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This Week

Research Notes

Articles

Cover: Found along the southern coast of Australia, this fossil tooth belonged to a previously undiscovered type of hypsolophodontid dinosaur that lived over 100 million years ago and was about the size of a human being. At that time, this area was still attached to Antarctica and was close to the South Pole, where winters would have been long, cold and dark. This fossil and others from Australia and northern Alaska are raising questions about how the dinosaurs survived polar climates. (Photo: S. Morton/Monash University)

Departments

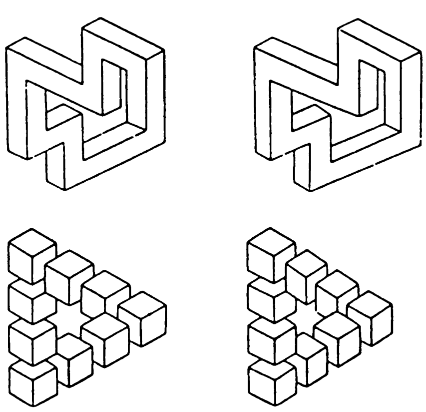
Letters

Knotty problems

Given all the mathematical difficulties in analyzing – much less solving – knot problems, and given the fact that the Princeton team is going to computer graphics methods anyway ("Shareware, Mathematics Style," SN: 1/2/88, p.12), it would seem that generating and viewing stereo pairs of their displays might prove fruitful. For one thing, reversing the stereo images instantly transforms any 3-D image in a unique way: All forward projections (bumps, peaks, etc.) become retractions (bowls, valleys, etc.) and vice versa.

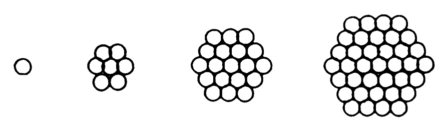
More interesting, perhaps, might be the mathematics involved with the many kinds of "impossible figures" one can dream up, such as those pictured below. Even more intriguing is the fact that these illusions are also preserved when viewed in 3-D. Is there an analytical mathematical basis for all the kinds of impossible knots that would serve as analogs to the "impossible structures" shown here? Shouldn't these analytical descriptions be fundamentally unlike those corresponding to ordinary (i.e. possible) structures and knots? Perhaps a simultaneous study of both kinds of mathematical structures would give additional helpful insights.

John W. Patterson
Professor, Materials Science & Engineering
Iowa State University
Ames, Iowa



Penny for your thoughts

In spite of mathematician Richard Guy's theorem that "You can't tell by looking" ("A Shortage of Small Numbers," SN: 1/9/88, p.31), I refuse to be intimidated into believing that I don't see a fairly simple illustration that the hexagon-building example will hold for hexagons constructed of any number of pennies.



The hexagons shown in the example can also be visualized as corner views of three-dimensional cubes built of stacked spheres with each penny representing one of the spheres and a side of the hexagon representing an edge of the cube. The total number of spheres in each cube is the number of cubes in the edge cubed. The number of spheres not shown in a given view is equal to the number of spheres in a cube of the next smaller size.

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For each size hexagon that number is also the sum of the number of pennies in all the previous hexagons. Unless this correspondence between the hexagon and the cube is an illusion, it appears that the relationship should hold for all sizes of hexagons.

I realize that this is not a mathematical proof, but until a counterexample is given, I will continue to believe what I see.

Joe Moore
Landover, Md.

Having just worked out the Twelve Days of Christmas (the total number of gifts through the n^{th} day is $\frac{n(n+1)(n+2)}{6}$), I thought I recognized the low-budget penny problem as more of the same, and it is.

If you look at the pennies as lying in numbered "rings" around the central penny, then the number of pennies in the n^{th} ring is $6n$ and the number in the n-ring configuration is $\frac{n(n+1)}{2}$.

Then the sum of the numbers of pennies in all configurations up through the n^{th} is $(n+1)^3$.

So the answer to the question is yes.

Bill Ennis
Willingboro, N.J.

I think the penny problem could be presented in a slightly different way that would be more interesting: There is a pyramid of pennies with a hexagonal base, with it and each intermediate layer of hexagons formed as Guy described. The top layer has one penny, for $n = 1$, the second with $n = 2$ (with seven pennies), the third with $n = 3$ (with 19 pennies), etc. How many pennies are there in the pyramid n layers high?

T.R. Specht
Sharon, Pa.

Subjective truths

Jonathan Eberhart's commentary on the nature of truth ("The Saying of Science," SN: 1/30/88, p.72) struck dead-center a major philosophical problem with science: "that one could not know [these conclusions] to be correct." Certainty of knowledge has long been a thorn in the side of epistemology; how we know what we know is a matter of much concern and debate.

Our faith in observation and experimentation has deepened to the point of tolerating very little that is contrary to accepted dogma. In science, it is very easy to overlook the fact that so much of what we find depends on what we seek.

This is not to denigrate the scientific method. However, to say that the knowledge we derive from it is reality-as-it-is, rather than merely represents reality-as-we-understand-it, is to give far too much credit to ourselves and not nearly enough to the incredibly complex richness of the world.

Drew Green
Tucson, Ariz.

I agree that "knowing" a conclusion to be correct is a questionable concept. However, in the case of Svante Arrhenius, whose assertion that "everything on Venus is dripping wet" was mentioned in my commentary, the issue is not whether he lacked the data to support such a conclusion, but that he stated it as an unquestionable fait accompli. — J. Eberhart

Luckily there are people like Percival Lowell who let their imagination hold the reins of reality. So strong was Lowell's belief in what he saw on Mars that he said what he believed, rather than what he observed. No wonder assumptions become muddled with facts, giving rise to false wisdom.

Now progress can be made, because the stage is set for a genius — a maverick who can struggle against the false wisdom of his forerunners by convincing his contemporaries what the facts are. And how does the clever scientist define the facts?

By communicating which facts go with which observation. If the communication is not based on "hunch, belief or other such toothless methodologies," as described in your commentary, then there is no need for a wild imagination. Only one or two facts may take care of many assumptions. Or, expressed in the words of Mark Twain, "There is something fascinating about science. One gets such wholesale return of conjecture out of such a trifling investment of fact."

Markus Zeller
Hamilton, N.Y.

Science is far more than quantitative measurements and "data points"; imagination is vital to its progress. The danger arises when the toothless methodologies are perceived as producing or confirming the data rather than as furthering data interpretation. Twain's remark, meanwhile, should be inscribed in some highly visible place on a tablet of stone. — J. Eberhart