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The natural philosophy of flying saucers

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"I could more easily believe that two Yankee professors would lie than that stones would fall from heaven." If President Thomas Jefferson could say this so unluckily in 1807, what should we say today to the contention that our earth is visited not merely by stones but by craft manned by intelligent beings? Jefferson's disbelief had in effect already been dealt with by Chladni, famous for his vibrating plates, in a battle with the French Academy that had reached its height about 1790. By that time, as Paneth has said, men of science were far too sophisticated to accept such yarns as that stones should fall out of the sky; but Chladni, who was a lawyer as well as a scientist, believed from his legal experience that eyewitnesses to meteorite falls were genuinely describing a natural phenomenon. After a 10 year battle, he ultimately convinced the French Academy that it was wrong, and that meteorites were real.

Perhaps my one claim to be writing this article is that to some extent I share Chladni's experience, for as an Intelligence Officer I had often to investigate the evidence of witnesses when it conflicted with established 'science', and sometimes it was the 'science' that was wrong. Let me therefore look as dispassionately as possible at the character of the evidence regarding 'flying saucers'. The phrase itself dates from 24 June 1947, but it seems that the apparitions to which it refers had occurred many times before then. Whether or not it was in the heavens that Ezekiel saw his wheels, the sky was a sufficient source of signs for the Roman augurs to scan it in their prognostic routine and it seems to have encouraged the Emperor Constantine handsomely with a χ - ρ celestial monogram before the battle of the Milvian Bridge. In the same tradition, some of us can remember the Angels of Mons.

It may indeed turn out that apparitions have been seen in the sky as long as human records have been kept. In his *History of the English Church and People*, Bede (735) described what would today almost certainly be claimed as flying saucers; and I remember reading an 11th or 12th century account where an object in the sky had caused "multum terrorem" to the brothers in a monastery. And perhaps for almost as long, the tendency of humanity to scare itself has been exploited by the hoaxer. I have read that Newton as a boy of 12 caused much alarm in his Lincolnshire village by flying a kite with a lantern at night.

There was much concern in England in 1882 when as objective an observer as E. W. Maunder of the Royal Observatory saw what he considered to be a celestial visitor. The object was also seen on the Continent by a future Nobel Laureate, the famous spectroscopist Zeeman. It was described in various ways — 'spindle shaped', 'like a torpedo, or weaver's shuttle', 'like a discus seen on edge' and so forth. It was said to glow with a whitish colour.

From measurements made on it, it must have been very large — perhaps 70 miles long and situated more than 100 miles above the earth's surface. Although Maunder said that it was different from any auroral phenomenon that he had seen, it is noteworthy that there was an intense magnetic storm at the time, coinciding with one of the largest sunspots ever recorded. It is therefore likely that Maunder's object was an unusual feature of an auroral display. There was another scare in 1897, when something like a winged cigar projecting a brilliant light from its head was seen over Oakland, California (Fort 1941). Similar objects were soon seen throughout the United States, but while some were undoubtedly the work of hoaxers, the cause of the original incident remains obscure.

My own contact with the subject goes back to about 1925, when I was told at Oxted in Surrey of a bright light that slowly made its way across the sky every night. In fact, I knew of one married couple who sat up all night watching it. It was Venus, which had attracted them by its brilliance; they had never before noticed that all the planets and stars seem to move across the sky. Venus, indeed, has caused much trouble through the years. In 1940 or 1941 there was an alarm that the Germans had a new high flying aircraft, because this was what was reported by the predictor crew of an anti-aircraft battery somewhere, I think, in the Borders. The aircraft, they said, was showing a light and they had determined its height with their rangefinder. The answer was, as far as I can remember, 26 000 ft and we wondered how they had managed to get such a precise measurement. Investigations showed that this was the last graduation on their range scale and that what they had tried to range upon was, once again, Venus. The same explanation has been true of several flying saucers that have been drawn to my attention in the north of Scotland; it has sometimes been possible to predict the nights on which reports would come in, depending on whether or not Venus was bright and visible.

