answer to a question. The young teachers were placed before a control panel with a 20-step dial that they believed set the level of the shock from slight to "extremely dangerous" (marked with the sketch of the head of a skeleton). As in Milgram's experiments, the machine did not actually transmit an electric shock, but the youngsters were convinced that it did, particularly when they heard the learners in an adjacent room pound the walls and scream in pain from steps 14 to 16, and fall silent after step 16 (as they were coached to do by the researchers).

All the while, the youngsters were consistently ordered to administer the shocks for the sake of the experiment, despite the sounds of pain they heard from the next room. A control group of children was given the option of either giving or not giving the shock when a mistake was made.

The researchers report in the July JOURNAL OF PERSONALITY AND SOCIAL PSYCHOLOGY that 73 percent of the test children continued to deliver shock all the way to the end of the scale, whereas only 16 percent of the control subjects did so. No significant differences were found between sexes or within the 10-year age range. Those youngsters who continued to administer shock above level 14 were classified as overobedient, because they went on with the test even though they could hear the protests and ultimate silence of their learners. In cases where the young teachers hesitated after hearing cries or reactions, they were urged on with orders such as, "The experiment requires that you continue," or, "You have no other choice but to continue." When asked after the sessions why they continued to punish the learners, 69 percent of the females and 40 percent of the males said it was because they were obeying orders, and 30 percent of the females and 60 percent of the males said it was because "punishment is beneficial for learning."

Yahya and Shanab, who is also on the faculty of California State University at Fresno, conclude "that this study has revealed not only that obedience and overobedience are culture free but that such behavior is observed very early in life." Such results, they add, identify orders as the critical variable and "rule out explanations that tend to depict humans as being aggressive in nature."

Milgram told SCIENCE NEWS he is "not surprised" that his findings appear to hold with children in a different culture. Children, he reasons, "have less reason not to be compliant than adults," who are more prone to conflict over "whether or not to go along with authority.

"I'm glad to see this [the experiment] done with a non-European culture," says Milgram, a psychology professor at the City University of New York's Graduate Center. "It adds a little strength or support to the universality of [my] findings" and shows that "obedience is not just a United States phenomenon." □

Science, the media and the paranormal

The NBC network's penchant for telecasting documentary-format features like "Outer Space Connection," "Bigfoot," "The Bermuda Triangle," and "In Search of Noah's Ark" was called "in scientific terms, a scandal."

Robert Sheaffer, a UFO analyst, described results of two of his recent investigations. One showed that a UFO report filed by Jimmy Carter when he was governor of Georgia, bannered by the National Enquirer last year and given front-page treatment by the Washington Post this year, was in fact a sighting of Venus. The other looked into a photo in the August SCIENCE DIGEST taken from space by Apollo 11. The photo as published contains a white spot the magazine labels "an unidentified object." Sheaffer's investigation revealed that the original NASA photo and negative contained no such white spot.

The magician James Randi described results of a demonstration by alleged French psychic Jean-Pierre Girard ("the man who lifts objects with his mind") conducted under strictly controlled conditions set up by Randi. During 3½ hours of attempts, Girard failed to produce any effects whatsoever. Randi also pointed to the stacks of books promoting paranormal claims compared with the modest few that critique such claims.

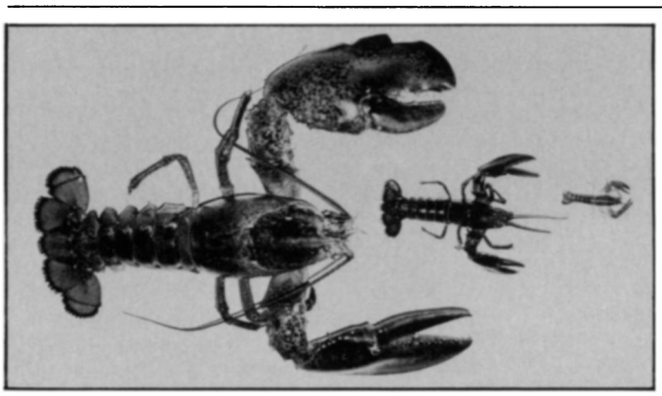
An article entitled "What Do We Really Know About Psychic Phenomena" in the August READER'S DIGEST was called "a serious act of journalistic imbalance" that presents hearsay as fact and that reports various "successful" experiments "without acknowledging that virtually all ... were subsequently proved to be inadequately controlled, inconclusive, and, in some cases, quite negative."

