

The annotations for a dog's gazing behaviour towards humans are organized based on grouping them under topic headers. The groups begin with explaining the dog's thinking behind the behaviour and its evolutionary timeline, explaining the factors influencing the behaviour and ending off with a review of the gazing behaviour.

## Determining the purpose and psychology behind gazing

1. **Marshall-Pescini, S., Colombo, E., Passalacqua, C., Merola, I., & Prato-Previde, E. (2013). Gaze alternation in dogs and toddlers in an unsolvable task: Evidence of an audience effect. *Animal Cognition*, 16(6), 933–943.**  
<http://doi.org/10.1007/s10071-013-0627-x>

**Summary:** Previous studies showed that dogs behave in ways that are similar to children like human referential communication and gazing. However, it was debated as to whether the behaviours were considered to be referential communication. This article investigated if dogs and toddlers use similar gazing in unsolvable tasks and if they were mindful of the audience's attention when they initiate communication. An apparatus was set up by placing a lid-less plastic container over a toy or food on a wooden board. The toy would be for the toddlers while the food would be for the dogs. Three one minute trials were done where the toddlers and dog attempted to get the toy/food. Then the ones that succeeded in the trials twice were presented with an unsolvable task which had the container screwed onto the board. In this task, there were two groups of subjects with the caretaker looking at the container in both groups. One group had the experimenter look at the container and another group had the experimenter turned away from the container. The authors found that the toddlers and dogs increased their gaze alternation with the caregiver or experimenter when faced with a difficult task. Dogs and toddlers gazed at the experimenter less when they turned away from the container. Toddlers gazed more at the caregiver more than dogs when the experimenter turned away. The results collected from the experiment suggested that dogs and toddlers have similar behaviours when faced with an unsolvable task and that they were mindful of the attentiveness of the audience. Overall, the experiment proved that the dog's behaviours like gazing was considered to be referential communication. Future studies could be done to design different research methods to understand motivational factors behind dog gazing.

**Contribution:** I chose this article to determine what was the purpose of a dog's gaze towards humans. It showed that a dog's gazing behaviour was used as referential communication. This meant that a dog gazed at a human when it was in an unfamiliar situation or when faced with an impossible task. More studies could explain how a dog was motivated to stare at a human when faced with impossible tasks or unfamiliar situations.

2. **Petró, E., Abdai, J., Gergely, A., Topál, J., & Miklósi, Á. (2015). Dogs (*Canis familiaris*) adjust their social behaviour to the differential role of inanimate interactive agents. *Animal Cognition*, 19(2), 367–374.**  
<http://doi.org/10.1007/s10071-015-0939-0>

**Summary:** Dogs could adjust their gazing behaviour depending on their human partner's behaviour in problem situations. Sometimes they do not detect how the human plays a role in the situation but would create expectations based on their previous experience with the human. This study used unidentified moving objects (UMOs) to determine if dogs were able to recognize the different roles they had and adjust their behaviour towards them. The two UMOs were a remote controlled car with a magnet at the front and a remote controlled truck with a magnet on its crane. They were used on an apparatus which was a box with a hole in the front and the top. The learning phase of the experiment had a magnetic bowl containing a treat placed in the front hole or the top hole. Then the two UMOs would enter the testing field and the car would bring the food out of the front hole or the truck would use the crane to lift the bowl out of the top hole while the dog was present. The vehicles did not move during the testing phase. The researchers measured how many times dogs gazed at the UMOs and the duration of each gaze. The study found that dogs would gaze more at the UMOs that brought the food out. This suggested that dogs would know which human would help them with unfamiliar situations based on the dog's experience with that human. Future studies could be used to determine if dogs could be able to recognize the abilities that different agents have. UMOs would have a better use than humans because dogs had no experience with them so they could not use past experiences to influence their behaviour.