It is necessary, in any discussion of flying saucers, to consider the nature of the evidence concerning them; it may therefore be relevant if I recount some of my experiences in similar matters, for the tensions associated with war provided fertile ground for the conception of apparitions. I can remember the Russians with the snow on their boots who came to Britain in 1914. One of my uncles was among the hundreds of people who saw them although, in his case, he could not see the snow because they were in a train going over a railway bridge. In fact no detachment of Russian troops ever came to this country. Years later I was told the explanation by the Chief of our Secret Service. In prewar days there used to be large consignments of eggs imported from Russia, and one of the ports at which they were landed was Aberdeen. An agent in Aberdeen on this particular occasion sent a telegram to his London headquarters to warn them that the eggs had been

Based on a lecture given to the North Eastern Branch of the Institute and Society and the Newcastle Astronomical Society.

anded and were on the train. With telegraphic economy he sent a signal such as "100 000 Russians now on way from Aberdeen to London" and inadvertently started the legend.

The years before 1939 were full of stories of an engine stopping ray. As I heard the story in 1937 or 1938 it was that an English family on holiday in Germany would be travelling in a car when its engine would suddenly fail, invariably on a country road, and usually at the edge of a wood. A German sentry would then step out of the trees and tell them that there were special tests in progress and that they would be unable to proceed. Some time later he would come back and tell them that it was all right for them to start the engine again and the engine would immediately fire and they were able to drive off.

By this time I was becoming concerned with Intelligence, and one of my tasks was to ascertain the truth about the mysterious rays. At about the same time someone thought that it was a pity that the Germans should have a monopoly in the story and a parallel story was deliberately spread, hinting that we, too, had a ray. Within a short time we in Intelligence were flooded out with stories of similar events in England. We were astonished at the circumstantial detail that the public had added. In one instance, said to have occurred on Salisbury Plain, it was no ordinary family that were in their car, but a family of Quakers — and Quakers, it was added, were well known for telling the truth.

Eventually, I got to the bottom of the story. The places most mentioned in Germany were the regions around the Brocken in the Harz, and the Feldberg near Frankfurt. These were the sites of the first two television towers in Germany. A Jewish radio announcer at Frankfurt who escaped to this country was at first puzzled when I told him the story and then, with a chuckle, he told me that he could see how it had happened. In the days before the television transmitters had been erected, the engineers made field strength surveys, but these surveys were rendered difficult by interference from the engines of motor vehicles. Under an authoritarian regime such as that of the Nazis it was simple to eliminate this trouble by stopping all cars in the area around the survey receiver for the period of the test. Sentries, who were probably provided by the German Air Force, were posted on the roads, and at the appointed hour would emerge and stop all vehicles. At the end of the test they would then give the drivers permission to proceed. It only required a simple transposition in the story as subsequently told by a driver for the vehicle to have stopped before the sentry appeared, giving rise to a two year chase after the truth.

The beginning of the second World War took me for a few weeks to Harrogate, where part of the Air Ministry was evacuated. I soon saw a flying saucer. It was high in the blue of a clear midday sky, gleaming white, and appearing hardly to move. Everyone stopped to watch it, but it was merely an escaped balloon. Such objects appeared throughout the war and were even reported by fighter pilots who tried to intercept them, only to find that the objects were too high. There were indeed enough such incidents for part of the Intelligence Organization to suppose that the Germans had developed a special high flying version of the Junkers 86 aircraft known as the Ju 86P, P indicating that the cabin was pressurized (an unusual step in those days) for the crew. It was further supposed that these Ju 86Ps were flying photographic reconnaissances of this country and that we were powerless to intercept them. I doubt in fact whether any such reconnaissances were made — certainly, and very surprisingly, there was

no photographic reconnaissance of London by the Germans from 10 January 1941 until 10 September 1944 when the Me 262 jet became available.

