

Bumble Bees Play With Balls and May Even Enjoy It
From [Marc Bekoff, Psychology Today / Animal Emotions](#)
November 2022

If we call an activity "play" for mammals, is it also play and fun for bees?

KEY POINTS

- Research on bumble bees shows we can call object manipulation "play."
- A taxonomic tree of play is much more expansive than previously thought.
- Research into the minds of highly diverse animals shows widespread cognitive skills, emotional lives, and sentience.

Bees are amazing animals. Detailed studies show that they enjoy rich and deep social, cognitive, and emotional lives. They display dopamine-based [positive emotions](#), get [depressed](#), [anxious](#), and pessimistic, are able to solve rather complex problems with which they're confronted, and their [complex and enigmatic minds](#) are hard at work both [inside and outside](#) of their hives.¹

I've long been interested in the evolution and ecology of play behavior in various animals, especially canids (members of the "dog family")—what it looks like, what it's good for, and it is more common among younger members of a given species—and a recent study on bumble bees shows that object manipulation—specifically ball-rolling—fulfills criteria that researchers use to define object play.² But do bees really play? Are they having fun when they roll balls here and there?

A rigorous [study](#) by Hiruni Samadi Galpayage Dona, who works at the School of Biological and Behavioural Sciences at Queen Mary University of London (UK), and her colleagues called "Do bumble bees play?" The detail with which this study was conducted sets a great example and a high bar for future studies in this and other areas of cognitive ethology.

The researchers asked the following three questions.

Do bumble bees engage in play-like object manipulation?

They do. In this part of the project, 45 captive honeybees were observed in a foraging area without food. Their behavior was recorded and filmed. The bees were trained to roll inedible wooden balls and were awarded food. Many of the bees went straight to the balls for no apparent reasons other than perhaps it was fun to roll them here and there. To reduce stress, the researchers fed the bees right after the experiment.

They wrote: "A total of 910 ball-rolling actions by 45 bumble bees were recorded. Individual bees rolled balls between one and 44 times on an experimental day and between one and 117 times across the whole duration of the experiment. Most bees (37/45) rolled balls for at least an additional day after feeding in the foraging area and 29 bees for at least two additional days after feeding."

Does age influence engagement in ball-rolling activity?

It does. Ball-rolling was observed more in younger bees and was age-dependent, similar to what has been seen in many other animals.



Ball-rolling action. The nine panels show the sequence of a ball-rolling action over time lasting, in this instance, approximately 4 s (timestamps in red at top left). The bee (a) approaches the wooden colored ball while facing it, (b) touches the ball with her forelegs, (c) holds onto the ball using all of her legs, (d–h) rolls the ball past the yellow ball and (i) finally detaches from and leaves the ball.
Source: "Do bumble bees play?," Open access, Creative Commons, CC BY 4.0

Can ball-rolling behavior act as an unconditioned stimulus?

In another experiment, 42 bees had a choice of going to two different colored chambers, one was blue and the other yellow. Only one of the chambers had balls in it. After the balls were removed, bees were given a choice of going to either the blue or yellow chamber, and they preferred to go to the chamber that previously had the balls in it. The researchers note: "Despite an obvious overall bias for yellow (Fig. 10), which chamber was associated with ball rolling had a clear effect on bees' choices during the test. These results again suggest that bumble bees find ball rolling rewarding."

Sex differences were noted—male bumble bees rolled the balls longer than females.

So, do bumble bees play with objects and enjoy doing it?

The results of this study show they do, as do many other animals. I received a few emails asking something like, "Do you think the bees are really playing?" I do believe so and agree with the researchers that ball rolling by bees fulfills the criteria of animal play that are applied to other animals—it's voluntary, spontaneous, and inherently rewarding. The bees weren't rewarded for pushing the balls, it wasn't stereotyped, and there were individual differences among the bees. It also occurred when the bees weren't stressed.

Of course, it is more difficult to know if bees enjoy playing with objects, as do dogs and other vertebrates who clearly show signs that they're happy, having fun, and enjoying doing something. But, to be fair to the bees, it's best to keep the door open concerning the possibility of "bee joy" and other positive bee (and perhaps other insect) emotions. Other scientists agree. Nothing is lost by doing so.

What might a taxonomic tree of play look like?

I look forward to more studies on bees and insects to learn just how broad-based their cognitive and emotional capacities are. With a rapidly growing database in the field of cognitive ethology that shows widespread and sophisticated cognitive skills, deep emotional lives, and [sentience](#) among diverse nonhumans, including insects, it wouldn't be all that surprising to learn that a taxonomic tree of play is much more expansive than previously thought.

There are many so-called "surprises" lurking in the minds of other animals.⁴ So, let's do the necessary work to learn more about them and put aside speciesist prejudices that members of certain species simply cannot and do not experience a wide range of emotions.

References

- 1) For more information on the complex social, cognitive, and emotional lives of bees click [here](#).
- 2) For detailed discussions of various aspects of animal play see Robert Fagen's *Animal Play Behavior*, Gordon Burghardt's *The Genesis of Animal Play: Testing the Limits*, and my and Colin Allen's "[Intentional Communication and Social Play: How and Why Animals Negotiate and Agree to Play](#)" and click [here](#).
- 3) The abstract for the study reads: A variety of animals have been found to interact with and manipulate inanimate objects 'just for fun', that is, to play. Most clear examples of object play come from mammals and birds. However, whether insects interact with inanimate objects as a form of play has never been systematically examined. Here, we show that rolling of wooden balls by bumble bees, *Bombus terrestris*, fulfils behavioural criteria for animal play and is akin to play in other animals. We found that ball rolling (1) did not contribute to immediate survival strategies, (2) was intrinsically rewarding, (3) differed from functional behaviour in form, (4) was repeated but not stereotyped, and (5) was initiated under stress-free conditions. Through the design of the experiment and with the support of behavioural observations, we excluded the possibilities that ball rolling was driven by exploration for food, clutter clearing or mating. Similar to vertebrate play, we also found age and sex differences for ball rolling by bumble bees: younger bees rolled more balls than older bees and male bees rolled individual balls for longer durations than females. We explicitly show that ball rolling is itself a rewarding activity. After being trained to find freely movable balls in one of two differently coloured chambers, bees showed a preference for the colour of the chamber where they had rolled balls. Our results contribute to the question of sentience in insects and lend further support for the existence of positive affective states in these animals.
- 4) [Manta Ray Fishes Make Friends—and It's Not Very Surprising](#); [Ants Rescue Sibs From Spider Webs and Surprise Us Once Again](#); [Marmosets Surprise Researchers By Sharing Food in Private](#); [Emotional honeybees and brainy jellyfish: More "surprises" in animal behavior](#).

[The Fascinating Complex Minds of Bees and Why They Matter](#).

[Happy Bees: Bumblebees Show Dopamine-Based Positive Emotions](#).

[What Does It Feel Like to Be a Honeybee?](#)

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Morell, Virginia. Don't worry, bees are happy. *Science*, September 29, 2016.