**Contribution:** I chose this article to determine if dogs gazed at a human because they understood the specific role they played when faced with an unfamiliar situation. This paper explained that dogs could choose the right person to help with an unfamiliar situation. This meant that dogs were able to generalize that a specific person can solve a particular situation. Future studies could determine if dogs are able to recognise the specific abilities a person has.

## Determining the evolutionary timeline of the gazing behaviour

3. **Johnston, A. M., Turrin, C., Watson, L., Arre, A. M., & Santos, L. R. (2017). Uncovering the origins of dog–human eye contact: Dingoes establish eye contact more than wolves, but less than dogs. *Animal Behaviour*, 133, 123–129. <http://doi.org/10.1016/j.anbehav.2017.09.002>**

**Summary:** Gazing is one of the important aspects of non-verbal communication between dogs and humans. Dingoes are the most recent ancestor of dogs living at least 5000 years ago. Recent studies have found that a dingo's behaviour when faced with social cognitive tasks is between a wolf's and dog's behaviour. For example, dingoes will understand human social cues more quickly than wolves but slower than dogs. This article investigates the interspecific eye contact between humans and dingoes using communicative tasks to specifically determine if the behaviours closely resembled wolves or dogs.

A dingo and a handler were brought into a testing area and allowed to explore the area until the dingo was comfortable. Then a 5 minute trial would occur where the dingo was allowed to wander around and interact with the handler. The handler could interact with the dingoes as long as they stayed seated and did not give the dingo food or toys. The duration of dingo-to-human eye contact and duration of handler touching dingo was recorded and

compared them to the durations of dogs and wolves done by a previous study. The authors found that dingoes initiating eye contact were similar to dogs. However the duration of the eye contact was between the dog's duration and wolf's duration. Dingoes had similar proportions of handlers touching them compared to dogs and wolves but dingoes had longer durations of touching. The results suggested that the motivation to initiate interspecific eye contact with humans occurred early in the domestication process but the motivation to maintain prolonged eye contact evolved later in the process. Future studies could compare dingo-to-human eye contact in a setting where the handler could not touch the dingo. Since handler's spent more time touching the dingo, it might influence the dingo's eye contact.

**Contribution:** I chose this article to explain how the dog's gazing behaviour towards humans evolved throughout history. Through the use of dingoes, it showed that initiating interspecific eye contact occurred early in the domestication process before the existence of dingoes. However, the motivation for prolonged gazing occurred after the existence of dingoes. More study using other canine species could be done to further develop the evolutionary timeline of gazing behaviour towards humans.

How life experience is a factor for gazing behaviour

- 4. Passalacqua, C., Marshall-Pescini, S., Barnard, S., Lakatos, G., Valsecchi, P., & Prato-Previde, E. (2011). Human-directed gazing behaviour in puppies and adult dogs, *Canis lupus familiaris*. *Animal Behaviour*, 82(5), 1043–1050. <http://doi.org/10.1016/j.anbehav.2011.07.039>**

**Summary:** Many studies had proven that dogs were capable of communicating with humans with a variety of methods like gazing. There was also evidence that showed that the behaviour could be influenced by both genetic factors and life experiences. This article compared the behaviour of different breeds and age groups when they are tested with a 'unsolvable task' paradigm. Comparisons were made between primitive, hunting/herding and molossoid breed groups. Comparisons were also made between 2 month, 4.5 month and adult age groups. An apparatus was made by using a lidless tupperware container and a wooden board. There were three solvable trials which had the food placed under the container. Then there was one unsolvable trial which had the container screwed onto the board so the dog could not retrieve the food. Observations on the behaviour of the dogs were made to determine the duration of the behaviour. This study found that 2 month old dogs had the shortest gaze duration throughout all breed types. When comparing the breed types, the hunting/herding group had the longest gaze. The hunting/herding group had the most cooperation between dogs and humans. These results suggested that dogs develop their gazing behaviour as they get older and gain experience coexisting with humans. Future studies could focus on determining if genetics was a factor in the gazing behaviour since certain breeds of dogs behave differently when they receive a stimulus.