1940 was a grand time for scares. Many people saw flares fired up by Fifth Columnists to guide the German bombers to their targets; I even had an eyewitness account from an RAF friend who had worked with me in finding the German navigational beams. I was involved in a hunt for Fifth Columnists in Norfolk in which the details were far more convincing than those of any Flying Saucer story that I have encountered but the explanation turned out to be quite innocent. Happily, observations of curious lights were not confined to one side. I was delighted to watch the pilots of Kampfgruppe 100 (the 'crack' beam bombing unit of the German Air Force) conduct a three week test of a theory that our Observer Corps was indicating the presence of German bombers to our fighters by switching on red lights whenever a German bomber was overhead. At the end of the check the Kgr 100 crews reported that they had confirmed the observation, despite the fact that we were doing no such thing.

Air crew, because of the intense strain involved, appeared to be especially susceptible to apparitions. Air Commodore Helmore, one of our ablest pilots in World War I, recalled to me in 1939 that he and his contemporaries had been scared of a particular kind of German anti-aircraft shell which burst with a purple flash. The legend was that these shells somehow radiated venereal disease — one can only guess at the chain of events that led up to these speculations.

In World War II our bomber crews repeatedly reported that they were shadowed by German single engine night fighters carrying yellow lights in their noses. The oddness of this observation was that, apart from the difficulty of putting a light in the nose of a single engine aircraft, there were at that time no German single engine fighters flying at night. No one ever completely explained the story. When I did get a chance to ask a German nightfighter crew whether they knew what the explanation was they said that they also knew that no single engine fighters were flying but that they had seen much the same thing as I described to them. American aircraft, later in the war, also saw what may have been the same phenomenon, both over Europe and over Japan. One theory, advanced by Professor Menzel (1953), who has studied such incidents in detail, is that it may have been some effect of light reflected from condensation in wing tip eddies.

Another of the aircrew theories, which ultimately did us very great harm, was that the control of German searchlights was mysteriously put out of action if our bomber switched on its radar identification device. Some of our most experienced and cool headed pilots believed this story, although one could see that it was ridiculous. Even if, by some accident, the German radar control had been upset originally by the radiation from our identification set, the Germans would very clearly have remedied the defect and used the radiation from our set as a means of identifying and locating our bombers — for we had thereby presented them with the answer to one of the most difficult problems in combat, that of getting your enemy positively to identify himself. They indeed exploited this technique towards the end of the war when their main radar equipment was jammed, and it cost us many bombers before we persuaded the Command that it must get the IFF sets switched off. There was another story that a beer bottle thrown out of a bomber would defeat the German radar, and I can remember Lord Chervell's humorous question "Must it be a freshly opened bottle?"

being solemnly recorded in the minutes of a War Cabinet discussion.

I had often to assess the evidence of eyewitnesses but even when these were observers who were anxious to help us, it was sometimes surprising how much in error their descriptions could be. I received, for example, three reports within a few weeks of one another in 1941 regarding German constructional activity on Mont Pinçon in Normandy. One report said that it was an underground aerodrome, the second that it was a long range gun and the third that it was a radio mast about 1100 ft high. Faced with such diversity, I guessed that none of these descriptions was correct but that, from the site, the construction was probably a radio navigational beam station, with an aerial (which was, incidentally, about 40 ft high) which could be rotated on a turntable of about 100 ft diameter. Photographic reconnaissance showed that my guess was correct; it also illustrated a more general point that witnesses were usually right when they said that something had happened at a particular place, although they could be wildly wrong about what had happened.

Another example that occurred, not to me but to Professor Charles Kittel, the American solid state physicist, may also be salutary. He and a British theoretical physicist were given the problem of establishing the pattern on which the Germans laid their mines at sea, the principal evidence being derived from the reports of minesweeper crews regarding the range and bearing of the mines as they were exploded by the passage of minesweepers. Kittel proposed to go on a minesweeping sortie, to get the feel of the evidence. His British counterpart refused to go, on the grounds that since they would only be making one trip the evidence that they were likely to obtain would be highly special to that particular trip and might colour their general judgement. Kittel at once found out the surprising fact that the reports of the crews were completely unreliable as regards range and bearing estimation, and that the only part of the evidence on which he could rely was whether the explosion had occurred to port or starboard. I believe that he managed to solve the problem of the pattern on this evidence alone, but that his colleague remained perplexed until the end of the war through accepting the ranges and bearings as accurate.

