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Small dogs display more aggressive behaviour than large dogs in social media videos

Natalie Solheim Bernales
Biology, Ethology

Preface

I have always loved animals, and dog especially (since most dogs actually want to get petted!). Animal welfare has also always been important for me. Since starting my Master studies here at NMBU, I have learned so much about what animal welfare actually is and I have learned a lot about dog ethology too. This makes me see the knowledge gaps between the public and the animals when it comes to good welfare. I see people handling their dogs in questionable ways and thinking behavioural problems are funny. I wanted look further into the behaviour of the dog and human, and hoped to fill the knowledge gap just a bit.

I want to give a huge thanks to my dedicated supervisor Ruth Newberry. Thank you for being the best professor I have ever had. Thank you for sitting with me for hours discussing. Thank you for never handing me the answers, and always making me use my brain. Thank you for holding out with me when I am the procrastination queen. Thank you for always believing in me and helping me through this Master process.

Abstract

Due to potentially greater vulnerability to accidents and attacks, the behaviour of small dogs may reflect greater threat sensitivity and need for protection than that of large dogs. Based on this hypothesis, I predicted that dogs of small breeds (<10 kg) would be more likely to show signs of aggression, stress, submission and attention-seeking behaviour than dogs of large breeds (>15 kg). I extracted behavioural data from 310 videos posted on YouTube depicting adult dogs of four small dog breeds (Chihuahua, Jack Russell Terrier, Dachshund and Yorkshire Terrier) and four large dog breeds (German Shepherd Dog, Border Collie, Labrador Retriever and Rottweiler; n=20 dogs/breed; mean±SE video duration: 59.8±2.0 s). Search terms included the breed name (n=160) for the control group, and the breed name with 'angry' (n=150) for the "angry" group. Behaviour in each video was scored using 1-0 sampling and effects of body size, breed, group and location were analysed by generalised linear models. Small dogs were more likely to show more total aggression (sum of vigilant, tail up, baring teeth, short bark, repeated barking, growling, snapping, biting: 1.9±0.13 vs 1.6±0.104; p=0.034), than large dogs. Snapping and biting incidents occurred in more of the small dogs, than the large dogs (0.22±0.05 vs 0.05±0.02; p=0.002). There were no differences between small and large dogs when it came to showing stress-related behaviour (sum of eye white, blinking, lip licking, trembling, panting, yawning, licking own body, ground sniffing, scratching), submissive behaviour (sum of looking away, withdrawing, tail down, paw lifting, presenting belly), and attention-seeking behaviour directed towards the handler (Sum of face licking, whimpering, paws on body, play invite, body licking, tail wagging, jumping). Small dogs were more likely to be on an elevated surface (including being held in a person's arms) than large dogs (0.35±0.06 vs 0.08±0.03; p=<0,001), and reaction-provoking actions by the handler (teasing the dog, hovering hands above the dog's head and moving camera close to dog's face) were not different between large and small dogs, although handlers were more likely to touch small aggressive dogs, than large aggressive dogs (0.2±0.05 vs 0.07±0.02; p=0.002). These findings suggest that the observed behavioural differences between small and large dogs were mediated by differences in the behaviour of humans towards the dogs, leading to escalated aggressive behaviour in the small dogs.

