Zajonc et al (1969)

According to Gates & Allee (1933) the presence of others can have a negative effect on performance. Conversely, others argue the presence of others can lead to improvements in performance. Zajonc (1965) suggested these two seemingly conflicting results could be reconciled if one assumed the presence of others to be a source of general drive (D).

In 1933 Gates and Allee reported a study on the maze learning of isolated and grouped cockroaches in which they observed a clear inferiority of performance of the grouped subjects. They attributed these effects to distraction, saying that cockroaches learning in groups were responding not only to the physical topography of the maze but to the social situation as well, and that the 'chemical traces introduced by one of the other cockroaches simultaneously occupying the maze may have acted to interfere with orientation'. Gates and Alice used an E-shaped maze suspended over water. Light served as a noxious stimulus, while an opaque bottle located in the central portion of the maze provided the subjects with the only means of escape. The procedure entailed placing the cockroach (or cockroaches) at one of the terminals of the maze and observing the time required to reach the goal bottle. Because of the many spatial alternatives available—at first all equally inviting— many response tendencies were elicited that were not correct. In fact, of the many ways in which the cockroach could proceed in the E-maze, only one led to escape, and hence to what the experimenter would consider as appropriate behaviour.' To the extent that the presence of conspecifics did act as a source of general drive (D), these many 'inappropriate' response tendencies were energised, delaying the emission of the appropriate one.

Zajonc et al (1969) proposed that if a situation in which the cockroach's response tendencies would be largely 'correct' or 'appropriate' could be contrived, an increment rather than a decrement in performance should be obtained under social conditions. They proposed that in comparison with maze performance, this situation would provide a rather stringent test of the drive theory of social facilitation.

This study reports two experiments in which the performance of cockroaches in a maze and in a runway was compared under various social conditions.

In experiment 1:

The independent variables (IVs) were:

(i) Whether the cockroaches performed alone or in pairs (32 of the cockroaches)
(ii) Whether the cockroaches performed alone or in pairs with an audience (40 of the cockroaches)
(iii) Whether the cockroach/cockroaches had to traverse a maze or a straight runway.

The dependent variable (DV) was the starting latency and the time taken to reach the goal box so the guillotine gate could be lowered.

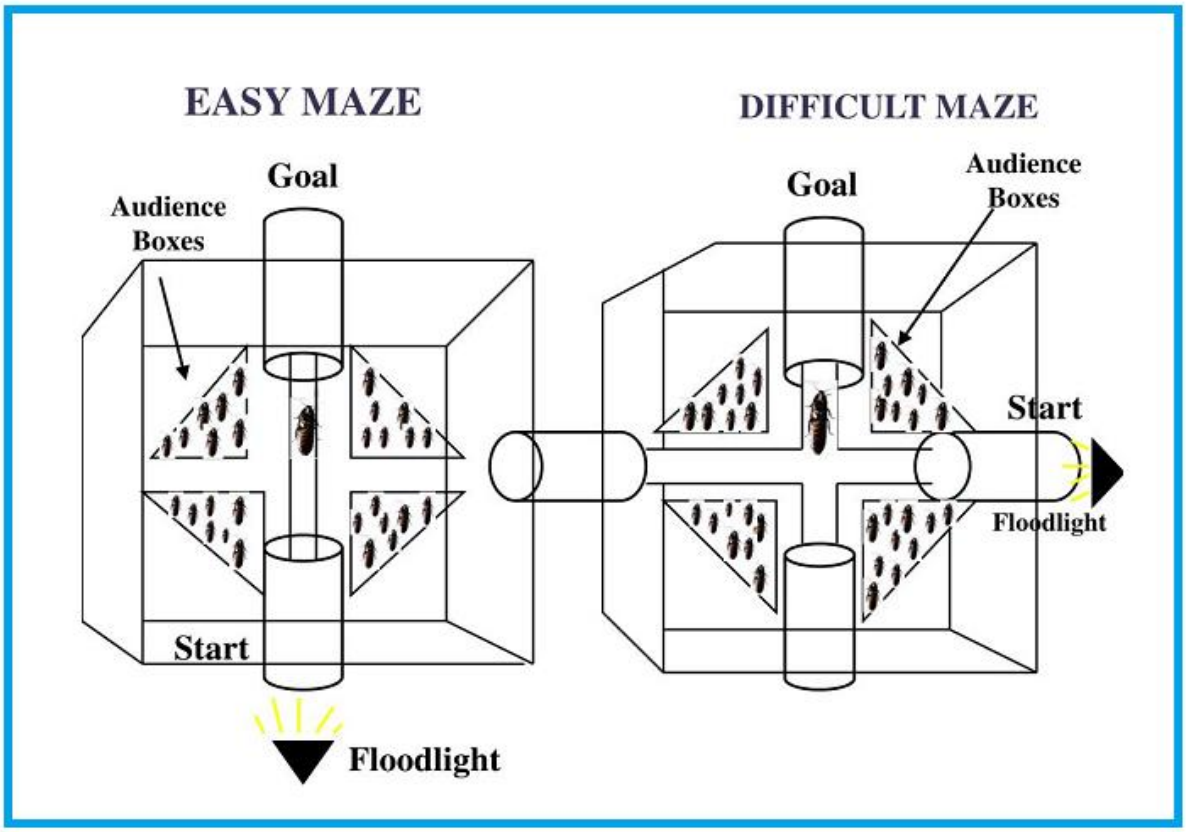
In experiment 2:
The independent variables (IVs) were:

