Is it playtime yet? Observing behavior in *Octopus vulgaris*

Erin Spencer, College of William and Mary

Kuba, M. J., Byrne, R., Meisel, D., & Mather, J. (2006). When do octopuses play? Effects of repeated testing, object type, age, and food deprivation on object play in *Octopus vulgaris*. *Journal of Comparative Psychology 120*(3), 184–90.

Animal intelligence has long been of interest to scientists and non-scientists alike. As humans, we define ourselves by being able to think, question, create, and solve problems. The study of behaviors throughout the animal kingdom helps us grasp the concept of intelligence and provides insight into our own evolutionary past. Often, these questions focus on our closest relatives – the vertebrates. But in recent years, intelligence studies have shifted to one of our more distant invertebrate relatives: the octopus. Recognized for its highly developed problem solving abilities, the study of octopus behavior has changed the way scientists perceive the evolution of intelligence. Recently, studies have delved into something we may not immediately think of as a highly advanced behavior – play – to learn even more about these complex invertebrates.

Previous studies suggested octopuses exhibit basic exploratory play behaviors. However, these studies used octopuses that were almost domesticated due to their extensive interactions with researchers. In 2006, Dr. Michael Kuba and his team set out to design an experiment that attempted to test natural play behavior in wild-caught animals. The goals of the experiment were to record presence of play behavior in octopuses under controlled conditions, examine how play behavior changed over time in constant conditions, and determine the influence of hunger level, age, and sex on play behavior.

Kuba collected fourteen wild octopuses of differing age and sex. Seven were male, seven were female, seven were subadults (mantle lengths from 4-7 cm), and seven were adults (mantle lengths 11-17cm). To keep behavior as natural as possible, all octopuses were kept in the same conditions and had minimal contact with humans. To test play behavior with non-food items, two types of Lego blocks were dropped in the tank, one smooth black and white Lego cube, and one blue snowflake Lego construction. A video recorder was then used to monitor octopus behavior. Behavior was classified on a scale of zero to four, where zero indicated the animal simply holding the object in its tentacles, and four indicated clear play

behavior. Play behavior included the animal towing the object across the tank for more than 30 seconds, pushing or pulling it more than 5 times, and passing it back and forth between arms more than 7 times (Fig 1).

Nine subjects exhibited Level Three behavior, also known as play-like behavior. Although feeding level, sex, or age did not have an effect on the amount of play behavior, play did increase over time. The occurrence of Level Zero interactions decreased over time, and the amount of play-like behavior increased from the third day to the sixth day of the experiment. There was a slight dip in the occurrence of play-like behavior on the last day of the seven-day experiment.

It seems that play behavior follows a specific sequence. First, the animals must recognize and learn to manipulate the object. Then, after a period of more in-depth exploration of the object, the animals transition to exhibiting play-like behavior. Additionally, the subjects treated their food and Legos differently. All subjects showed only Level Zero or One Level interactions with food, which included eating, exploring, or ignoring the item, but not play. The difference in behavior indicates they have the cognitive ability to distinguish between prey and non-prey items. In this study, octopuses exhibited curiosity, the ability to learn, and a desire to play with foreign objects – three traits that have not been traditionally associated with invertebrates.

These data suggest we have to rethink our theories about where play comes from. To date, play has only been recorded in vertebrates and mollusks, two taxa that split over 1.2 billion years ago. Considering that none of the taxa in-between these two seem to play, either play behavior evolved with the common ancestor and then was lost by all taxa except for two distantly related ones, or play behavior evolved independently in the two groups. In following the principle of parsimony, the least complex explanation should be preferred, and therefore it is unlikely that this behavior originated with their common ancestor. Somehow, octopuses have evolved a cognitive ability that was once thought to be unique to mammals.

Despite the evidence that play behavior occurs in octopuses, very little is known about the specific adaptive function of play. One theory is that because octopuses are heavily dependent on learning to react to their surroundings for protection from predators, play allows

them to be more psychologically flexible by interacting in new, varied experiences. The fact that play behavior was not seen with food items supported the theory that play emphasizes interactions with new items. Perhaps something they learn through play behavior, such as how to pick up, tow, and hold a shell against their body could help them in defensive interactions in the future.

Clearly, research needs to be done to learn more about the origins of play behavior and its adaptive functions. Similar experiments should be conducted with other Cephalopods to see if play behavior present in other orders besides Octopoda. This would provide other clues as to the evolutionary origins of invertebrate play. Although this experiment determined there was no difference in the rate of adult play compared to subadult play, additional experiments should look into the different types of play in the two age groups. Play could serve different functions at different ages and perhaps is exhibited differently as age increases. This would provide insight into the more adaptive side of play behavior.

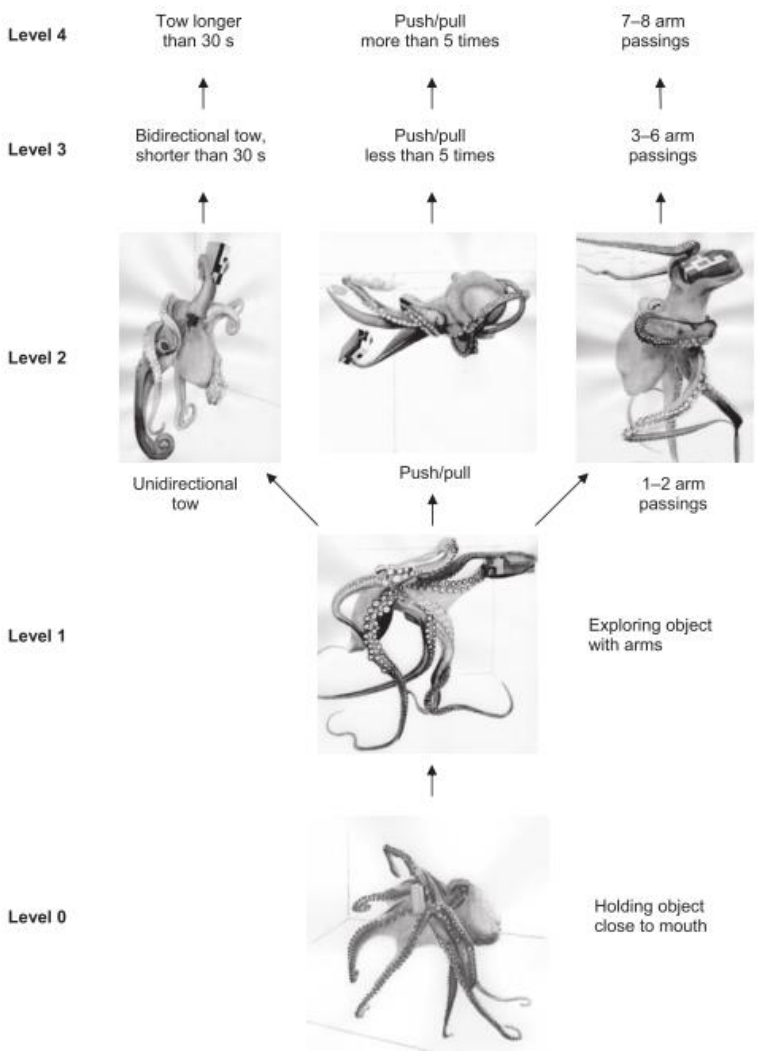

Fig 1. The criteria for play behavior on a scale of 0-4. Level 2 illustrates three types of exploratory behavior observed. Each of these behaviors, if repeated many times or maintained for a specific duration, could be considered play or play-like behaviors.