Sammendrag

På grunn av potensielt større sårbarhet for ulykker og angrep, kan oppførselen til små hunder gjenspeile større følsomhet ovenfor trussler og behov for beskyttelse enn for store hunder. Basert på denne hypotesen forutser jeg at hunder av små raser (<10 kg) vil med større sannsynlighet vise tegn på aggresjon, stress, underkastelse og oppmerksomhetssøkende oppførsel enn store raser (> 15 kg). Jeg har utvunnet atferdsdata fra 310 videoer lagt ut på YouTube som viser voksne hunder fra fire små hunderaser (Chihuahua, Jack Russell Terrier, Dachshund og Yorkshire Terrier) og fire store hunderaser (Schäferhund, Border Collie, Labrador Retriever og Rottweiler; n = 20 hunder/rase; gjennomsnitt ± SE video varighet: 59,8 ± 2,0 s). Søkeord inneholdt rasenavnet (n = 160) for kontrollgruppen, og rasenavnet med "angry" (n = 150) for «sinte»-gruppen. Oppførselen i hver video ble scoret ved hjelp av 1-0 prøvetaking og effekter av kroppsstørrelse, rase, gruppe og sted ble analysert av generaliserte lineære modeller. Små hunder var mer sannsynlig til å vise mer total aggresjon (summen av årvåken, halen opp, vise tennene, korte bjeff, gjentatt bjeffing, knurring, glefsing, biting: 1,9 ± 0,13 mot 1,6 ± 0,104; p = 0,034) enn store hunder. Hendelser med glefsing og biting skjedde hos flere av de små hundene enn de store hundene (0,22 ± 0,05 mot 0,05 ± 0,02; p = 0,002). Det var ingen forskjeller mellom små og store hunder når det gjaldt å vise stressrelatert atferd (summen av øyehvite, blunking, leppeslikking, skjelving, pesing, gjesping, slikking av kroppen, lukte på bakken, skrape på kropp eller miljø), underdanig oppførsel (summen av å se bort, trekke seg sammen, halen ned, poteløft, presentere magen) og oppmerksomhetssøkende oppførsel rettet mot håndtereren (Summen av ansiktsslikking, klynking, pote på kroppen til håndtereren, lekeinvitasjon, kroppsslikking, logring, hopping). Små hunder var mer sannsynlig til å være på en forhøyet overflate (inkludert å bli holdt i en persons armer) enn store hunder (0.35±0.06 mot 0.08±0.03; p=<0,001), og reaksjonsfremkallende handlinger av håndtereren (provosere hunden, sveve hendene over hundens hode og bevege kameraet nær hundens ansikt) var ikke forskjellig mellom store og små hunder, selv om håndtereren var mer sannsynlig til å berøre små aggressive hunder enn store aggressive hunder (0,2 ± 0,05 mot 0,07 ± 0,02, p = 0,002). Disse funnene antyder at de observerte atferdsforskjellene mellom små og store hunder ble formidlet av forskjeller i menneskers oppførsel mot hundene, noe som fører til eskalert aggressiv oppførsel hos de små hundene

Table of contents

1.1 Introduction

Dogs are among the most popular animals to keep as pets however, dog aggression can be a problem for the dog owners, and the health of the dog (Botchelt, 1983). Globally, there are no estimates for how many dog attacks towards humans occur each year but different studies suggest that there are over tens of millions (World Health Organisation, 2018). Dog attacks are hard to measure as they only get reported if the person attacked goes to the doctor (Duffy et al. 2008) or if they report it to the police (Overall and Love, 2001), and most likely it is only the large dogs that get reported because they are most likely to deliver enough damage for the human to need medical assistance (Duffy et al. 2008). This overlooks the number of dog attacks that happens on a smaller scale every year, possibly involving small dogs. Dogs that show aggressive behaviour risk abandonment, or euthanasia if the problems are not fixed (Orihel et al. 2005). Dog attacks can also leave people with Posttraumatic Stress Disorder (PTSD) and being scared of dogs (Peters et al. 2004; Salgado, 2016). The main objective of this study was to investigate differences in the aggressive behaviour of small and large dogs, and how humans respond to it.

1.2 Aggressive behaviour

An attack on a human may be a dog's last resort, and seldom occur without provocation or signs threatening a provoker before an attack. Aggression has been divided into two biological categories, competitive aggressiveness and protective aggressiveness (Luescher and Reisner, 2008). Competitive aggressiveness has been associated with dominance, possessive or territorial aggression (Luescher and Reisner, 2008). Competitive aggression in dogs can be shown by barking, growling, snapping and/or biting and body postures such as tail straight up, a vigilant stance with a tense body, head up, ears standing up and lips curled back showing teeth (Hasiri. et al. 2013). Possessive behaviour (resource guarding) can include looking away or withdrawing from a person, growling with the upper lip curled up showing the teeth, and snapping and/or biting a person who is trying to take away an object from the dog (Jacobs et al. 2018). These are behaviours that people will most likely recognise as aggressive, and result in people being more cautious around the dog.

