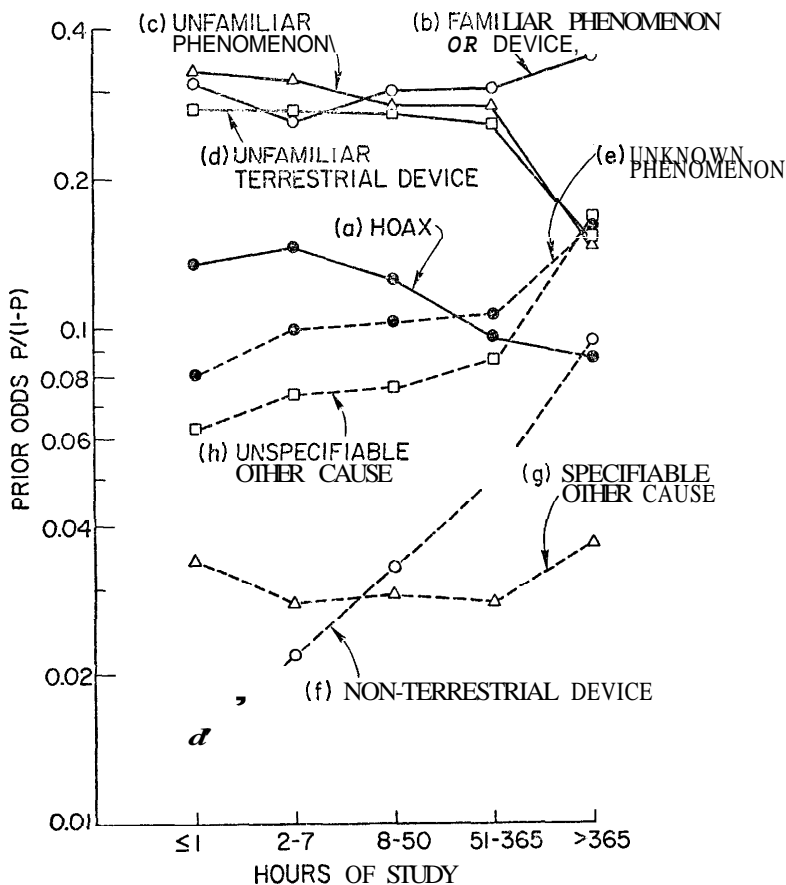


Fig. 3.9 Prior odds $[p/(1-p)]$, logarithmic scale] assigned to possible causes as a function of hours of study of UFO problem.

ly on various information sources are (f) (alien device), (c) (natural phenomenon), and (h) (unspecifiable other cause), listed in order of sensitivity. The sources of information which have most influence on the prior probabilities are, in order of importance, case studies, first-hand investigation, and popular books. The trend is always the same: if any source of information has any effect, it is to reduce the probabilities of "conventional" causes (a - d), and to increase the probabilities of "unconventional" causes (e - h).

It is also interesting to compare the distribution of prior probabilities proposed by non-witnesses and by witnesses. This comparison is made in Figure 3.10, from which we see that witnesses attach slightly more weight to the unconventional causes, especially (f) (alien device) and (h) (unspecifiable other cause), in comparison with non-witnesses.

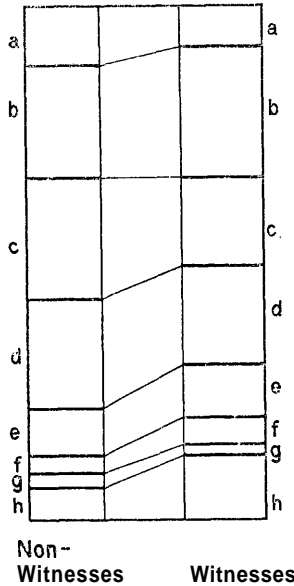


Fig. 3.10 Comparison of assignments by non-witnesses and by witnesses of prior probabilities. Probabilities sum to unity. (a), etc., defined in text, see Section 3.4.

3.5 Desire to Help

Question 10 of Q1 is the following: "If you could see a way to contribute to the resolution of the UFO problem, would you wish to do so? Yes () No (). If you checked 'Yes', do you see any such opportunity? Yes () No ()." The replies to this question from all respondents are summarized in Table 3.7. We see that the great majority of respondents would wish to help but, of these, the great majority see no way to do so. This is a striking result and it is interesting to explore this question further.

TABLE 3.7
Interest in contributing to resolution of UFO problem.

	Number of Respondents	Percentages of Those who Wish to Help	Percentages of all Respondents
Do Not Wish to Help	244		18.6%
Wish to Help but See No Way	930	87.1%	81.4%
Wish to Help and See Way	138	12.9%	

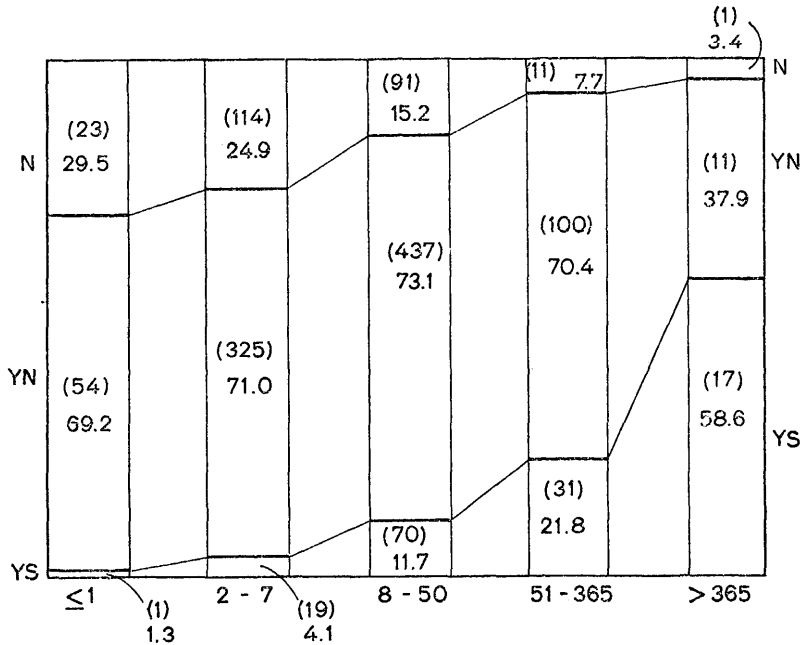


Fig. 3.11 For each group defined by number of hours of study, breakdown according to interest in contributing to resolution of UFO problem, and whether or not respondent can see opportunity to do so.