**Contribution:** I chose this article to determine if the dog's gazing behaviour towards humans began at birth or was developed as the dog gets older. It showed that dogs develop the

behaviour as they grew up with humans. This article provided more information that dog breeds that socialized with humans more had stronger gazing behaviour. More studies could focus on how genetics played a role in the gazing behaviour.

- 5. Scandurra, A., Prato-Previde, E., Valsecchi, P., Massmo, A., & D’Aniello, B. (2015). Guide dogs as a model for investigating the effect of life experience and training on gazing behaviour. *Animal Cognition*, 18(4), 937–944. <https://doi.org/10.1007/s10071-015-0864-2>**

**Summary:** Dogs could use communicative behaviours like gazing to communicate their requests to their human owners. There could be variation in this type of behaviour due to what their lifestyle is like and their experiences with humans. This study compared guide dogs living in a kennel (trained dogs) or living with a blind person and their family (working dogs). They were faced with an impossible task paradigm which consisted of an apparatus. This apparatus used a glass container placed on a rectangular wooden platform while the owner and a stranger stood at either end. Three “solvable” tasks were done which had the food placed under the container and an “unsolvable” task was done which used double sided adhesive tape to make the container unmovable. There were four types of dogs used in the experiment: trained dogs, young untrained dogs, working dogs and old untrained dogs. The young untrained dogs were a control for trained dogs and old untrained dogs were a control for the working dogs. The authors found that the trained dogs spent less time gazing and took longer to gaze at the owner or stranger while the other three groups behaved similarly. The authors also found that the dogs did not show preference of whether to gaze at the owner or the stranger. These results suggested that dogs who live and interact with humans were more likely to use the gazing behaviour than dogs that do not live with humans. More studies could be done by comparing untrained solitary dogs with untrained dogs living with humans as pets to further confirm that interaction with humans promotes gazing behaviour.

**Contribution:** I chose this article to explain that training a dog did not strengthen their gazing behaviour. It further proved that the strength of a dog’s gazing behaviour towards humans was increased by having the dog live with humans and be allowed to interact with them. This study could be repeated with untrained dogs to determine if there were differences in behaviour.

- 6. D’Aniello, B., & Scandurra, A. (2016). Ontogenetic effects on gazing behaviour: A case study of kennel dogs (Labrador retrievers) in the impossible task paradigm. *Animal Cognition*, 19(3), 565–570. <http://doi.org/10.1007/s10071-016-0958-5>**

**Summary:** The lifestyle that a dog lives in can impact their behaviours toward humans like gazing. For example, water rescue trained dogs gazed towards humans more than search-and-rescue dogs. This study focuses on determining the behavioural differences between dogs living in kennels and dogs living in houses as pets. It also determines if a kennel dog shows more preference to their caretaker compared to a stranger.

This experiment used an impossible task paradigm to study gazing for social referencing. Labrador Retrievers were used in this experiment which had 9 kennel dogs and 10 control pet dogs. An apparatus was made with a class food container sitting upside down on

a wooden platform. A stranger and caretaker of kennel dogs or the owner of pet dogs was in the testing area on opposite sides of the room. These people would look straight ahead while ignoring the dog. A “solvable” trial was done three times which had the treat placed under the glass container unlocked. After the dog solved them, the unsolvable phase occurred which had the container locked. The duration of the gaze towards either person and the latency of the gaze was recorded. The results showed that kennel dogs gazed at a shorter duration and longer latency than the pet dogs. These results suggested that dogs that live and interact with humans use gazing more than dogs who had limited human interaction. Some future experiments that could be done with different breeds of dogs since Labrador retrievers were used in this experiment and they were known to be the most sociable breed of dogs.

**Contribution:** I chose this article to further explain how increased interaction and living with humans influenced the strength of a dog’s gazing behaviour by comparing untrained dogs. It further proved how coexisting with humans was needed in order to utilize the gazing behaviour toward humans. More studies could determine if a dog’s breed influences their gaze towards humans.