I have made this discursion into some of my war experience because it is relevant to the flying saucer story in that it illustrates the difficulty of establishing the truth from eyewitness reports, particularly when events have been witnessed under stress. I do not, of course, conclude that eyewitness reports must be discarded; on the contrary, excluding hoaxers and liars, most witnesses have genuinely seen something, although it may be difficult to decide from their descriptions what they really had seen.

The end of the war brought me an experience that was directly connected with the flying saucer problem. In fact, although the term was invented in America as the result of something seen by Kenneth Arnold, piloting a private plane near Mt Ranier on 24 June 1947, the modern scare about strange celestial objects started in Sweden early in 1946. I was Director of Intelligence on the Air Staff at the time and I had to decide whether or not there was anything in the story. I am not sure of the incident that started it off, but the general atmosphere was one of apprehension regarding the intentions of the Russians, now that their post-war attitude was becoming clear. It was, for example, the time of Winston Churchill's 'iron curtain' speech. At any rate, a number of stories began about people seeing things in the sky over Sweden, and this gained such volume that the Swedish General Staff asked the population in

general to keep its eyes open. The result, of course, was an immediate spate of reports. Many of these could be quickly dismissed by explanations such as wild geese seen at a distance, but one or two were so widely reported that they must have been something more unusual.

Some of the technical officers on my staff were quite convinced and subscribed to the Swedish explanation that the objects were long range flying bombs being sent over Sweden by the Russians. Even such a cool headed judge as Field Marshal Smuts was convinced enough to refer to them in a broadcast talk as evidence of the Russian threat. The belief was strongly aided by what I think must have been two unusually bright meteors, which were clearly visible in daylight. One of these led to many reports almost simultaneously, from a wide area of Sweden; an enthusiastic Intelligence officer joined all the reports up into one track according to the times of the individual reports and this track seemed to show that the object sometimes hovered and sometimes flew for hundreds of miles within half a minute. What he had failed to notice was that almost every report said that the object had been seen to the east of the observer, and this would have been impossible if his track was genuine. The explanation, of course, was that the individual times of sighting that were reported represented the scatter of errors in the individual watches of the observers, and that they had all been witnessing one event; this was a large, bright meteor that had appeared over the Gulf of Finland.

However, such a simple explanation did not satisfy some of my officers, who clearly disapproved of my scepticism. I pointed out to them that since we had two years before studied the behaviour of German flying bombs, we knew the order of reliability of such missiles, which was such that 10% or so would come down accidentally through engine failure. The Russians were supposedly cruising their flying bombs at more than twice the range that the Germans had achieved, and it was unlikely that they were so advanced technologically as to achieve a substantially greater reliability at 200 miles than the Germans had reached at 100 miles. Even, therefore, if they were only trying to frighten the Swedes, they could hardly help it if some of their missiles crashed on Swedish territory. The alleged sightings over Sweden were now so many that, even giving the Russian the greatest possible credit for reliability, there ought to be at least 10 missiles already crashed in Sweden. I would therefore only believe the story if someone brought me in a piece of a missile.

I did not have to wait long. The other Director of Intelligence on the Air Staff, an Air Commodore who tended to side with those who believed in the story, telephoned me to say that while the Swedes had not actually picked up a crashed missile, someone had seen objects fall from one of the missiles and had collected them. The Swedish General Staff handed them to us for examination; they were a miscellaneous collection of irregular lumps of material. The piece that I remember best was perhaps three inches across, grey, porous and shiny, and with a density not much more than that of water. Charles Frank (now Prof. F. C. Frank of Bristol) and I looked at it and at one another, and laughed; but since we had been set a silly problem we thought that we would deal with it in a suitable manner, and so we sent the collection of specimens to the chemical department at Farnborough for a formal analysis. We did not foresee the scare that was then to arise; Farnborough, instead of sending the report of their analysis directly back to us, sent it to the technical officers who were among the believers.