Actual numbers are shown in parentheses; numbers not in parentheses are percentages.

- N = Does not wish to contribute.
- YN = Wishes to contribute but does not see opportunity.
- YS = Wishes to contribute and sees opportunity.

In studying replies to this question by age group, we find that interest in contributing to the solution of the problem decreases with age, from a high of 88% in the 21-30 age bracket to a low of 65% in the 61 and older bracket. We also find that, for those wishing to help, the fraction of those who see a way to help decreases from about 15% in the youngest bracket to about 10% in the oldest bracket.

In comparing respondents with different degrees, we find that there is not a great deal of difference among those with BS, MS or PhD degrees. However, only 61% of respondents with no degree would wish to help.

When the fields of degrees are broken down into the three groups: astronomy/astrophysics, physical sciences and mathematics, the only notable feature is that, of those wishing to help, 15% of those with astronomy/astrophysics degrees see a way to do so, as against 8% for each of the other two fields.

When replies to Question 10 are broken down according to number of hours of study, a very strong trend emerges, as shown in Figure 3.11. Not only does the interest in contributing to the problem increase with hours of study, but the ability to propose ways to attack the problem increases rapidly with study.

TABLE 3.8
Opinion of fields relevant to study of UFO problem (1,307 replies).

Meteorology	82%	(1,069)
Psychology	76%	(997)
Astronomy/Astrophysics	69%	(906)
Physics	68%	(893)
Aeronautical Engineering	40%	(519)
Sociology	34%	(439)
Other	8%	(106)

When replies are broken down according to source of information, we find that about 88% of those using case studies or first-hand sources wish to contribute to the problem and that, of these two groups, about 27.5% can see a way to do so. The comparable numbers are 85% and 15% for those who use popular books or scientific sources, and 83% and 12% for those who derive their information from newspapers and magazines.

3.6 Other Topics

Question 5 of Q1 invites the respondent to give his views on the fields he believes to be relevant to the UFO problem. The results are shown in Table 3.8, where they are ranked in order. There is no significant difference between the evaluations made by non-witnesses and by witnesses except that, in the case of physics, a larger fraction of witnesses (81%) than of non-witnesses (67%) consider it relevant.

Question 9 of Q1 invites the respondent to state whether he would like to obtain more information about the UFO problem and, if so, the form in which he would prefer to receive his information. Seventy-five percent (75%) of respondents expressed a wish to obtain more information. The preferences of those who wished to obtain information are shown in Table 3.9. We see that almost all respondents wishing information would like to obtain it via scientific journals. Other possible sources receive only fragmentary support.

In June, 1977, a further letter (L4) and questionnaire (Q4), shown in the appendix, were sent to the group of "witnesses" who had responded "Yes" to question 7 of Q1. Each of these respondents was asked to check the account of his event; as a result of replies received, some changes were made. They were also invited to estimate certain probabilities, as described in L4. Of these, the probabilities P, represent a new assessment of the probabilities given in re-

TABLE 3.9
Of those respondents (987 or 75% of total) who wish to obtain information, this table shows the percentages who wish to obtain information in each of the forms specified.

Scientific Journals	92%	(908)
Review Lectures	32%	(310)
Books	31%	(302)
Symposia	26%	(259)
Other	8%	(79)

TABLE 3.10

For each of the cases indicated, this table shows the probabilities assigned by the witness to possible causes when the prior probabilities are assumed to be equal ($1/7$). For this presentation, (g) and (h) were combined into "some other cause". See letter L4 and questionnaire Q4 in the appendix.

	a	b	c	d	e	f	g + h
ID8	0.0001	0.5	0.4	0.0001	0.1	0.0001	0.0001
NL3	0.0001	0.2	0.5	0.05	0.2	0.1	0.01
NL4	10^{-5}	0.2	0.01	0.4	0.2	10^{-5}	0.19
NL9	0.03	0.05	0.1	0.7	0.03	0.01	0.08
NL12	0.01	0.133	0.061	0.663	0.061	0.01	0.061
NL13	0.0001	0.5	10^{-6}	0.5	10^{-6}	10^{-7}	0.01
NL15	10^{-5}	0.1	0.05	0.7	0.05	10^{-6}	0.1
NL16	10^{-10}	0.05	0.1	0.5	0.25	10^{-6}	0.1
NL17	0.036	0.107	0.25	0.179	0.179	0.179	0.071
NL18	0.0006	0.031	0.31	0.31	0.31	0.006	0.031
NL20	10^{-6}	10^{-6}	0.3	0.01	0.3	0.4	10^{-6}
NL26	0.014	0.056	0.417	0.069	0.097	0.069	0.278
NL27	0.06	0.06	0.06	0.06	0.03	0.06	0.63
NL29*	$10^{-100000}$	$10^{-100000}$	$10^{-100000}$	$10^{-100000}$	10^{-50}	0.9	0.1
DO3	$4.2 \cdot 10^{-11}$	0.083	0.417	0.083	$4.2 \cdot 10^{-6}$	$4.2 \cdot 10^{-11}$	0.417
DO10	.005	.04	.1	.05	.5	.09	.215
DO15	0.001	0.2	0.749	0.02	0.02	10^{-7}	0.01
PH3	0.01	0.01	0.01	0.01	0.01	10^{-8}	0.95
PH6	$6.4 \cdot 10^{-8}$	0.58	0.258	0.032	0.00064	$6.4 \cdot 10^{-7}$	0.129
RA1	10^{-100}	10^{-10}	10^{-10}	10^{-10}	0.4	0.4	0.2
RA2	10^{-4}	10^{-4}	0.01	0.98	0.01	10^{-22}	10^{-4}
RA3	10^{-4}	10^{-4}	10^{-4}	0.01	0.96	10^{-22}	0.03
TR1	10^{-9}	0.9	0.04	0.05	0.01	0.01	10^{-4}
IN4	0.5	0.2	0.009	0.05	0.001	0.05	0.19

