

through imitation. Cornetz does not believe that the social coöperation of ants is altogether a result of individual action, but points out that there may be much less mutualism than is generally believed.

Cornetz (8) believes from a study of *Myrmecocystus* that this ant has, to a greater or less extent, an impression of the territory immediately surrounding the nest entrance, but that this memory is inconstant and of short duration, especially when based upon the visual sense. When the memory is olfactive it may persist for a long time.

Cornetz (10) compares the sense of direction of the rat and the ant. The rat observed by Szymanski (Essais pour exprimer par des nombres le rapport entre des stimulants de genres différents. *Archiv. f. d. ges. Physiol.*, Bonn, 1912) when liberated in a box containing a pan of water wandered about until it found this, but each succeeding time, by the "dropping of useless movements," shortened the distance traveled, till it finally went directly to the water. On each trip the rat had revived impressions that had been received on the previous trips. The ant, on the other hand, is guided by an impression received on each outgoing journey, and revived on the homegoing route. To what extent the ant is able to remember a direction "to the right" or "to the left" is still completely unknown, but Cornetz ventures the hypothesis that the ant does not need a memory, but possesses "en soi" a sense of direction. This he believes to be not at all impossible, though hard to conceive.

Cornetz (10a) experimented on the estimation of distance in ants. Workers of *Pheidole pallidula* away from the nest were decoyed by little pieces of cheese on to a knife blade, and taken to a point at a short distance away. When the ant dismounted from the blade it set out in a line parallel and opposite to the outgoing trail, reversing the direction of march in the manner usual to ants, but owing to the change of the starting point, not in the direction of the nest. Cornetz made careful comparison of the distance traveled on the wrong trail, and the distance to the nest if the ant had not been moved to another starting point. Where both trails were on the same kind of material, there was an error of from one-tenth to one-fifth of the distance, though one ant erred by three-fifths, which is an abnormal amount. When the trails were different (one on cement and the other on