that it is normally serial and have provided an experimental situation forcing the subject to view and recognize patterns serially and to reveal the order of feature processing by his eye movements. We have shown that, when perception is serial in this way, it tends to follow a fixed path from feature to feature, the scanpath, and we have explained this in terms of a general theory of pattern perception. It is difficult to explain the experimental results without recourse to some higher-level process involved in the perception and recognition of the patterns and any such process must probably have much in common with the theory we have proposed. Details of this and a related experiment, together with a fuller theoretical discussion, are presented elsewhere (*13*).

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Copulation and the Inhibition of Pregnancy in Rats

Postcopulatory genital stimulation has been suggested by Adler and Zoloth (*1*) to be contraceptive in the rat. In their experiment, each female rat was permitted five intromissions after the initial ejaculation. Three intromissions were reported sufficient to dislodge the vaginal plug. Manual stimulation applied to the cervix also necessitated removal of the vaginal plug. There is no mention of the effect of removing the vaginal plug when there was no other stimulation. That behavior disrupted pregnancy as claimed is not substantiated. I suspect the sperm were lost from the uterus when the plug was removed, if sperm ever reached the uterus. No evidence was presented to show whether or not sperm arrived in the uterus in 15 minutes when the vaginal plug was in place. The importance of the vaginal plug has been demonstrated by the finding that removal of the seminal vesicles and coagulating glands which form the plug results in a reduction in fertility (*2*).

The evidence presented on results of double matings to males whose offspring were distinguishable does not support the conclusions. Since sperm from certain males are more likely to fertilize eggs than sperm from other males when used in direct competition or when given an advantage in time or order, there is no reason to invoke postcopulatory inhibition (*3*). That pregnancy was not disrupted by copulatory behavior is shown by the fact that litters of normal size resulted from matings with the second male [table 3 in (*1*)]. Removal of the vaginal plug, whether by man or by rat, may interfere with retention of sperm, but it does not appear to inhibit pregnancy.

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In our paper (*1*) we demonstrated that female rats receiving cervical stimulation after mating did not have sperm in their uteri at a time when unstimulated female rats did have sperm (1 hour after ejaculation). Furthermore, the stimulated female rats (although pseudopregnant) had a reduced number of pups in their uteri 20 days after mating. We concluded that critical cervical stimulation after ejaculation disrupts the pregnancy that normally follows an ejaculatory series, probably by interfering with the function of the vaginal plug and subsequent sperm transport.

Dziuk agrees with our facts and our hypothesis concerning the mechanism (*2*). He says, "Removal of the vaginal plug, whether by man or by rat, may interfere with retention of sperm. . . ." However, he concludes, "That behavior disrupted pregnancy as claimed is not substantiated." Dziuk is actually making three related criticisms concerning the nature of what we demonstrated.

Dziuk's basic disagreement with us is semantic; it concerns the "definition" of pregnancy and the functional role of behavior in the regulation of pregnancy. In the broadly biological sense, pregnancy is the total physiological response which results in the birth of offspring; it includes both the secretion of gestagen and the process of sperm transport and fertilization. It is important to analyze the detailed mechanisms of these phenomena, but it is just as important to integrate, functionally, the animal's behavior into the total pattern of pregnancy. Any factor that interferes with the normal physiological course of events between a male's ejaculation and the subsequent birth of his litter 3 weeks later can be said to "inhibit" or "prevent" the pregnancy that the male began. The important point in our study is not that an experimenter can artificially disrupt a physiological system (sperm transport) but that the male rat can and does have this effect. That the male has this inhibitory effect on pregnancy has potential significance for population regulation and the evolution of rodent sexual behavior (*1*).

In the second part of his criticism, Dziuk goes on to cite the classic experi-

ment of Blandau (*3*) in which the deposition of a vaginal plug was shown necessary for sperm transport. Subsequent work (*4*) has shown that a number of intromissions prior to ejaculation are also necessary for sperm transport to follow ejaculation. Implicit in these studies was the idea that sperm were transported into the uterus within a matter of seconds after ejaculation (*5*). Blandau says, for example, "It thus seems certain that at the time of ejaculation the spermatozoa of the rat are normally propelled in masses through the cervical canals into the uterine cornua . . ." (*3*, p. 263).