*As provided by respondent.

sponse to question 8 of Q1. Since the number of respondents replying to Q4 is much smaller than the number responding to Q1, these data are not presented in this report. The instructions given concerning P' turned out to be insufficiently precise, so that many of the returns showed misunderstanding of the intent of the question; for this reason, these data are not reported.

The estimates P_2 are more interesting, since they give assessments of the significance of the events reported, and the results are presented as Table 3.10. For each event, identified by the code used in Section 4, estimates of probabilities of possible causes are given as responses which the respondent gives when asking himself the following question: "Suppose that I began by being completely open-minded on this issue, perhaps because I had no prior relevant information whatever, and hence began with the values (prior probabilities) $P_0(a) = \dots = P_0(g) = 1/7$. If I were to consider this particular event, how would

TABLE 3.11

Comparison of averages of prior probabilities and post probabilities given by 44 "witnesses"

	Priors	Posts
(a) Hoax	.08	.04
(b) Familiar Phenomenon or Device	.23	.23
(c) Unfamiliar Natural Phenomenon	.18	.13
(d) Unfamiliar Terrestrial Device	.22	.28
(e) Unknown Natural Phenomenon	.09	.05
(f) Alien Device	.05	.05
(g) Specifiable Other Cause	.03	.08
(h) Unspecifiable Other Cause	.12	.14

this event alone influence these probabilities?" Note that item (g) in Q4 is "some other cause" and is therefore equivalent to the "sum" of items (g) and (h) as they appeared in Q1.

3.7 Comparison of Prior Probabilities and Post Probabilities

Respondents who checked "Yes" to Question 7 of Q1 were sent a second form Q2. Question 47 of Q2 reads as follows: "In order to summarize your assessment of the event in a manner which can be compared with members' 'informed prejudices', please assign 'post probabilities' to the following set of possible causes (a) Hoax, etc." It is therefore interesting to compare the post probabilities obtained in this way with the prior probabilities given by the same respondents. Only 44 respondents made estimates of both sets of probabilities. The results are given in Table 3.11. On computing the standard errors of the means, we find that all estimates differ significantly from zero except the post probability for (a) (hoax). The differences between the priors and the posts are found to be not significant.

The only change, in going from the priors to the posts, seems to be that each respondent becomes slightly more definite about possible causes. This shows up by estimating the "entropy"

$$E = \frac{1}{\ln 8} \sum_{i=1}^8 P_i \ln P_i \quad (3.1)$$

of each set of probability assignments. $E = 0$ if the respondent is quite definite about what he saw so that $P = 1$ for one cause and $P = 0$ for the rest, and $E = 1$ if he is completely open-minded and assigns equal probabilities to the set of possible causes. We obtain the average values

$$\bar{E}(\text{prior}) = 0.64, \quad \bar{E}(\text{post}) = 0.43.$$

This difference is statistically significant, but the change hardly represents a dramatic and manifest revelation.

Appendices

L1. First Letter

Letter mailed to all members of the AAS on April 25, 1975.



INSTITUTE FOR PLASMA RESEARCH
STANFORD UNIVERSITY
VIA CRESPI, STANFORD, CALIFORNIA 94305

April 25, 1975

Dear AAS Member:

Since 1946, newspapers have carried occasional--sometimes frequent--reports of people seeing strange things moving in the sky. These reports of "unidentified flying objects" have suggested, to many people, that there are strange but real objects, termed "UFOs", moving around in our skies. On the other hand, many people believe there is no worthwhile evidence for such a conjecture and dismiss it.

Most reports of this type come from people who have no scientific training and no knowledge of astronomy. For this reason, I have been interested in trying to determine whether a group of scientists would, if asked, volunteer reports similar to those advanced by non-scientists. I made a trial run of such a survey in 1973, sending questionnaires to 1100 members of the San Francisco Chapter of the American Institute of Astronautics and Astronautics. Results of this survey were published in *Astronautics and Aeronautics*, 12, 60, 1974.

I am now of the opinion that it would be most valuable to survey a group of astronomers. If a sufficiently large group of astronomers offer no reports of the UFO type, this would strengthen the view that such reports are misperceptions of known objects and phenomena. If, on the other hand, a group of astronomers submit a number of reports fitting, for instance, the categories described by Professor J.A. Hynek (The **UFO Experience**, Henry Regnery Co., Chicago, 1972), this would strengthen the view that there is a real phenomenon which a trained observer can distinguish from known natural objects and events.

One of the peculiarities of the UFO problem is that its scientific status is itself a matter of somewhat emotional debate. Some scientists (such as Dr. Hynek and the UFO Subcommittee of the AIAA) express the view that the problem demands serious investigation, whereas others (such as Professor Donald **Menzel** and the late Professor E.U. **Condon**) have argued that such a study would be a waste of time and money.