My Air Commodore friend telephoned me to say that

he now had the Farnborough report and that it substantiated the idea that the specimens had come from something quite mysterious, because one of them contained over 98% of an unknown chemical element. It was the grey porous specimen that was the cause of the trouble; Farnborough had analysed it for such elements as iron, manganese and so forth and had found traces of all of them adding up to less than 2%. The remaining 98% they had been unable to identify. Charles Frank and I were delighted. I telephoned the head of the chemical department at Farnborough (now a Fellow of the Royal Society) and asked him whether he really believed in the analysis that his Section had done. When he said that he did, I asked him how he could be satisfied with an analysis that left 98% of the substance unidentified, and he agreed that it was rather a puzzle. I then asked him whether they had tested for carbon. There was something of an explosion at the other end of the telephone. Carbon would not have shown up in any of the standard tests, but one had only to look at the material, as Charles Frank and I had done, to see that it was a lump of coke.

These were the only specimens that were ever claimed to have come from a Russian flying bomb, and the story might then have died. But by this time it had gone round the world and we received a signal from the British mission in Tokyo because General MacArthur had asked them to enquire into the story that a missile had fallen in England during the previous few weeks. The same Air Commodore telephoned me, asking how he should reply to the signal. I told him that, so far as I knew, nothing like a missile had fallen in England since the end of the war, and to this he replied: "Well, it might tie up with the Westerham incident." When I asked him what Westerham incident, he said: "Good God, I was supposed not to tell you about that." And then, of course, he had to tell me.

It transpired that on the previous Saturday one of my technical officers had received a telephone call from a man who said that his name was Gunyon, and that one of these newfangled contraptions had fallen out of the sky into one of his fields, and that he thought it was the Air Ministry's business to come and remove it. The technical officer concerned happened to be one of the believers and he saw a chance of convincing his Director that the Russian flying bomb really existed. He therefore asked farmer Gunyon how to find his farm, and was told that if one drove from Croydon to Westerham one should look out for a public house called 'The White Dog' and drive up the lane beside it, and that the farm was at the end of the lane. The technical intelligence resources of the Air Ministry were immediately mobilized and the two staff cars full of officers set off to find farmer Gunyon. When they got into the right area, they were disappointed to find no public house of the right name. But, being good Intelligence officers, they realized that the name may have been misheard over the telephone. They therefore enquired whether there were any public houses with similar names, and they were soon directed to one called 'The White Hart'. They were beginning, in any event, to need a drink, and they asked the publican whether he knew where farmer Gunyon lived. The pubkeeper did not know anyone by the name of Gunyon but, again, they asked whether he knew of anyone with a name that they could have mistaken for Gunyon over the telephone. Happily, he did. There was a farmer called Bunyan about three miles over the hill, and this astonished man duly received the full force of Air Technical Intelligence. Ultimately, he satisfied them that he had not telephoned the Air Ministry and that all his fields were in good order. They returned sadly to London. On the

way, in seeking an explanation, they concluded that their Director had decided to have some fun with them and had made them waste their Saturday on a wild goose chase, just to teach them a lesson for their credulity. The only satisfaction left to them, they thought, was not to let their Director know how well he had succeeded, and they had therefore decided that they would not tell me what had happened. Although I appreciated their respect in giving me credit for such a happy hoax, I had in fact nothing to do with it, and I still do not know who thought of it. Even after that, some still believed in a Russian flying bomb, but the scare in Sweden and Britain gradually died down.

Even so, the Swedish scare had sensitized the western world so much that Kenneth Arnold's 1947 story set up a secondary scare in America that quickly overshadowed the primary source. Arnold was flying his own aircraft near Mt Ranier in Washington State on 24 June, when he saw "a chain of small saucer-like things at least five miles long swerving in and out of the high mountain peaks". There is no reason to doubt that Arnold genuinely saw something but, as D. H. Menzel has suggested, it may have been no more than snow swirling off the peaks or small clouds forming over them. Arnold's story triggered off a wave of sightings, with saucers appearing almost daily over one part or the other of the United States and since the Russians were at that time considered incapable of making apparitions cruise at such a long range, some other origin had to be found. The United States Air Force went even further than the Royal Air Force had done and set up an official investigation 'Project Saucer' on 22 January 1948 (this was succeeded in February 1949 by 'Project Grudge' and in March 1952 by 'Project Bluebook', which survives today). Eventually, in January 1953, a special Panel under CIA and USAF auspices was called to assess the evidence. The Chairman of the Panel was H. P. Robertson, the distinguished relativist, and with him were L. W. Alvarez, L. V. Berkner, S. A. Goudsmit and T. L. Page. They concluded, briefly, that there was no evidence for any "artefacts of a hostile foreign power", and that there should be a "debunking of the flying saucers".