In our study (*1*), we found that an immediate, permanent ingress of sperm does not automatically follow ejaculation and deposition of a plug, and that copulatory behavior itself may inhibit the ingress of sperm. Current investigations indicate that sperm do not normally reach the uterus in maximum amounts immediately after ejaculation. [During the first 6 minutes after ejaculation, female rats had on the average 68×10^5 sperm ($n = 9$). Females killed from 6 to 8 minutes after ejaculation had 498×10^5 sperm in their uteri ($n = 8$).]

Finally, Dziuk faults our interpretation of our double-mating experiment, stating that pregnancy could not have been disrupted by copulatory behavior because "litters of normal size resulted from matings with the second male." This is precisely what one would expect since the second male's ejaculation was not followed by more copulatory stimulation. Dziuk cites his and other's work on cattle and rabbits (*6*) [species in which the males do not deposit solid, coagulating vaginal plugs as male rats do (*7*)]. He correctly states that several factors may influence which male's sperm ultimately fertilize a female's eggs (for example, the sperm's time in the uterus and the superiority of one type of sperm over another). In fact, in our study, the pigmented male's sperm are normally at a competitive disadvantage with respect to the albino male's sperm; the only case in which the pigmented sperm "win out" is when the pigmented male rat begins stimulating the female rat soon after the albino male has ejaculated. (Dziuk's reference to capacitation involved hours, not minutes.) We conclude that postejaculatory cervical stimulation is contraceptive in rats; it inhibits the effects of a previous ejaculation.

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Tektites from the Earth

Recently, O'Keefe (*1*) has published another report in which he tries to maintain that tektites come from the moon, and, as usual, he has attempted to answer my argument for the low probability of objects coming from the moon and arriving on the earth in a localized area (*2*). He compares an unusual rock of the moon—in fact, parts of the unusual rock of the moon—with some unusual tektites. He finds rough agreement for the more abundant elements and no evidence for agreement for the less abundant ones. He mentions Taylor's (*3*) work in a reference but does not discuss his results. Taylor found a rock in Australia, a subgraywacke (which is a muddy sandstone), which for some 45 or 50 elements agrees in composition remarkably well with the abundant class of tektites found in that area. Taylor did not maintain that this rock was the particular one that produced the tektites, nor did he maintain that the tektites came from material in Australia. Subgraywacke is rather a common form of sandstone. O'Keefe's handling of the data, as has been usual for 10 years both by him and by others, is of a very partisan character, and he has not considered the high improbability of the lunar origin. The rocks of the moon, at the present time, would seem to indicate that tektites have not come from the moon.

O'Keefe proposes that tektites are propelled from the moon by volcanoes (*1*). It would seem likely that this process, requiring a velocity of at least 2.38 km/sec for the objects expelled, would probably be produced only by rather large, vigorous volcanoes and only in a vertical direction from the lunar surface. At a velocity of 2.38 km/sec, the objects expelled would travel in orbits near that of the moon, since they would have the angular momentum of the moon.

If the object were propelled in the forward direction from the moon at a velocity greater than 2.60 km/sec, it would leave the earth-moon system. On the other hand, if it were propelled in the backward direction at a velocity of 2.60 km/sec, it would fall directly to the earth. If we assume that it were expelled by a volcano in other areas of the moon and in various directions at velocities between 2.38 and 2.60, it would surely remain in the earth-moon system with orbits quite different from that of the moon. If the objects were to hit the earth, very special directional velocity considerations are required to make a direct hit on the first pass. My remarks are, of course, based on the assumption that the moon moves in a circular orbit, which is approximately true. If the object should be propelled with high velocity, it is quite easy to calculate the probability that it would be captured by the earth, since it is only a matter of the angle subtended by the earth at the moon. In this case, with an equal probability of the objects' being propelled in all directions, it would mean that about one in ten thousand would arrive at the earth. As O'Keefe states, there is a focusing effect of the earth's gravitational field for low velocities; hence, the probability would be somewhat greater than this. What appears to be true is that one must expect that a great variety of objects of various kinds would be propelled from the moon on the basis of a reasonable probability and would move in a great variety of orbits in the earth-moon system. They would cross the orbit of the moon, of course, having originated at the moon, and pass near it; they would then be captured by the moon, thrown out of the earth-moon system by interaction with its gravitational field, or thrown into orbits such that they would hit the earth. On the basis of this probability, we would expect tektites to be found in terrestrial deposits of all ages on all parts of the