

[Note: This is an extract from a General Training Reading text on the subject of understanding bee behaviour. The text preceding this extract described Karl von Frisch's experiments and his conclusions about two bee dances.]

At first, von Frisch thought the bees were responding only to the scent of the food. But what did the third dance mean? And if bees were responding only to the scent, how could they also 'sniff down' food hundreds of metres away from the hive*, food which was sometimes downwind? On a hunch, he started gradually moving the feeding dish further and further away and noticed as he did so that the dances of the returning scout bees also started changing. If he placed the feeding dish over nine metres away, the second type of dance, the sickle version, came into play. But once he moved it past 36 metres, the scouts would then start dancing the third, quite different, waggle dance.

The measurement of the actual distance too, he concluded, was precise. For example, a feeding dish 300 metres away was indicated by 15 complete runs through the pattern in 30 seconds. When the dish was moved to 60 metres away, the number dropped to eleven.

Von Frisch noted something further. When the scout bees came home to tell their sisters about the food source, sometimes they would dance outside on the horizontal entrance platform of the hive, and sometimes on the vertical wall inside. And, depending on where they danced, the straight portion of the waggle dance would point in different directions. The outside dance was fairly easy to decode: the straight portion of the dance pointed directly to the food source, so the bees would merely have to decode the distance message and fly off in that direction to find their food.

But by studying the dance on the inner wall of the hive, von Frisch discovered a remarkable method which the dancer used to tell her sisters the direction of the food in relation to the sun. When inside the hive, the dancer cannot use the sun, so she uses gravity instead. The direction of the sun is represented by the top of the hive wall. If she runs straight up, this means that the feeding place is in the same direction as the sun. However, if, for example, the feeding place is 40° to the left of the sun, then the dancer would run 40° to the left of the vertical line. This was to be the first of von Frisch's remarkable discoveries. Soon he would also discover a number of other remarkable facts about how bees communicate and, in doing so, revolutionise the study of animal behaviour generally.

* Hive – a 'house' for bees; the place where they build a nest and live

Questions 38 – 40

Complete the sentences below.

Choose **NO MORE THAN TWO WORDS** from the text for each answer.

Write your answers in boxes 38-40 on your answer sheet.

- 38** Von Frisch discovered the difference between dance types by changing the position of the
- 39** The dance outside the hive points in the direction of the
- 40** The angle of the dance from the vertical shows the angle of the food from the