- 7. Cavalli, C., Carballo, F., Dzik, M. V., & Bentosela, M. (2019). Gazing as a help requesting behavior: A comparison of dogs participating in animal-assisted interventions and pet dogs. *Animal Cognition*, 23(1), 141–147. <http://doi.org/10.1007/s10071-019-01324-8>**

**Summary:** Dogs used gazing to get the owners attention when faced with an unsolvable task. A dog’s gazing behaviour towards humans could be influenced by phylogenetic and ontogenetic factors. Dogs who participated in animal-assisted interventions (AAI) interacted with humans more than pet dogs as they assisted in things like education or therapy. This study compared the behaviour between AAI dogs and pet dogs during an unsolvable task. An apparatus was built using a wooden board with a glass container filled upside down on the platform. First, there was the solvable phase which had three trials which placed the food in the container and was left unlocked. The dog was given a maximum of one minute per trial to get the food. Then there was the unsolvable task which had only one three minute trial which had the container locked after food was added in. An owner and a stranger were standing at each side of the board looking straight ahead. The dog was allowed to interact with the container or people during the trial. The gazing time, latency of first gaze, direction of first gaze, frequency of gaze alternation, contact with the people and interaction with the apparatus was recorded during the unsolvable task. The authors found that AAI dogs gazed longer and more than pet dogs. The AAI dogs also interacted more with strangers than with their owners. This meant that life experiences played a role in gazing behaviour as dogs who had higher exposure to humans had increased gazing. A limitation from this study was that the AAI dogs have many different tasks that they carry out throughout their lives. More studies should be done to determine if different jobs the AAI dogs have impact their social cognitive abilities.

**Contribution:** I chose this article to provide information on how a dog’s lifestyle influenced their gazing behaviour towards humans. It provided information that increased interaction with a

variety of humans changed their gaze orientation to allow them to gaze at strangers rather than caretakers. More studies could help determine how different jobs that dogs have could influence their behaviour.

## Biological factors influencing gazing behaviours

- 8. Dzik, M. V., Cavalli, C. M., Barrera, G., & Bentosela, M. (2020). Oxytocin effects on gazing at the human face in retriever dogs. *Behavioural Processes*, 178, 104160. <http://doi.org/10.1016/j.beproc.2020.104160>**

**Summary:** Gazing was used as a form of non-verbal communication between dogs and humans. Previous work found that as dogs gazed at their owners, their oxytocin levels would increase. This article investigated how administering oxytocin to dogs would impact their gazing behaviour on humans. It wanted to see if the gazing duration would be longer if dogs were given oxytocin. This study was done by having oxytocin or saline placebo control administered into dogs nasally 40 minutes before the experiment. Then there was a communicative learning task which consisted of three phases: acquisition phase, extinction phase and reacquisition phase. The acquisition phase had three two minute trials which reinforced gazing by giving the dog a treat every time it gazed at the experimenter's face. The extinction phase had three two minute trials which did not reinforce gazing which meant that no treat was given even when the dog gazed. The reacquisition phase had one two minute trial which gave treats each time dogs gazed at the experimenter. During each phase, another experimenter would record the duration of the cumulative gaze time. The authors found that dogs gazed longer in the extinction phase than the acquisition and reacquisition phase. This meant that the dogs learned to gaze for food in the acquisition phase and gazed longer in the extinction phase to consistently communicate that they wanted more food. The duration of gaze in each phase increased slightly with oxytocin treated dogs compared with control dogs. However when comparing neutered and intact dogs, the intact oxytocin treated dogs gazed more than the neutered oxytocin treated dogs. Future studies should focus on understanding the reason as to why being intact would allow oxytocin to impact gazing. There should also be more studies on determining oxytocin levels in different dog breeds.

**Contribution:** I chose his article to explain the hormonal effects that influenced the dog's gazing behaviour towards humans. It explained more about a known social hormone known as oxytocin and explained its impact on gazing. It also explained how oxytocin influenced gazing more on intact dogs than on neutered dogs. More studies could focus on how being intact allowed more oxytocin influence and if breed type affected oxytocin levels.