For these reasons, the enclosed questionnaire has two aims. The first is to determine the opinions of **AAS** members on this difficult problem. The second is to find out if any AAS members can report any events which they could not identify and which may be related to the UFO phenomenon. Each member is respectfully urged to complete this questionnaire, whether or not he has an observation to report. I shall attempt to make the results of the survey available to every interested member of the AAS.

Thank you for your cooperation.

Sincerely yours,

P.A. Sturrock
Professor of Space Science
and Astrophysics

PAS:cg
Attachment

Q1. First Questionnaire

Questionnaire accompanying L1.

UFO QUESTIONNAIRE

1.
 - a. Are you an observer? Yes () No ()
 - b. If your answer is "yes", are you amateur () or professional ()?
 - c. Do you observe the night sky? Yes () No ()
Do you observe the sun? Yes () No ()
 - d. What is your highest degree? BS () MS () PM ()
 - e. What is the field of your highest degree? _____

2. What is your estimate of the total number of hours you have spent reading or otherwise informing yourself about the UFO problem? (Check one.)
 - a. ≤ 1 ()
 - b. 2 - 7 ()
 - c. 8 - 50 ()
 - d. 51 - 365 ()
 - e. > 365 ()

3. Please indicate your sources of information, entering "1" for your primary source, "2" for the next most important source, etc.
 - a. Newspapers and popular magazines ()
 - b. Popular books ()
 - c. Books and articles by established scientists ()
 - d. Study of case material ()
 - e. First-hand investigation ()
 - f. Other: _____ ()

4. Do you think that the UFO problem (Check one.)
 - a. Certainly deserves scientific study ()
 - b. Probably deserves scientific study ()
 - c. Possibly deserves scientific study ()
 - d. Probably does not deserve scientific study ()
 - e. Certainly does not deserve scientific study ()

5. If the UFO problem is subjected by scientific study, which of the following fields do you expect to be relevant? (Check any number.)
 - a. Aeronautical Engineering ()
 - b. Astronomy/Astrophysics ()
 - c. Meteorology ()
 - d. Physics ()
 - e. Psychology ()
 - f. Sociology ()
 - g. Other: _____ ()

6. Have you ever discussed a UFO report with a credible witness? Yes () No ()
If you checked "yes", were you able to explain the report
 - a. to your satisfaction? Yes () No ()
 - b. to the witness's satisfaction? Yes () No ()

7. Have you yourself witnessed or obtained an instrumental record of any event which you could not identify and which may be related to the UFO phenomenon?
Yes () No ()
If your answer is "yes", you will receive a second questionnaire, but please enclose with this form a narrative account of the episode.
Did you report the event? Yes () No ()
If so, to which organization? _____

8. As a way of expressing your informed prejudices on this subject, please consider the following hypothetical situation:—Some of your colleagues in the AAS submit UFO reports in response to question 7. You are invited and agree to investigate one of these cases and express your conclusions by assigning a subjective probability to each of the possible causes listed below. It is desirable that, before you study the case, you first assign a "prior probability" to each of these causes on the basis of your present knowledge. Please assign priors to the following set, noting the requirement $\sum P = 1$.
- | | |
|--|-----|
| a. Hoax | P = |
| b. Some well established phenomenon or device | P = |
| c. Some established but unfamiliar natural phenomenon
(such as ball lightning) | P = |
| d. Some unfamiliar terrestrial technological device
(such as a weather balloon) | P = |
| e. Some hitherto unknown natural phenomenon | P = |
| f. A technological device not of terrestrial origin | P = |
| g. Some other cause which you can specify: | P = |
| _____ | P = |
| h. Some other cause which you cannot specify | P = |
9. Would you like to obtain more information about the UFO problem? Yes () No ()
If you checked "yes", in what form would you prefer to receive this information?
(Check one or more.)
- | | |
|--|-----|
| a. Review and research articles in scientific journals | () |
| b. Books | () |
| c. Review lectures | () |
| d. Symposia | () |
| e. Other (please specify) _____ | () |
| _____ | |
10. If you could see a way to contribute to the resolution of the UFO problem, would you wish to do so? Yes () No ()
If you checked "yes", do you see any such opportunity? Yes () No ()
If so, please specify briefly: _____
11. Do you wish to be informed of the results of this survey? Yes () No ()
12. Please note here any additional comments you wish to make.

13. The following information is requested but will not be divulged.

Name _____ Age _____

Position and Affiliation _____

Mailing Address _____

L2. Second Letter
Letter mailed to all respondents to Q1 who checked answer "Yes" to Question 7.



INSTITUTE FOR PLASMA RESEARCH
STANFORD UNIVERSITY
VIA CRESPI, STANFORD, CALIFORNIA 94305

June 1975

Dear

Thank you for taking the time to fill in the UFO questionnaire. There has been a very good response. To date, I have received over 1,300 replies. There were fewer rude remarks and more encouraging remarks than I had anticipated.

About 5% of those responding checked "yes" to item 7. You were one of these respondents. Most, but not all, sent with their questionnaire a narrative account of the episode.

As promised in the questionnaire, I am now mailing out a second form to those who had an episode to report. With very slight modifications, the form I am using is that which was drawn up by Professor Condon's team at the University of Colorado. Although you probably covered a number of these questions in your original narrative account, it would be most helpful if you would nevertheless repeat the information as you complete this second form.

Do not bother to repeat your narrative account if you have already covered this fully in your first return, but please give an expanded narrative on this form if your first description was only a few lines.

Let me repeat that this information is being requested in confidence. I shall not divulge the identity of any respondent (unless he specifically and voluntarily authorizes me to do so, as some have done).

There is one rather delicate item at the end of the questionnaire to which I must draw your attention. I was surprised that almost all respondents entertain the possibility that a report of a possibly UFO-related event from an AAS member may in fact be a hoax of which the member may be the victim but may possibly be the perpetrator. Since it is clearly desirable to screen out reports of which members are the perpetrators, I ask you to attach your signature to this form to testify that your account is submitted in good faith. I apologize for this request and hope that no member feels insulted.