These critiques, analyses, and expressions of concern about media handling of claimed paranormal phenomena were presented last week in New York at a meeting and news conference called by the so-called Committee for the Scientific Investigation of Claims of the Paranormal. This is a self-appointed group of scientists, philosophers, science journalists, magicians and other investigators organized last year (SN: 5/29/76, p. 346). They are concerned about what they consider a flood of unevaluated claims about the paranormal put forward by proponents as facts.

The committee called upon the press and publishing industry to cooperate with the scientific community in providing "more responsible balanced treatment of claims of the paranormal" and urged educators to provide more instruction in the scientific method and in methods of critical thinking. "We are virtually overwhelmed by pseudoscientific, proparanormal propaganda."

Editorial reaction to the committee's plea has been mixed. The Washington Star chided the group for overseriousness and overkill: "It is classic gnat-killing by sledgehammer." The New York Times echoed most of the committee's concerns: "Science is not the be-all of existence, but its enemies can all too easily be the end-all." □

Lobster proportions dictate behavior



Fred Lang

Young lobsters are better suited for a quick escape; older lobsters for a fight. These lobsters are 41, 17 and 7 centimeters long.

Flight or fight? When a predator appears on the scene, choice of defense strategy had better be both rapid and wise. But animals don't always react in the same manner to the same threat. A lobster's response to attacking fish and octopuses shifts during its lifetime. When it is young, the animal generally chooses to tail flip out of a threatening situation. As it ages, it becomes more and more likely to stick around and put up its claws. Researchers at the Woods Hole Marine Biological Laboratory now relate this changing strategy to the shape and workings of the lobster as it grows from a 14-millimeter juvenile to a 90-centimeter adult.

In the escape response, the tail flip, contraction of abdominal muscles propels the lobster backward. Its effectiveness depends on the speed with which a nerve signal is conducted from the brain and the relative size of the abdomen. Fred Lang and colleagues find that the

nerve-conduction time remains at about 4 milliseconds until the animal is 5 centimeters long (the increase in diameter of the nerve axon compensates for the increased length of the nerve). However, the time required for the signal to reach the abdomen increases steeply for larger animals, reaching more than 16 milliseconds for a 20-centimeter lobster. As the animals age, the weight and length of the abdomen decrease relative to their total size, making the abdomen less able to propel the animal away from danger, the investigators report in the Aug. 12 SCIENCE.

The growing ferocity of the claws makes up for a less effective flight mechanism in old lobsters. Claw weight and length increase with age relative to the lobster's total dimensions. Furthermore, each claw specializes to act as either a crusher or cutter.

The behavioral changes are appropriate to these physical differences. Juveniles, 3 to 5 millimeters long, respond to a wooden rod with a tail flip 98 percent of the time. Adults, 17 to 25 centimeters long, tail flip only 18 percent of the time. The adult lobsters usually respond aggressively with raised, open claws.

Recent experiments, Lang says, indicate the change in defense strategy is gradual and reaches a minimum of about 10 percent tail-flip responses when the lobster is 90 centimeters long. The fraction of escape responses may still decrease, but more slowly, after that length.

The explanation for the switch is not that older animals are unable to flip their tails. When an adult loses its claws, it reverts to the tail flip as an escape mechanism. "Thus while the neural circuit for the reflex is intact and functional, it is simply not an efficacious response for a large, clawed animal," the researchers say.

Now the researchers are trying to determine the mechanism for the strategy change. Lang hypothesizes that nerve signals from the claws inhibit the tail-flip response. As the claws grow, they probably develop more sensory receptors and thus transmit more signals. Experiments in which sensory nerves are cut should shed light on this conjecture.

Crayfish, which have smaller claws than lobsters, have a somewhat different behavioral strategy. Like young lobsters, they are easily alarmed and use the tail-flip escape often. The nerve axons that carry signals to the muscle responsible for the tail flip take up a greater portion of the nerve cord than in lobsters, suggesting the greater importance of the tail flip.

The researchers propose that since different structures in animal bodies grow at different rates, growth rates can provide insight into behavioral strategies. "These results demonstrate that physical factors place constraints on particular behaviors," Lang and colleagues conclude. □

HEAO: One up and two to go

Anyone ever caught in dense fog will readily recall the profound revelations accompanying its dissipation: one suddenly sees the previously invisible detail and obtains a clearer impression of the terrain. To date, astronomers have largely labored within analogously obscured conditions. Earth's atmosphere—although it allows free passage to much of the electromagnetic spectrum—insidiously absorbs X-rays and gamma rays, and thereby renders astronomers blind to a great deal of incoming celestial information.