- 9. Persson, M. E., Sundman, A.-S., Halldén, L.-L., Trottier, A. J., & Jensen, P. (2018). Sociality genes are associated with human-directed social behaviour in golden and Labrador retriever dogs. *PeerJ*, 6, e5889. <http://doi.org/10.7717/peerj.5889>**

**Summary:** Dogs used gazing as a method for communicating with humans and being able to cooperate with them. Two genetic regions on chromosome 26 (SNP1 and SNP2) were found in

beagles to be associated with human contact-seeking behaviors. This article investigated the changes of the genetic regions before and after domestication of the dog. It also studied the association of these genes and the gazing behaviour. Comparisons in the genome were made between golden retrievers, Labrador retrievers and wolves by looking at the genetic regions to find differences in nucleotide sequence. The two dog breeds faced an impossible task which was using an apparatus that had a plastic tray and with three identical circular wells covered with lids with odor ports. There were treats placed under each lid and the dog would be able to retrieve the treat in all except the middle well which is an impossible task. Observations were made like the duration and frequency of the behaviour. The results showed that each individual had genetic variation in SNP1 for both dog breeds but all wolves had no variation. Both dog breeds and wolves have genetic variation in SNP2 for each individual. The study also found associations between the gazing behaviour and the gene regions. SNP1 was found to be associated with the physical contact variables like the duration of gaze. SNP2 was found to be associated with behavioural variables like the gazing frequency. The article suggested that genetics played a role in allowing communication between dogs and humans and genetic changes occurred as dogs became domesticated. Future studies could focus on using other breeds of dogs to verify that the gene regions were associated with the behaviour.

**Contribution:** I chose this article to explain the genetic factors that played a role in a dog's gazing behaviour towards humans. It advanced the knowledge on the role of genetic regions which were found to be associated with human-contact behaviours. More studies could help determine if the genetic regions were different in other dog breeds.

## Review on gazing behaviour

**10. Koyasu, H., Kikusui, T., Takagi, S., & Nagasawa, M. (2020). The gaze communications between dogs/cats and humans: Recent research review and future directions. *Frontiers in Psychology*, 11, 3687. <http://doi.org/10.3389/fpsyg.2020.613512>**

**Summary:** Dogs have been able to coexist with humans for more than 10000 years through the use of non-verbal communication called gazing. This article reviews many different research that explores gazing behaviour from dogs to humans. The direction of a human's gaze alters the behaviour of the animal. For example, a dog will eat food from the person who gazes at them. Dogs will be directed to a certain object if an owner looks or moves to it. If there are two bowls of food and the human goes toward one of them, the dog will follow them and eat from that bowl. Dogs also display social referencing when they are in an unfamiliar situation like an unknown object. They can also read emotions that humans show and alter the behaviour to accommodate the emotion. The authors observed that dogs will nuzzle and lick the human when they show physical attributes to sadness. One of the differences between dogs and cats is that dogs gaze and cooperate with humans more than cats. This is due to how dogs evolved from cooperation for hunting with humans for food while the cats did not cooperate with humans but behave differently to earn food from humans.

This behaviour helps form the bonds between animals and humans. For example dogs will use attention-getting behaviors more when the human looks at them to promote a bond. Also there is eyeblink synchronization during the gazing between humans and cats/dogs which is a sign of mutual understanding. Dogs and cats can also use smell and sounds to help with bond formation as it can help identify familiar humans.

**Contribution:** This review article explains the function of gazing behaviour from dogs to humans and how this leads to coexistence between dogs and humans. It also explains the use of this behaviour as a means of communication but there are still questions that need to be answered like how dogs evolved to bond with humans explaining more in detail about the gazing function. This review article helps to quickly understand the function of gazing and its role in bond formation. It also helps provide some primary articles to study gazing behaviour in detail.