Thank you once again for your cooperation with this inquiry. I hope to receive the completed questionnaire shortly.

Sincerely yours,

P.A. Sturrock
Professor of Space Science
and Astrophysics

PAS:cg
enc.

Q2. Second Questionnaire
Questionnaire accompanying L2.

PLEASE PRINT CLEARLY

Location of Sighting: _____ Date of Sighting: _____
Name of Observer: _____

UFO SIGHTING FORM

[as devised and used by University of Colorado UFO Project]

Please return to:

P. A. Sturrock
Institute for Plasma Research
Via Crespi
Stanford University
Stanford, California 94305

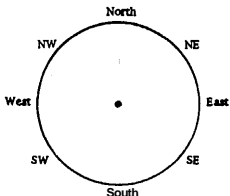
I. PERSONAL ACCOUNT

In your own words, Please describe the incident as it happened. (If additional pages are needed, they are numbered.)

Note to observer: In filling out this form, please be as complete and accurate as possible. Some of the information asked for may not apply to your sighting or may be unavailable to you. In such cases, please indicate.

II. ENVIRONMENTAL SITUATION

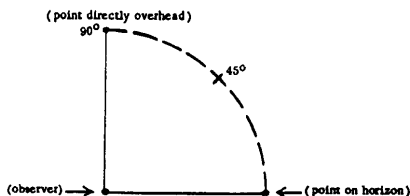
1. What was your exact location when you observed the UFO(s)? (Include the name of the city or town you were in, or the distance to the nearest city or town.)
2. What was the date? _____
3. How long did you observe the object(s)? Hours: _____ Minutes: _____ Seconds: _____
 From _____ A.M. _____ P.M. _____ ZONE (When FIRST seen)
 To _____ A.M. _____ P.M. _____ ZONE (When LAST seen)
4. Assuming you had stayed in one place, what is the longest time you COULD HAVE OBSERVED the UFO(s)?
 Hours: _____ Minutes: _____ Seconds: _____
5. How did you first happen to notice the object(s)?
6. What had you just been doing?
7. A. In what direction did you FIRST see the Object(s)? (Indicate this in the diagram by drawing an arrow from the center of the circle (observer's position) to the point on edge representing the object's position. Label this point No. 1.
 B. In what direction did you LAST see the object(s)? (Indicate by drawing a second arrow labeled No. 2.)



8. Estimate the MINIMUM distance and altitude of the object(s) from you and how you determined this measurement.

- a. distance: _____ b. altitude: _____

9. Estimate the elevation (in degrees) of the object(s) in the sky. Mark position on the dotted line in the diagram. If elevation of object changed, please mark BOTH highest position and lowest position.



10. Did you observe the **object(s)** through any of the following? (Circle) Include information on type of equipment: model, type of film, filters, etc. (See question number 45.)

- | | |
|-----------------|-----------------|
| a. eyeglasses | f. binoculars |
| b. sunglasses | g. telescope |
| c. windshield | h. theodolite |
| d. windowpane | i. still camera |
| e. movie camera | j. other |

11. Was **object(s)** observed by radar? _____ If **so**, where was the radar located? (Give **name(s)** of radar operator(s) and information on speed and flight **path(s)**, if available.)

12. Please describe weather conditions and type of sky; i.e. bright daylight, nighttime, dusk, etc. Were stars or moon visible?

13. Was there any wind? _____ If **so**, please give direction and speed as accurately as you can.

14. What was the position of the sun **and/or** the moon in relation to **object(s)** and to you? (Please explain.)

15. Briefly describe the type of terrain in the area.

16. Did you see any conventional aircraft in the area immediately before, during, or after the incident?

17. Please list any airport, military, governmental, or research **installation(s)** in the area. Are there any other unique features or landmarks (either natural or **manmade**) in the vicinity? _____ If **so**, please describe.

18. Sketch or include a map of the area, labeling north, your position, the apparent course or **position(s)** of **object(s)** and any other important landmarks. (Please use separate piece of paper for sketch and attach to this report.)

DESCRIPTION OF OBJECT(S)

19. Were you able to see the **object(s)** clearly? Please describe any limiting factors.

20. Did you see more than one **object**? _____ If **so**, how many? _____ Make a sketch showing formation and position changes.

21. Did the **objects** all appear to be similar to one another? _____ If not, describe the differences in question #22.

22. Please give a detailed description of the **object(s)**, including shape, color, lights, surface features (if any), etc. Sketch the **object(s)** in detail according to your description.

23. If only lights were seen, did they seem to maintain fixed positions relative to one another? In other words, could they have been attached to a solid object? Please explain.

24. Did object(s) leave any physical evidence of its presence (i.e. burns, radioactivity, disturbed ground, wreckage, other)? Please describe.

Were any samples taken? Yes No
 By Whom? _____ Where to? _____
 Was any analysis done? Yes No By Whom? _____
 Please summarize results if known. If report is available, please attach copy.

25. Did object(s) make any sound? _____ If so, what kind?

26. Did object(s) produce heat? _____ If so, please explain.

27. Did object(s) produce an odor? _____ If so, please describe it.

28. Did object(s) appear to be solid or gaseous?

29. Was object(s): (circle one) a. fuzzy or blurred?
 b. like a bright star? c. sharply outlined

30. How would you describe the brightness of the object(s)? (Circle one)
 a. brighter than the sun?
 b. brighter than the moon?
 c. brighter than any star (or planet)?
 d. brighter than the background?
 e. same brightness as the background?
 f. darker than the background?
 g. other (explain)?

