

placing three circles in a visually pleasing arrangement such that they have an obvious relationship but remain distinct figures. Try it with three pennies! All the pattern takes is a good eye; for more precision, a twice-doubled rope suffices very well. The second photo in your article, with the quadrants stomped down, is a "fox and geese" pattern — a children's game we used to play in fresh snow. We packed down (the parallel will presumably not escape you) an outer and inner circle connected by four perpendicular spokes; the "fox" chased the "geese," and one wasn't allowed to step out of the packed down areas.

Master geometers, indeed!

Donald Duncan
Cambridge, Mass.

The fact that subsequent analysis of a figure reveals certain geometric properties inherent in the figure does not mean that a knowledge of geometry was needed to construct it in the first place. One can make a circle with a pencil and a piece of string without knowing either the value of pi or the equation for the circumference of a circle, just as Babe Ruth could hit a home run without knowing either Newton's laws or the velocity of the bat at impact needed to give the ball the right trajectory to knock it out of the park.

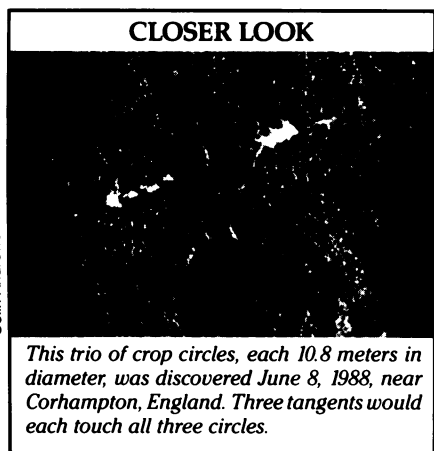
Richard S. Siluk
Houston, Texas

Sometimes a person looking for patterns will shift data, a little bit here, a little bit there, and before you know it, he finds the pattern for which he was looking. The result always tells you something about the student but very little about the thing being studied.

One will note in your article that the circles in the first photograph do not align their tangents as stated. One will also note that even with this additional reach to find a pattern, only 61 percent of the data could conform, and this was only from a selected test sample representing probably around 2 percent of the total data available.

Harold Enslie
Estes Park, Colo.

I was fascinated by the discovery of five new theorems from Euclidean geometry in the designs in the English wheat fields. I was equally disappointed by the author's repeated reference to "the hoaxers," as though the issue has been settled. Recent information indicates otherwise.



This trio of crop circles, each 10.8 meters in diameter, was discovered June 8, 1988, near Corhampton, England. Three tangents would each touch all three circles.

Colin Andrews

First, in many of the designs the wheat has been gently bent over at ground level and continues to grow, even being harvested. The stalks are not broken; they are simply bent over right at ground level. How this happens is a mystery. Any hoaxers using boards would break the stalks if they worked at ground level.

In addition, significant alpha and beta radiation has been found in some of the designs, growth nodes of the wheat stalks were enlarged, and cell walls were stretched and swollen. (The latter two effects might be produced by heat; recently, cell walls were stretched when exposed to microwave radiation.) Seeds were malformed in 20 to 40 percent of samples taken earlier in the summer.

Obviously, the two retired landscape painters could not have produced all these effects. No one should claim the crop designs are hoaxes until there is better evidence. In the meantime, we should approach the phenomenon with a truly scientific attitude, looking at the evidence with open minds and drawing conclusions as warranted. Whether the designs are caused by UFOs, supernatural beings, natural causes or something else, we should remain objective and not allow ourselves to be limited by our personal biases.

John C. Kasher
Professor of Physics
University of Nebraska at Omaha
Omaha, Neb.

Is it possible that the crop-circle makers are trying to suggest in a jokey way that there is more knowledge—either once known and now forgotten, or as-yet-undiscovered—than our contemporary science and mathematics ordinarily admit, and that we could stand to broaden the horizons of our understanding?

Alexei and Cory Panshin
Riegelsville, Pa.