The verdict of the Robertson Panel did much to restore a critical view of flying saucer stories and to offset the efforts of publicity seeking charlatans; but the Panel could not, of course, quell the enthusiasts who claimed to discern in its conclusions a range of motives that included the 'whitewashing' of the United States Air Force and its inability to cope with the invaders, celestial or otherwise (others even postulated that the unfortunate USAF had itself started the flying saucer stories by trying out a new secret weapon). If I may interject a personal comment here, it happens that I knew H. P. Robertson well; he was the representative appointed in 1943 by the American Chiefs of Staff to decide whether or not we in Britain were being hoaxed by the Germans regarding the existence of the V-1 flying bomb. He was immediately convinced by our evidence, and we owe him much, both for his personal help and for the promptness of the American technical support that followed his conclusion. He was always as anxious as anyone I know to establish the truth, and he would never have made an attempt to suppress it if it proved unpalatable; the same is true of the other members of his Panel who are known to me. Nevertheless, their findings have recently been criticized again, especially by a distinguished meteorologist, Dr James E. McDonald (1967) of the University of Arizona and by Dr J. Allen Hynek (1966), Director of the Dearborn Observatory of Northwestern University. Dr Hynek's criticism is the more interesting for the fact that he has been for 20 years a consultant to

the United States Air Force, and he was an associate member of the Robertson Panel. For most of this time he held that saucers were fictions, and he contributed an article to the *Encyclopaedia Britannica* (1964) that threw much doubt on their existence. Recently, however, he appears to have changed his mind, and he now believes that there are sufficient unexplained pieces of sound evidence to justify a new examination. As a result, the United States Air Force has set up a fresh investigation at the University of Colorado, Boulder, headed by Dr Edward Condon, the former Director of the National Bureau of Standards. The study was initiated in October 1966 and is expected to take 18 months at a cost of \$300 000.

It appears that the Russians, too, have been facing similar doubts, for Air Force General Anatoli Stolyarov has recently been appointed head of a committee of investigation (*The Times*, 13 November 1967). Again, this comes some years after *Pravda* had published official denials of flying saucers in 1961.

Let us consider the difficulties that face these new investigations. Apart from the liars and hoaxers who have done much to confuse the issue, and those witnesses who have simply had hallucinations, there are many witnesses who have genuinely observed something. Some of these witnesses have seen manmade vehicles such as balloons, aircraft, rockets and satellites, but have misidentified them in unfamiliar circumstances. Others have seen natural phenomena including mirages, ice haloes, mock suns, Brocken ghosts, lenticular clouds, phosphorescence at sea, ball lightning, Venus and so forth. Some have seen and have even photographed convincing artefacts such as the detached image of the plane of a Herald aircraft through complex refraction at the edge of one of the cabin windows. Others have observed unusual echoes on radar screens such as the 'ring angels' due to the morning flight of starlings.

The foregoing explanations account for the majority of flying saucer reports. The size of the unexplained residue may be gauged from the statement of the Under Secretary of State for Defence in the House of Commons on 9 November 1967. Over the period 1 January 1959 to 30 September 1967, 625 reports were received by the Ministry of Defence; 70 remain unexplained after investigation. For comparison, the American figures, given by the Staff of Project Bluebook in a report of February 1966, are 6817 alleged sightings in the years 1953–65 inclusive; of these, 1248 were reported too vaguely to allow an attempt at explanation. Of the remaining 5569, there were 237 for which explanations could not be found.

Summarizing the British and American experience, it appears that perhaps 10% of the alleged sightings cannot be explained. In this residue, it is probable that the majority of witnesses have made substantial errors in their descriptions. A point of dispute is whether, after such errors have been allowed for, there is enough left that is unexplained to make us think that there is a gap in our knowledge either of natural phenomena or of an extraterrestrial invasion of our atmosphere, perhaps by intelligently controlled spacecraft.