31. Was the object(s): (circle one)
 a. self-luminous? b. dull finish? c. reflecting?
 d. transparent?

32. (Circle the items which apply and DESCRIBE as clearly as you can.) Did the object(s):
 a. appear to rotate (as a whole or in part)? f. leave any visible trail?
 b. change shape? g. drop anything?
 c. change color? h. separate into parts or explode?
 d. change brightness? i. disappear and reappear?
 e. give off smoke or vapor? j. appear to affect any animals?

33. Did the object(s) appear to affect any mechanical or electrical devices (i.e. automobile engine, headlights, radio, T.V., appliances, clocks, watches, etc.)? _____ If so, please explain in detail. (include make, model, transmission type if automobile, etc.)

34. Can you describe the interior of the object(s) in any way?

35. Do you have any reason to believe the object(s) was occupied? If so, please explain

36. Was the APPARENT size of the object(s) compared with the following familiar objects? (Note: The moon is the same size as a pencil eraser (1/4") held at arms length) Please check the appropriate boxes.

THE OBJECT WAS

smaller	same size	larger	familiar objects
			than a. faint star
			than b. bright star
			than c. object half as large as moon
			than d. the moon
			than e. dime at arm's length
			than f. nickel at arm's length
			than g. quarter at arm's length
			than h. half-dollar at arm's length
			than i. an orange at arm's length
			than j. other object at arm's length: PLEASE SPECIFY ()

37. What would you estimate the ACTUAL size of the object(s) to be (measured in feet along its greatest dimension)?

III. MOVEMENT OF OBJECT(S)

38. In what direction was the object(s) traveling? _____

39. Describe the movement of the object(s), including the path(s) and nature of motion (i.e. steady, wobbling, waving, jerky, etc.) Did it (they) move significantly with respect to background of stars or landscape? Sketch path(s) showing orientation of object(s) in sky.

40. Did object pass in front of or behind any fixed physical objects such as trees, clouds, mountains, buildings, etc. Describe any notable relationships to such object(s) if observed.

41. Can you estimate the speed of the object(s) _____ How was this determined?

42. Did the object(s) disappear while you were watching? _____
If so, how? _____

43. Please give names and addresses of other witnesses, if any. Indicate relationship of witnesses to you, if it exists, and whether their sightings occurred before, during or after yours.

44. Have you seen other objects of an unidentified nature? _____ If so, use separate forms or attached pages to describe these sightings.

45. Please enclose photographs, motion pictures, news clippings, notes of radio or television programs (include time, station and date, if possible) regarding this or similar observations or any other background material. IF PHOTOGRAPHS OR MOTION PICTURES ARE ENCLOSED, BE SURE TO INCLUDE ALL INFORMATION ON CAMERA TYPE, FILM TYPE, FILTERS, CAMERA SETTINGS, WHERE DEVELOPED, ETC. ORIGINAL NEGATIVES ARE NECESSARY FOR PHOTOGRAPHIC ANALYSIS. If you wish to have items returned to you, please indicate.

46. Have any other groups or individuals interviewed you? If so, please give names and date of interview.

47. (added by PAS)

In order to summarize your assessment of the event in a manner which can be compared with members' "informed prejudices", please assign "post probabilities" to the following set of possible causes. Please note once again the requirement that $\Sigma P = 1$.

- | | |
|---|-----|
| a. Hoax | P = |
| b. Some well established phenomenon or device | P = |
| c. Some established but unfamiliar natural phenomenon (such as ball lightning) | P = |
| d. Some unfamiliar terrestrial technological device (such as a weather balloon) | P = |
| e. Some hitherto unknown natural phenomenon | P = |
| f. A technological device not of terrestrial origin | P = |
| g. Some other cause which you can specify: _____ | P = |
| h. Some other cause which you cannot specify | P = |

Please give the following information:

Name Telephone - Home _____
 Address Business _____

Please attach your signature to this report to testify that this account has been submitted in good faith.

Signature _____ Date _____

L3. Third Letter

Letter mailed in July 1975 to 100 randomly chosen members who had not returned Q1.



INSTITUTE FOR PLASMA RESEARCH
STANFORD UNIVERSITY
VIA CRESPI, STANFORD, CALIFORNIA 94305

July 1975

Dear AAS Member:

In April of this year, I undertook a survey of the membership of the American Astronomical Society concerning the UFO problem. Of the 2,600 questionnaires which we believed to have been mailed out, 1,322 have been completed and returned.

In order to assess a survey of this type, it is important to know whether there is a relevant selection mechanism determining which members return questionnaires. I know that some members simply did not receive their copies. It is likely that others misplaced them or for various irrelevant reasons failed to return them. However, it is also possible that some members had a negative reaction to the survey, or the topic of the survey, and for this reason chose not to complete and return the form.

The only way that I can see to obtain information about these significant questions is to send out a short follow-up questionnaire to a randomly selected small number of members from whom I have not received the first questionnaire. For this reason, I enclose a comparatively simple follow-up sheet and a stamped, addressed envelope. It would be most helpful if you would kindly take a minute to complete the sheet and put it in the mail.

Please note that if your failure to return the original questionnaire was unintentional, you are invited to complete it at this time, and an extra copy is enclosed. If you do this, please enclose both the April and July questionnaires in the enclosed envelope. If, on the other hand, your failure to return the form was intentional, please do not complete and return the April questionnaire at this stage.

In the event that you have strong negative feelings about surveys in general, or this survey in particular, I apologize for further encroaching on your time. However, you may be interested to know that, of the 51% of your colleagues who have already cooperated with the survey, a significant fraction volunteer the view that the survey is a good idea.

Thank you for your time and cooperation.

