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A Game of Hide and Seek: Object Permanence in Dogs

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The present study looked at the effect external cues have on dogs' performance during object permanence tasks. Three domestic dogs of different breeds and ages were exposed to two different situations, in both the dogs had to find a toy they saw the experimenter hide behind one of three panels. The first situation consisted of the researcher standing next to the correct panel, and the second one consisted of the researcher standing next to an incorrect panel at the time of search. The results suggest that dogs lack of representational thought and that their performance is based on external cues such as the experimenters' position, the dogs search for the toy where the experimenter was standing the majority of the times. It is suggested to investigate the role of reinforcement in the task, as well as to determine if different types of cues have any effect on performance as well.

Through time dogs have shown to be intelligent animals, they recognize people, voices, they have a great olfactory system, some of them are great swimmers, hunters, trackers, most of them have really good physical abilities, they fetch, they learned basic obedience commands, they have emotions they used in their interactions with humans, and they even find hidden objects. This last one, keeping track of objects is an important skill for many species, especially because it is strongly linked to foraging as they have to remember where they saw food and in which places they have already been looking for it (Barth et al, 2006). The ability to remember where a hidden object is and find it is one of object permanence and displacement. This concept began with Piaget (1937/1954) when he developed his staged like infant development where he mention object permanence as an important ability to determine the stage the child was in (Collier- Barker et al, 2004). Piaget then conceived a task to measure this ability, the Object Displacement task. Here the child sees the experimenter hide a desire object under a displacement container, then he moves the container behind one of three boxes, empties the displacement container
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and then shows the child the empty container. The child must then indicate where the
object is. This task is known to provide evidence of representational thought. (Piaget
1954). I set out to find if dogs' performance in an object permanence task is due to actual
mental representation, or if there are external factors that aid their performance.

Collier-Barker et al (2004) tested dogs for invisible displacement in a series of
experiments. In experiment 1 they tested visible displacement in contrast with invisible
displacement where performance yielded positive results for both tasks. In experiments 2,
3 and 4, researchers controlled for external cues, and modified trials to contrast results.
They added elements to the apparatus such as curtains, they covered the experimenters
face, they removed the displacement object from the setup after moving the ball behind
one of the boxes, or they moved it away from the correct box and left it adjacent to an
incorrect box. In general the results showed that performance was affected by the changes
in the set up and by the external elements added or removed from it. It was concluded
that when motivated, the dogs would find the object, but not on the basis of mentally
reconstructing the objects' past trajectory, but rather rely on cues in the environment. At
the same time it was clear that dogs don't search at random (Collier-Barker et al 2004)

Fiset and Gagnon (2000) conducted a study to investigate what type of spatial
information controls a dogs' search behavior when they have to locate a spatial location
where they saw an object move and disappear. They did a series of experiments where
they controlled for allocentric and egocentric information that could aid the dogs to
determine where the object had been hidden. The results suggested that dogs encode both
allocentric and egocentric information to locate a spatial position, nevertheless dogs
Object Permanence demonstrated to use mostly egocentric information to aid their performance, and only when all egocentric information was controlled by the researchers, dogs resorted to the use of allocentric information.

On a different study Hare and Tomasello (1999) tested dogs on the basis of human and conspecific social cues to locate hidden food. They used two different cues: gaze direction where the informer would stand equidistant to two hiding places looking at the correct one, and local enhancement where the informer would stand closer to the correct box. Also they used two different informers: a human and a conspecific. The results of this study showed that dogs are very good at using social cues, 8 of the 10 dogs used in this study performed above chance; dogs used human cues even when the human informant was totally unfamiliar. A new finding from this study was that dogs are also good at using cues provided by a conspecific.

On the basis of this review it is expected that the dogs will be more assertive on their performances upon external cues, they will search for the toy wherever the experimenter is standing.

Method

Subjects

The subjects used in the present study were three purebred, domestic dogs; two males, one female (*canis familiaris*). None of the dogs had previous experimental experience at the time of the study other than the typical obedience training for domestic dogs, taught by their owner. At the time of the experiment the dogs were fed Innova
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Large Breed Dog, dry dog food manufactured by Natura Pet Products in Santa Clara, CA, and water was available ad lib. The amount of food given to the dogs was reduced by one cup (250 ml) during one week prior to the experiment to ensure the dogs motivation. This reduction was made as suggested by the dogs’ veterinary in order to keep the dogs at a healthy weight. See table one for a list of the subjects along with their breeds, sexes, ages, and weight and amount of food given daily during the experiment.

Table 1
Subjects and their breeds, sexes, ages, weights, and food ration

<table>
<thead>
<tr>
<th>Subject</th>
<th>Breed</th>
<th>Sex</th>
<th>Age (in years)</th>
<th>Weight (in lb)</th>
<th>Food (in ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brando</td>
<td>Chocolate Lab</td>
<td>M</td>
<td>11</td>
<td>115</td>
<td>500</td>
</tr>
<tr>
<td>Disel</td>
<td>Boerboel</td>
<td>M</td>
<td>2</td>
<td>155</td>
<td>1250</td>
</tr>
<tr>
<td>Cloe</td>
<td>Great Dane</td>
<td>F</td>
<td>2</td>
<td>110</td>
<td>750</td>
</tr>
</tbody>
</table>

Apparatus

This study used three identical blue, squared cardboard panels (2ft X 2ft). The panels were located side by side 4ft away from each other, 3yd away from the dog. The panels were placed in a semi circle, so that all of them were at the same distance from the dog. The toy was an orange, rubber Orka Jack. The food reinforces were McIntosh apples cut in cubes of about 1 ½ inches big.