Those who have pressed the last explanation, and especially those who have believed in little men from Venus or Mars, must have been discouraged by the latest evidence regarding surface conditions on those planets. But I doubt whether they will be any more finally discouraged than were those who believed in the Russian flying bombs over Sweden. Hope is not the only thing that springs eternal in the human breast. If Earth proves to be the one planet in the solar system that supports intelligent life, it is still

possible that intelligent beings from a more distant system have found the way to cross intervening space in small craft without ageing on the long journey; and, although it is unlikely, it is just possible that the craft are small enough not to have shown up on astronomical or radar surveys. Jesse Greenstein of Mt Wilson and Palomar Observatories has calculated that a vehicle 100 ft in diameter would easily show up at a height of 50 miles on any of the 5000 plates of the Palomar Sky Survey.

Perhaps I may be permitted to make some remarks on resolving the confusion of evidence, for I have had to do this before. In particular, I had to sort out the true from the false in the scare of 1943 about the threat of the German rocket. In the early stages this was not difficult, since there were few reports, and they were substantially secret and independent. But as the stories grew, it was almost impossible to tell whether or not a particular report came from someone who genuinely knew something or whether he was repeating a rumour. By that time there was no question about whether or not there was a rocket — the question was what it weighed. Finally I found a touchstone — I would accept a weight only from a report that had also mentioned that liquid oxygen was one of the fuels, which I by then knew to be true. The result was spectacular; out of hundreds of conflicting reports this touchstone selected only five, and these pointed consistently to a total weight of about 12 tons with a warhead from one to two tons, in contradistinction to the 80 tons with a 10 ton warhead that had been mooted. These five surviving reports thus led me to the correct answer.

Unfortunately, I have not found a similar touchstone for flying saucer reports. We are then left with assessing probabilities from what we know about the physical world, but we cannot reject the flying saucer hypothesis simply because it is unlikely. This would merely lead to the danger of repeating the error of the French Academy regarding meteorites. But are flying saucers simply of the first order of unlikeliness? I think not, for I would apply the same argument as I used regarding the apparitions in Sweden. There have been so many flying saucers seen by now, if we were to believe the accounts, that surely one of them must have broken down or left some trace of its visit. It is true that one can explain the absence of relics by supposing that the saucers have a fantastic reliability, but this adds another order of unlikeliness. At least the French Academy had some actual meteorites to examine.

I think that this is where the natural philosopher must take his stand, for there is a well tried course in such a situation. This is to apply 'Occam's razor' — hypotheses are not to be multiplied without necessity. Of all the possible explanations for a set of observations, the one with the minimum of supposition should be accepted, until it is proved wrong. Otherwise one lives in a fearsomely imaginative world in which rational conduct becomes impossible. There is a story of one of my more eccentric colleagues that will illustrate what I mean. He was at the time a Fellow of one of the men's colleges in Oxford, but he happened also to tutor some of the women students in philosophy. One of the girls went into his room for a tutorial one day, only to find that he seemed not to be there. However, she was accustomed to some of the curiosities in his behaviour and she was not unduly surprised when, a minute or two after she had sat down, his voice boomed from under the table: "Read your essay!" This she proceeded to do, and then waited for his comments. Something that she had said reminded him of Occam's razor and he proceeded to give her an example. Poking his head out from under the tablecloth he said:

“Supposing that I was to say to you that there is a tiger outside the door, but that the tiger is frightened of me so that every time I go to the door to see it, it runs away and hides round the corner. If I were to tell you that this was the explanation of why I see no tiger outside my door, you would say that I was mad — or, at least, a little peculiar!” Are flying saucers as imaginary as my colleague’s tiger?