Sincerely yours,

P. A. Sturrock
Professor of Space Science
and Astrophysics

PAS:cg
enclosures

Q3. Third Questionnaire
Questionnaire accompanying L3

July 1975

To :
From : P.A. Sturrock, Stanford University
Subject: UFO Survey, Follow-up Sample

Please check your replies to the following questions:

Did you receive the questionnaire mailed in April? Yes () No ()

If you did not, you are invited to complete and return the enclosed copy.

Did you mail back the questionnaire? Yes () No ()

If so, on what date? _____

If you did not return the questionnaire, was this unintentional ()
or intentional? ()

If it was unintentional, you are invited to complete and return the enclosed copy.

If it was intentional, do not now complete the questionnaire, but please check one of the following to provide a simple index of your opinions:

The UFO problem certainly deserves scientific study ()
The UFO problem probably deserves scientific study ()
The UFO problem possibly deserves scientific study ()
The UFO problem probably does not deserve scientific study ()
The UFO problem certainly does not deserve scientific study ()

Additional comments:

L4. Fourth Letter

Further letter mailed to all respondents to Q1 who checked answer "Yes" to Question 7.

INSTITUTE FOR PLASMA RESEARCH
STANFORD UNIVERSITY
VIA CRESPI, STANFORD, CALIFORNIA 94305



June 1977

Dear Colleague,

Thank you for your cooperation in completing returns for the UFO Survey. As you will note from the enclosed report, I have incorporated an account of your event in Section IV (). I have attempted to follow your account as closely as possible, while rewriting it in narrative form for easy reading. I should be obliged if you would check over my transcription of your account and let me know if my account needs modification or amplification in any way.

You will remember that, in the first questionnaire reproduced on pages 186 and 187, I incorporated a question (question 8) aimed at obtaining numerical estimates of each respondent's prejudice concerning the phenomenon. The second questionnaire, reproduced on pages 189-194, incorporated a corresponding question (question 47) to **determine** a similar assessment of each reported event. Unfortunately, these questions were not expressed sufficiently clearly for the purposes I had in mind. I did not explain that I intended to use the information, according to Bayesian principles, for the crucial step of distinguishing between initial prejudice and new information derived from a particular event. In order to give you a detailed background of the formalism and rules which I am adopting, I enclose a reprint of an article entitled *"Evaluation of Astrophysical Hypotheses", which is based upon Bayesian probability theory.

The first point which I should have emphasized is that one must be very cautious about setting $P = 0$ or $P = 1$ as a probability of any statement since; if one makes such a choice, one can never depart from that choice, no matter what information subsequently becomes available. That is, one's mind is completely made up for all time. This means that there is an enormous difference between setting $P = 10^{-5}$ or 10^{-10} or 10^{-15} , on one hand, and setting $P = 0$, on the other hand.

The second point concerns the representation of a new piece of evidence (such as an experienced event) in terms of probabilities. One way to do this (which is the way I previously adopted) is to ask for

*Astrophysical Journal, 182, 569-580 (1973).

-2-

probabilities before the information is received, ask for probabilities after the information is received, and compare the two. However, in the case of the questionnaires, respondents had already made their observations when they completed question no. 1. Furthermore, they had probably forgotten their probability estimates, given in Q1, when they came to give corresponding estimates in Q2.

For these reasons, I consider that the original procedure was not well planned. I consider that the following scheme is preferable.

- A) Combine items g and h into a new item g "some other cause". This may be either specifiable or unspecifiable, it does not now matter which.
- B) Agree that we all start in a hypothetical state of being completely open-minded (before we even review our prejudices!), so that the "priors" are

$$P_0(a) = \dots = P_0(g) = 1/7$$

- C) Each respondent now reflects on all the relevant information at his disposal (Fact 1) except his own personal observation. He lumps all this information together as "Fact 1" and then, on the basis of all this information, he assigns new probabilities

$$P_1(a), \dots, P_1(g) .$$

These should sum to unity* and, for the reasons given before, it is unwise to give the value zero to any of these probabilities.

- D) The respondent now ignores all his prior information and thinks only of the particular event (Fact 2) which he witnessed and reported. He then asks himself the following question: "Suppose that I began by being completely open-minded on this issue, perhaps because I had no prior relevant information whatever, and hence began with the values $P_0(a) = \dots = P_0(g) = 1/7$. If I now were to consider this particular event, how would this event alone influence these probabilities?". Having reflected upon this question, he ends up with a set of probabilities

$$P_2(a), \dots, P_2(g),$$

which represent, in summary form, the strength of the "evidence" provided by that particular event. Once again, it is desirable that none of these values should be zero, although they may be as small as seems appropriate, and they should sum to unity*. One may now obtain the "post" probabilities, representing the combined influence

* It meets our needs if you give relative weights which we can normalize to unity.

-3-

of prejudice and evidence, by multiplying the probabilities to form

$$P_1(a) P_2(a), P_1(b) P_2(b), \text{ etc.}$$

and then normalizing to unity.

- F) In the preceding exercise, $P(a)$ was the probability that a particular event, which you were called upon to investigate, was due to cause (a). Another important question is the following: "What is the probability that some UFO reports (made by any people anywhere in the world) are due to cause (a). We may denote this by $P'(a)$. It would be illuminating to have your estimates of these quantities, based on your "prejudices", that is, based on all relevant information except your own experience. (There is no reason why these probabilities, summed over causes, should sum to unity.)

It would be very helpful to me if you would kindly estimate these three sets of probabilities on the enclosed sheet and return it to me in the enclosed envelope.

Thank you for your past cooperation and thank you in advance for your present help.

Sincerely yours,

P.A. Sturrock
Professor of Space Science
and Astrophysics

PAS:bb

Encl. 2

Q4. Fourth Questionnaire
Questionnaire accompanying L4.