Hasn't SCIENCE NEWS already suggested the origin of the "mysterious" crop circles in an article many months ago describing military experimentation with X-ray lasers, particle-beam weaponry and the like? It seems that these formations could be the result of airborne testing of energized beams of some sort.

William E. Lerner
Kirkland, Wash.

"Euclid's Crop Circles" by Ivars Peterson was intriguing and thought-provoking. There is indeed a wealth of geometric relationships implicit in the construction of some crop circles, and as a "veteran" circles investigator (since 1987), I hope to send further details of this to Gerald Hawkins.

However, Peterson is very naive to accept the hoaxing claims of Bower and Chorley, who certainly have no knowledge of Euclidean theorems. A crop circle they made to demonstrate their technique to the media was no more than an unswirled mess and quite unlike the real thing. Few British circle researchers take their claims seriously, and one should not always believe what one reads in tabloids.

George Wingfield
Shepton Mallet, England

The flattened-grain pictures from England and the analysis by astronomer Gerald Hawkins will no doubt encourage Bigfoot and friends to redouble their efforts to make it into your pages. While we are waiting, maybe you will serve up the Piltdown Man?

Bo Thott
Cutler, Maine

I'll bet your article on crop circles draws more correspondence than anything you have published in recent history. Geometry would be an excellent way for extraterrestrials to try to bridge the language gap.

Roger Dorr
Portola Valley, Calif.

Gerald S. Hawkins responds:

I am pleased about the lively response to Ivars Peterson's article on the crop circles. The phenomenon is a mystery, with many theories and no accepted explanation. Lord Zuckerman, former science adviser to the British government, has suggested that we investigate the theory of hoaxers first, so researchers are trying to pin down an intellectual profile. Are the crop-pattern makers hitting these geometries by blind luck, or are they communicating at some level of mathematical knowledge?

I did not choose these patterns to prove a point; they stood out from the rest and gained media attention. For example, the SCIENCE NEWS cover photo shows Crop Theorem II, with two of the concentric circles defined by three equilateral triangles, one marked in the wheat and two others obtained by geometric construction. It was created in the dark, and I don't think it was unplanned.

My first step was to analyze the complete data set for 1981-88, when 18 accurately measured rings and circle groups were published. I was surprised when 11 patterns gave diatonic ratios, significant beyond coincidence at the 99 percent level. I was again surprised when the triple tangent formation, the first geometry and the only such in 1988, yielded the diatonic 4:3. That was the curious thing. Were the eight diatonic ratios (including the octave) a connecting thread from circles to geometry? Euclid had not referred to this set of numbers in his theorems or in his books on harmony.

I use the word "theorem" in the dictionary sense — a proposition embodying something to be proved. It does not have to be complicated to qualify for that name. Today, many of Euclid's theorems would be called simple. They are all based on a straightedge and compass, which for hoaxers in the fields become pegs and strings.

The solution $\cos^2(\pi/n)$ is well adapted to a computer, which can be programmed to show how diatonic ratios occur for a set of angles. However, this is not a Euclidean theorem, and use of trigonometry would make working in the crops more difficult. The circle makers would need a method for dividing an angle into n equal parts — in the dark.

Incidentally, the fifth theorem that I have in mind invokes a symmetrical shape where the parameter assumes diatonic ratios to produce the triangle, square, hexagon and ringed circle as special cases. In Euclid's system the crop theorems would fit in Elements, Vol. XIII. It is unlikely that hoaxers could draw these by doodling in the dark, and it is best not to discuss my fifth theorem at the beginning of the 1992 season. Theorems are easy to copy but difficult to conceive.

The practical result of the geometry and diatonics is that we can eliminate all theories proposed for the phenomenon as a whole that depend on a natural science process.

There has been much jest and amusement over the crop-pattern phenomenon, but there is a serious aspect. Harvesting of the food supply has been interfered with for more than a decade in England, and increasingly elsewhere in the world, by an undetected intrusion into our environment. The jesting will be out of place if the phenomenon continues to spread.