Procedure

All procedures were the same for all three dogs, dogs were tested independently; during all procedures the researcher was accompanied by a second person who assisted in the handling of the dogs. Both experimenters rotated positions during all three phases to avoid person bias.
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Familiarization. The dogs were held by the assistant while the researcher wiggled an object that was known by dog as a play toy. Then the researcher placed the object in front of one of three panels. After the researcher placed the toy in front of the panel the assistant let go of the dog, and the researcher commanded the dog to get the toy “where is the toy go get it”. When the dog got the toy following the command, it was reinforced verbally “good dog!”, and with a piece of apple. If it failed to get the toy, there was no reinforcement of any kind and the assistant took the dog back to initial position for the following trial. The criterion for shaping was 15 consecutive trials of the dogs getting the toy with no interruptions after the command was given. The toy was placed in front of every panel the same number of times to avoid biases and no trial was the same as the one before.

Trials: The dogs were held by the assistant while the researcher placed the toy behind one of the panels, then the assistant took the dog out of the room and then inside the room again, after coming back in the room the assistant let go the off dog. When the dog got the toy right after being let go, it was reinforced both verbally and with food, if the dog searched for the toy but went behind the wrong panel, it was only verbally reinforced, “good dog, good try”, if the dog got distracted somehow there was no reinforcement whatsoever and it was taken back to initial position. The criterion for trials was 10 consecutive times of the dogs finding the toy behind the correct panel. For both shaping and trial phases the researcher was be standing beside the panel where the toy was placed.
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*Testing:* there were two different testing sessions that took place in an alternating manner. The procedure for both was the same as in trials: the dog was held by the assistant, then the researcher placed the toy behind one of the panels, after the assistant took the dog out and then in the room, and last the dog was be let go by the assistant to search for the toy after the researchers command. In one of the testing sessions the researcher moved beside a wrong panel while the dog is taken out of the room, and in the other testing session the researcher stayed beside the correct panel where the toy was placed. The toys were always placed behind the panel from the left side of it based on dogs' perspective. There were 30 testing sessions held, 15 of each condition.

Criterion for reinforcement included the dog lifting or pushing the toy with his mouth and touching or pushing it with its paws.

Results

A summary of the data collected is presented in Figure 1. The data consisted of the recorded choices made by the dogs during testing trials; the choice could be either correct or wrong. Figure 1 presents the results of the correct choices the dogs made when looking for the toy. The graph shows that all subjects did more correct choices when the experimenter was standing next to the correct location of the toy, indicating that the presence of the experimenter had an effect on performance. Two of the three dogs searched 14 of 15 and the third one searched 10 of 15 trials for in the correct place when the experimenter was cuing accurately. These results are higher than those for the wrongly cued condition where performance was 5, 3 and 4 out of 15 correct choices.
Figure 1. Number of correct choices during accurately cued and wrongly cued trials
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when the experimenter was standing beside a wrong panel. Notably subjects performed better when the experimenter was serving as an accurate cue.

Discussion

Consistent with previous research the results of this study support the hypothesis that the experimenter was going to serve as a cue for correctness in performance during trials. Dogs always went searching for the toy where the experimenter was standing and not where they saw the experimenter had hidden it in the first place.

The success of the study was in part to the fact that experimenters control for several variables. The experiments took place in an indoors setting far from visual, olfactory or hearing distractions. As all the dogs were familiar with one of the experimenters, during all phases of the study experimenters rotated positions to avoid a situation where the dogs based performance on familiarity to the researcher. Also for the reinforcement part, researchers made sure the dogs never saw when the reinforcement was taken by the experimenter, plus the reinforcement used didn’t have any smell to it, in addition given the fact that the dog had to lift, push or touch the toy accuracy during performance wasn’t due to the dog searching for the piece of food, but for the toy. Although results were satisfactory and proved the hypothesis there are some things that could be taken into consideration for improvement in future research. First number of subjects as this study only used 3 subjects. Second number of trial and number of sessions, this experiment took place during one day session with each dog, maybe if testing was done during a number a different days results would have been different. Last
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food reinforcement should not be given to the subjects to guarantee performance based on the true demands of the task and not on hunger.

In conclusion, we observed that dogs use spatial encoding rather than representational thought when it comes to object permanence and finding hidden objects, further research could expand on the limitations of different kinds of cues, and to determine which ones aid better. Also it would be interesting to see what role is the reinforcement playing in the experiment, how would performance and accuracy be affected if the subjects got only verbal praise on correct trials. On the other hand although is clear that this task does not involve memory from the part of the dog, it should still be a topic of interest for researcher to determine in what situations and for what purposes do dogs make use of their memories.
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