SURVEY OF THE MEMBERSHIP OF THE AMERICAN
ASTRONOMICAL SOCIETY CONCERNING THE UFO PROBLEM

Follow-up Questionnaire, June 1977

Please enter your estimate of $P_1(a)$, etc., as requested in the accompanying letter, and return to P.A. Sturrock, Institute for Plasma Research, Stanford University, Stanford, California 94305. A return envelope is provided.

	$P_1(a)$, etc.*	$P_2(a)$, etc.*	$P'(a)$, etc.†
a. Hoax			
b. Some well established phenomenon or device			
c. Some established but unfamiliar natural phenomenon (such as ball lightning).			
d. Some unfamiliar terrestrial technological device (such as a weather balloon)			
e. Some hitherto unknown natural phenomenon			
f. A technological device not of terrestrial origin			
g. Some other cause			

* Please give relative weights, which will then be normalized to sum to unity.

† Each value is independent of other values. The sum need not be unity.

Name _____

Signature,
please _____

Date _____

Sample of Comments from Group IS (those who returned Q1 and signed their names).

Appendix C. Sample of Comments from Group IS

C1. I object to being quizzed about this obvious nonsense. Unidentified = unobserved or factually unrecorded: modern mythology. Too much respectability given to it.

C2. This seems to be the age of "screwball" science — or rather pseudo-science.

C3. I think the whole subject is a bore, and that serious scientists should not become involved in it unless they have nothing better to do. I think the problem is less a Physics problem than a sociological/psychological one and newspapers and sensation-seekers have a vested interest in keeping it going.

C4. ... I have been an ardent amateur observer over the years and have generally had several friends observing with me From about 1928 to the 1960's we have watched the sky for literally 1,000's of hours and none of our group has ever witnessed anything not normally explicable.

C5. Question 8 is not easy to answer. I would assume most observational astronomers could distinguish between a star, planet, aircraft, meteor, weather balloon, etc. and a UFO. So this would not leave many familiar phenomena or devices which could be the cause of a UFO, if an astronomer sighted one.

C6. 1) Having talked to some (non-AAS) "experts" in the UFO field, I am convinced that 99.9% of them are crackpots, psychopaths or otherwise unreliable characters. 2) Any organization being set up by the AAS to investigate UFOs will undoubtedly ask the Government (i.e. the taxpayer) for funding. It would seem to me that funds could be used to better advantage in astronomy. Besides, the probability is very high that you end up with just one more unnecessary empire building agency, staffed by people who can't make it on their own in science, and will hang on for dear life.

C7. There seem to be too many extremely peculiar reports by reliable witnesses for this subject to be lightly dismissed. I think that any scientist who is seriously interested in studying this topic, should be encouraged to do so, although he should be aware that such research stands a fairly high risk of being unproductive.

C8. I have spoken to a number of people who claim to have sighted things which could be accounted for by (the extra-terrestrial-probe) hypothesis. Most such observers never made any "official" report. I feel that the ratio of unre-

ported to reported sightings is high. I feel that there is a residue of high-strangeness, high-reliability sightings

C9. ... My group and I personally pay considerable attention to professional sky observing. While we observe many things we cannot explain at the time, I do not believe that in the last thirty years we have seen anything that would strengthen the case for the existence of extra-terrestrial technological devices I believe that directed research programs should be pushed in all disciplines and that the investigators should keep an "open mind" insofar as is practical.

C10. I find it tough to make a living as an astronomer these days. It would be professionally suicidal to devote significant time to UFO's. However, I am quite interested in your survey.

C11. As a scientist I am prepared for the unexpected observation, but also as a scientist I am not going to take someone's word for it without proof ... It would be very interesting if... UFO's really exist ... in the sense that (they) are Martians (There is) also the possibility that a real UFO (may) represent a natural phenomenon ... never before discovered.

I am completely fed up with those who exploit astrology, UFO's and the possibility of extraterrestrial life just to make a buck and see their names in print It would be for the greater ultimate good of science if ... was frozen in liquid nitrogen and sent off into space in an unguided missile at some good relativistic velocity.

C12. I was highly pleased to receive your questionnaire on "UFO's", as it clearly indicates that the question of the nature of the phenomenon has not been entirely scrapped by the scientific community

Unexplained lights have been seen on the volcanic uplands of Mauna Kea in Hawaii for hundreds of years, and numerous individuals who have worked at the observatory there have seen them

In the old days sightings had a much greater chance of slipping into the astronomical literature. See for examples *Astronomy and Astrophysics* 13, 172 (1894), or a report by E. E. Bernard in *Astronomische Nachrichten* 172, No. 4106 (1906). (Also refers to Kandilli observation, see Case SL.)

C13. The UFO problem deserves study, but no crash program. Rather steady, non-flashy procedures.

C14. The approach for too long has been to spend inordinate amounts of time and effort in case investigation. That is fine and should be done but not by scientists whose valuable analytical abilities should be directed toward systematizing, relating, computing and theorizing.

C15. It will indeed be fortunate if an increasing number of our scientifically trained people will admit that there exists a fascinating and as yet unexplained phenomenon worthy of careful investigation.

C16. Menzel and Condon have made further investigation unnecessary unless some really new phenomena are reported There is no pattern to UFO reports except that they predominantly come from unreliable observers.

C17. I believe that the Condon Report was a costly whitewash and that many of the participants either had closed minds to start with or lacked the guts to put what they really believe over their signatures.

Acknowledgments

I wish to thank the Council of the American Astronomical Society for their sympathetic consideration of my proposal to conduct this survey; all the members of the Society who responded to my request for information; Allen Hynek, Jack Kuettner, Ted Northrop, Dave Saunders and Vern Zurick for helpful advice concerning the questionnaire; Chris Garner for her tireless support; Keith Marzullo for handling the computer processing of the data; and George Abell for pointing out to me the correct interpretation of one of the cases. I also thank Jacques Vallee for introducing me to this fascinating but refractory problem.

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