Of course, the difficulty in applying Occam’s razor is in deciding which explanation of flying saucers involves the minimum hypothesis. Jefferson was committing scientific suicide with the razor when he preferred to believe that professors would lie. And it is also true that the explanation with the minimum of hypothesis is not always the right one. I can recall just one occasion when Occam led me astray in this way. This was towards the end of 1943 when the method of propulsion of the German flying bombs was unknown. I thought that I was able to deduce it from a set of facts as follows. On the plans of one of the flying bomb sites that had been sent to us by one of our spies, backed up by what we could see on aerial photographs, there seemed to be one fuel store on each site. Indeed, it was so labelled on the plan. The store was divided into two parts, and I concluded from the disposition of the entrances and blast walls that two kinds of fuel were to be used and that the designer was taking unusual precautions to prevent them from coming into contact. I already knew of two such fuels, hydrogen peroxide and sodium permanganate. These were already being used in rocket propelled glider bombs, and I even managed to establish that some of the servicing crews for these particular fuels were being allocated to the flying bomb sites. Moreover, when I checked the volume of peroxide that could be held in the store, it was enough to propel 20 peroxide rockets to London, and this was consistent with the storage in the rest of the site for 20 flying bomb bodies. There was therefore no need to postulate any other engine, on this evidence, for the flying bomb beyond a development of the peroxide rocket engine. Everything was consistent and had been well supported by evidence. And yet the conclusion was wrong. A more complicated hypothesis turned out to be right. The peroxide was used merely for firing the bombs from their catapults, and their main means of propulsion was a new type of engine, the Argus tube, which burned ordinary fuel. The reason that this ordinary fuel did not show up on the site was that the bombs arrived already filled with fuel from a central store.

At the same time, I must emphasize that in compensation for this one instance where Occam’s razor led me astray, there were many instances where it led me to the truth when many other people were confused. The essential thing in applying the Razor is that one must be completely honest in realizing that, while it dictates the best operational course, it can lead to the wrong result and one must not cling to the simple explanation to which it leads if subsequent observations show that this is incorrect.

Here it is advisable to remember the advice of Pasteur (1854):

Preconceived ideas are like searchlights which illumine the path of the experimenter and serve him as a guide to interrogate nature. They become a danger only if he transforms them into fixed ideas — this is why I should like to see these profound words inscribed on the threshold of all the temples of science: ‘The greatest derangement of the mind is to believe in something because one wishes it to be so.’

Keeping all these facts in mind, the balance of the evidence regarding flying saucers as I see it — viewed against the critical situations in which I used to have to

decide on courses of action based on evidence from eye-witnesses and other sources — is heavily against their being intelligently controlled vehicles. But I also know that, even if the current American and Russian investigations come to this same conclusion or even a stronger one, it will not discourage the flying saucer believers. For these investigations are faced with the impossible job, if flying saucers do not exist, of proving a completely negative case. This is one of the most difficult of all Intelligence tasks, and even if the investigation is as thorough as humanly possible, the flying saucer exponents will always be able to conjure new hypotheses that had not been considered.

If known natural phenomena are insufficient to explain everything that has been genuinely seen, the alternative to the intelligently controlled vehicles is an as yet unrecognized natural phenomenon. This is distinctly possible — the case may be similar to that of ball lightning, the occurrence of which has long been both asserted and disputed. But ball lightning has been seen by many observers with a scientific training, including a Deputy Director of the Meteorological Office. In this it appears (apart from a few recent reports from Russia) to differ from the flying saucer and since there is no reason to expect that scientists are more likely to be favoured relatively to laymen by ball lightning than by flying saucers, we may conclude that either the saucers are much rarer even than the comparatively rare ball lightning, or that the latter has often been mistaken by lay observers for saucers.

In coming to a conclusion about the existence of flying saucers, there is a strong temptation to be overcautious, because if you turn out to be wrong in denying their existence the error will be blazoned in the history of science; but if you merely turn out to be right, there will be little credit in proving a negative case. My own position has been that if at any time in the last 20 years I had had to take a vital decision one way or the other according to whether I thought that flying saucers were fact or fantasy, Russian or extraterrestrial (why has China never been credited, by the way?), I would have taken that decision on the assumption that they were either a fantasy or an incorrect identification of a rare and unrecognized phenomenon; and while I commend any genuine search for new phenomena, little short of a tangible relic would dispel my scepticism of flying saucers.

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