Thom invented catastrophes in order to explain the discontinuous processes. Thom's theory builds on the results of 300 years' research into the manner in which continuously changing causes produce continuously changing results. But Thom succeeded in showing how continuously changing causes may produce results that exhibit dramatic discontinuities, or in his terminology, catastrophes.

There is more to the theory, of course, than pictures of folded sheets of paper. Scientists have long recognized that when two or more causative agents vary independently (temperature and pressure in the atmosphere, for example, or hostility and fear in animal behavior) the totality of all possible results can be represented conveniently by a surface with as many dimensions as the number of causative agents. Such surfaces are called manifolds and are the objects studied by differential topologists.

In developing his theory of catastrophes, Thom showed first how a manifold with an appropriate pleat can explain observed instances in which continuous causes produce catastrophic consequences. He then went on to classify all possible pleats in manifolds of low dimensions—thus providing scientists with a relatively small number of models for catastrophic phenomena together with a general proof that these models are the only possible ones. It is this latter point, contained in Thom's basic theorem on the classification of elementary catastrophes, that forms the core of the theory.

Thom showed that under certain specific but quite general circumstances, any singularity of a function on a manifold is equivalent to one of a few basic types called "elementary catastrophes." In a two-dimensional manifold (representing two interacting causes) there are just two possible types of catastrophes —a fold-catastrophe which may occur at the boundary of the manifold, and a cusp-catastrophe caused by a pleat on the surface of the manifold.

In 3, 4 and 5 dimensional manifolds there are, respectively, 5, 7 and 11 possible elementary catastrophes. Since these cases are quite difficult to visualize and interpret, Zeeman's Warwick colleagues Tom Poston and Ted Woodcock have developed computer graphics to illustrate the higher dimensional catastrophes.

One curious feature of Thom's classification theorem is that when the number of dimensions (the number of causative factors) reaches 6, the number of possible elementary catastrophes becomes infinite. As the number of dimensions increases, so does the space available in the manifold. Eventually the manifold contains enough room for the elementary catastrophes to evolve continuously from one to another. □

Mariner 10 returns to Mercury

Since March 29, when Mariner 10 flew by the planet Mercury, Mariner has almost completed a full journey around the sun, while Mercury has been around almost twice. On Sept. 21, spacecraft and planet will meet once again, although a mishap aboard the probe last week has strained the chances of a third encounter in the spring.

Unlike the first flyby, the September meeting will take place along Mercury's brilliantly sunlit side (SN: 7/6/74, p. 9), which will both enable photography of the south polar region of the planet and trim the spacecraft's trajectory for a third pass next March. The probe is expected to pass slightly less than 48,000 kilometers from the planet, much farther out than the 689 kilometers that separated them last March, but it should increase photo coverage of the sunlit side to 60 percent, as well as providing better viewing angles of areas already photographed. The only other of Mariner's instruments to scan the planet during the encounter will be an ultraviolet airglow detector seeking traces of hydrogen, helium, oxygen, neon and carbon in the thin atmosphere.

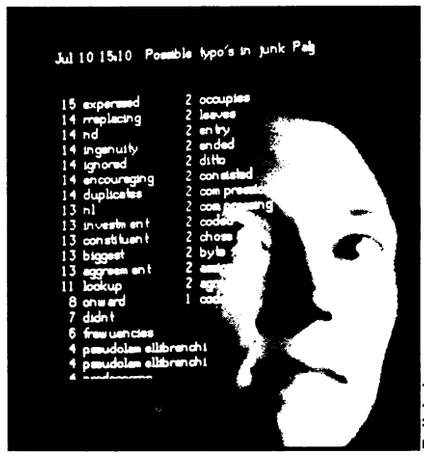
What worries flight controllers at Jet Propulsion Laboratory in Pasadena is that the spacecraft may run out of gas before it can come around a third time. Last Wednesday, an uncontrolled oscillation in the circuit that stabilizes Mariner on its roll axis caused the stabilizing jets to expend 0.54 pounds of the remaining 1.8 pounds of control gas. This should not affect the upcoming encounter, but will make things tight for the spring meeting. A previously developed solution involving orienting the spacecraft in a certain position (SN: 5/18/74, p. 319) was only partially applicable this time, and although a flight official estimates that next year's encounter could be accomplished on as little as 0.8 pounds of gas, a "strict conservation strategy" will be in force all the way. □

Searching out typos by computer

First newspapers and printing houses used computer tape to eliminate hand typesetting. Then they put in cathode ray terminals to eliminate hand copy-editing in the newsroom and hooked these to the computer tape operation. Now, Bell Labs of Murray Hill, N.J., has developed a way to computerize the proofreading operation and hook up all three.

By using standard medium-sized computers—found with increasing frequency in the publishing business—a 100-page book or a complete newspaper could now be proofread for misspellings and typographical errors in about three minutes. Two Bell researchers, Robert Morris and Lorinda L. Cherry, developed a special computer program to carry out this function for the Bell system's own extensive writing mill of in-house books, pamphlets and technical reports.

The system is fairly simple. The text is entered directly into the computer, either through a teletype machine or a cathode ray terminal (a television screen on which words appear as the author writes on a keyboard.) The computer then rapidly breaks each word into all of the possible two- and three-letter combinations and compiles them into a table of common word segments used in the article. It stores this in its memory—and one second has passed by. The computer then rescans the entire document and compares each wrong whole word to the table and assigns to each an "index of peculiarity." Two seconds. Then the computer prints out a list of the peculiar words in the order of their peculiarity, with the strangest one at the top—three seconds.



Cathode ray screen shows word list and computer-assigned index of peculiarity.

The author or proofreader now has a list of words to check for corrections, but does not know or need to know how many times each appeared or where they appeared in the text. He instructs the computer to correct each word wherever it appears, sends the document through one more time, and is finished.

The computer program will not catch punctuation or semantic errors, but should cut total proofreading time tremendously, a Bell spokesman says, and should be useful to large publishing concerns with electronic equipment. □