(i) Whether the cockroaches had to traverse a maze or a straight runway

(ii) Whether the cockroaches had to traverse a maze / runway outfitted with mirrors alongside the vertical walls; whether the cockroaches had to traverse a maze / runway stimulated by the presence of olfactory cues associated with their conspecifics' or whether the cockroaches had to traverse a maze / runway alone, in socially neutral conditions.

The dependent variable (DV) was the starting latency and the time taken to reach the goal box so the guillotine gate could be lowered.

They created an easy and difficult maze (as illustrated).



Experiment 1 used 72 adult, female cockroaches. For at least one week prior to the first experimental trial they were housed in individual mason jars with screened lids and kept in the dark with a relatively constant temperature of 75 degrees Fahrenheit. They were fed an 'ad lib' diet of peeled and sliced apples – meaning this food was available at all times with the quantity and frequency of consumption being the free choice of the cockroach.

They wanted; (i) To test the drive theory of social facilitation (ii) To determine if socially mediated effects obtained in cockroaches when the participants could not profit from directive cues provided by companions (i.e. an audience) would affect performance times.

Before each trial the runway (or the maze) was swabbed with alcohol and then allowed to dry thoroughly. The starting box and goal box were swabbed in the same manner before each set of 10 trials. The cockroach was placed in the starting box which was covered with an opaque container similar to the one that covered the goal box. Each trial began by removing the cover, turning on the floodlight, and removing the guillotine door separating the opening in the starting box from the runway or the maze. The floodlight was always in line with the runway or the maze and 10 inches directly behind it. The trial was terminated when the cockroach (or the pair of cockroaches) entered the goal box and the guillotine gate was lowered behind it (or them), or in 5 minutes—whichever was earlier.

For the 32 animals involved in the co-action condition and the 40 that were involved in the audience condition:

(i) Half of the cockroaches worked in the runway and half in the maze.
(ii) In addition, within each combination of condition and task, half of the animals were run in the alone condition and half in the social condition.
(iii) In the co-action condition participants were placed into starting boxes in pairs. For purposes of identification they were marked with airplane dope, one white and one blue.
(iv) In the audience condition 10 adult female were placed in each of the four audience boxes. A control group of 20 cockroaches, which was not to be exposed to a passive audience, worked with audience boxes in position, but empty and clean.
(v) All cockroaches run in the audience condition and in their proper control conditions were run individually.
(vi) Starting latencies to the nearest second and total running times to the nearest tenth of a second were recorded. Starting latency consisted of the interval beginning with the opening of the guillotine gate of the starting box and ending at the time the last part of the roach's body left the starting box.

In all conditions the subjects were given 10 consecutive trials, all separated by 1-minute inter-trial intervals. This meant cockroaches were observed alone and under two types of social treatments, co-action and audience whilst they traversed either a straight runway or a maze.

In experiment 2, 180 female cockroaches were used. All cockroaches were kept in individual mason jars for 4 days prior to the experiment. 1/3 (60) of the cockroaches were assigned to the mirror condition (Mi), 1/3 (60) to the odour condition (Od) and 1/3 (60) to the solitary (alone) condition.

This experiment attempted to determine if socially mediated effects such as those obtained in Experiment 1 would be produced if the immediate presence of conspecifics (members of the same species) were somehow curtailed or reduced.

Two conditions were employed. In both conditions there were no other cockroaches beside the participant cockroach. Both dealt with some components of the presence of conspecifics, one emphasising its cue effects, the other emphasising its energising (general arousal) effects. Therefore, in the first the insects ran in mazes and runways which were outfitted with mirrors alongside their vertical walls. In the second treatment regular runways and mazes were utilised, but the animals were stimulated by the presence of olfactory cues associated with their conspecifics.

These conditions were compared with one in which the insects were observed under solitary and socially neutral conditions.

The results showed cockroaches running in the maze co-action condition took longer to reach the goal box than cockroaches running alone. However, cockroaches running in the runway co-action condition took less time to reach the goal box than the cockroaches that ran alone. The same pattern of results was found for the audience condition.

The study concluded that the presence of an audience of conspecifics is a sufficient condition for the enhancement of dominant responses, such that the performance of the subject in a one-alternative task is improved and the performance of the subject in a multi-alternative task is impaired. Also, the presence of others can enhance performance in either well learned or instinctive behaviours. These findings have many applications to sports performance with human athletes.