A promise of "clearer skies" rode with the successful launch last week of the first of three High Energy Astronomy Observatories—HEAO-A. Orbiting 240 miles above the ground and well-removed from the atmosphere's murky umbrella, the 3-ton satellite successfully began using its keen electronic eyes in a search for high-energy phenomena. If all continued to go as scheduled, it became fully operational on Aug. 18.

Many common astronomical bodies like stars radiate much of their energy as visible light. Studying this with conventional optical telescopes for several hundred years, astronomers have deduced an impressive corpus of knowledge.

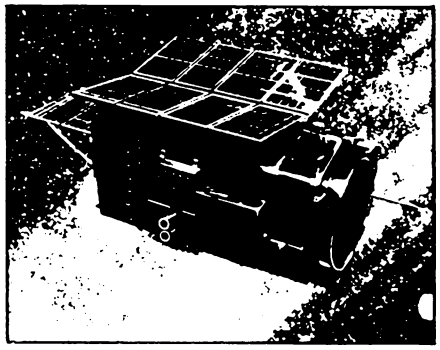
There are, however, exotic objects like X-ray busters, quasars and black holes, which emit tell-tale information about themselves via high-frequency radiation. Up until now, astronomers have garnered only a few peeks at the unobscured cosmos, using small sounding rockets, balloons and the Uhuru satellite, launched in 1972. Uhuru particularly distinguished itself by sighting some 339 X-ray-emitting objects, including a possible black hole in Cygnus X-1.

Uhuru's capabilities, however, pale by comparison with those of HEAO-A, which houses four separate experiments and will ultimately detect several times as many sources as did Uhuru.

The first experiment is designed to search the entire sky for any objects that discharge low-energy (150 electronvolts) to high-energy (20,000 eV) X-rays (wavelengths, 10 to 0.1 angstroms). The Large-Area X-ray Survey experiment is so sensitive, it will even detect an object that is only five ten-thousandth as intense as the Crab nebula.

The faceted, cylindrical satellite will be kept "looking" roughly along directions perpendicular to the earth-sun line. About this axis, it will rotate once every 30 minutes, enabling the experiment to scan the entire sky in just six months. (HEAO-A, however, is designed to live for a year.) The detector has a total viewing surface, arranged in seven proportional-counter modules of about 14,000 square centimeters—several times greater than Uhuru's.

A second experiment will survey the heavens for objects—both pointlike and diffuse—that emit anything from 10,000-eV X-rays to 10-MeV gamma rays (wavelengths, 0.1 to 0.0001 angstroms). The instrument is an array of scintillation counters—devices that produce detectable light whenever penetrated by a high-energy particle or electromagnetic radiation. With these, it will be possible to measure whether the incredible uniformity of the universal background radiation persists at gamma-ray energies. Also, the detector's electronic reflexes can respond to fluctuations in an object's emission that occur as frequently as once every 50 microseconds.


NASA

HEAO-A will see with an unclouded eye.

A third experiment will record the gross structure of the sky's X-radiation from 200 to 60,000 eV (wavelength, 10 to 0.01 angstroms). The experiment's proportional counters will define the celestial "topography" in X-rays, much as a terrestrial map indicates relief with isometric contours. And, importantly, the Cosmic X-ray experiment will also decipher what portions of this background radiation are actually due to the cumulative emissions of discrete sources—as opposed to those due to ubiquitous gas and dust.

The fourth experiment will provide accurate location measurements of X-ray sources whose radiation is between 1,000 and 15,000 eV (wavelength, 1.0 to 0.1 angstroms). It will not only determine positions of selected objects to within five arc-seconds, it will measure their angular sizes to within twice that accuracy—about one five-hundredth the apparent size of the moon. The experiment, as well as the entire satellite, orients itself using two star cameras that recognize key landmarks: well-known stars, visible to the naked eye.

The subsequent satellites, HEAO-B and HEAO-C, are scheduled to be launched in 1978 and 1979 respectively. The HEAO-B will carry a focusing X-ray telescope that will scrutinize the most interesting objects seen by its predecessor. The HEAO-C will do experiments involving virgin cosmic rays—that is, before they're altered as a result of charging through earth's atmosphere—and more extensive gamma-ray observations. □