Protective aggressiveness can include fear-, pain-, or punishment-induced aggressiveness (Luescher and Reisner, 2008). The dog shows more submissive and stress-related behaviour,

and tries to leave the situation rather than to attack. If they cannot leave, they might attack as the last resort and can therefore be as dangerous as a competitive aggressive dog. Furthermore, because people might not recognise the signs of anxiety given by a dog before an attack, people might push and provoke the dog more than they would have done to an more competitive aggressive dog. Protective aggressive behaviour can be indicated by a submissive body posture such as tail between the legs, low body carriage that makes the dog look smaller, ears down (Hasiri et al. 2013), paw lifting giving an appearance of being injured, presenting of the belly, looking away and withdrawing (Serpell 2017, pp 141-143). Stress-induced behaviour can include panting, showing the white of the eye, excessive blinking and/or lip licking because of stress-induced dryness, yawning repeatedly, and/or trembling (Stracke et al. 2011; Serpell, 2017, pp. 274). Other stress behaviour could include displacement behaviour like excessive licking of the body, excessive sniffing or excessive scratching of the body or environmental substrate (Landsberg et al.2003, pp.196; Serpell 2017, pp. 274).

Sometimes it can be difficult to see or perceive the warning signs that a dog gives. This can be because the person does not know what signs to look for, or because they see the signs as something else. Play behaviour in dogs can be shown with a play bow, jumping around, paw lifting to the face of the playmate and tail wagging (Serpell, 2017, p. 150-51), but play behaviour can also overlap with behaviour given in an aggressive context. The dog will bark and growl, though with different acoustics than an aggressive dog. Pongrácz et al. (2005) showed that people could hear the difference between barking in a play situation and an aggressive situation, and another study showed that the growls of larger dogs were perceived by humans as being more aggressive (Taylor et al. 2009). However, it may be difficult to read a situation based on acoustics alone, especially with an unfamiliar dog. The dog might also try to snap or bite a play object or human in a play situation, and although it may not use the same bite strength as in an aggressive attack, accidents can happen. It can also be difficult to differentiate between play and possessive behaviour. It can therefore become dangerous if the person misinterprets the situation.

1.3 Small vs. large dogs
People appear to perceive and treat small and large dogs differently. People might tolerate aggressive behaviour in small dogs more, as they appear less scary and cause less damage than larger dogs. A study by Arhant et al. (2010) showed that owners of small dogs (<20 kg) perceived their dogs as less obedient, more aggressive and excited, and more anxious and

fearful compared to large dog owners (dogs >20kg). Also, Bennett and Rohlf (2007) showed that small dog owners reported their dogs to be more disobedient and excitable than large dog owners. Small dogs were also reported to have less training and to be trained by different training methods compared to large dogs (Arhant et al. 2010), with large dogs getting more formal obedience training (Kobelt et al. 2003). Small-dog owners were also less consistent in interactions with their dogs. Small dogs had less play opportunities, and the play methods were different between small and large dogs. Large dogs played more tug of war, and with balls with their owner (Arhant et al. 2010), and fetch with a ball or other objects (Westgarth et al. 2008) than small dogs. Because small dogs weigh less, and have a small frame and small head and gape size, they are more likely to be seen as less of a threat than large dogs. McGreevy et al. (2013) showed a difference in small vs large dogs, with small dogs showing more undesirable behaviour like stranger-directed aggression, owner-directed aggression and hyperactivity than large dogs. One of their interpretations was that there might be a neurological differences between the reactions of small and large dogs to their environment, with small dogs being more reactive. Human size and strength compared to a small dog can be seen as threatening for the dog (Arhant et al. 2010), as just a tug of the leash can be more forceful and have different consequences for a small dog compared to a large dog, and could make small dogs more fearful and have negative associations towards humans. Small dogs might also have to perform more escalated behaviour than large dogs to be noticed, and their behaviour might be a cry for attention or help.

1.4 Youtube

To understand differences between small and large dogs' aggressive behaviour, I looked at videos of aggressive dogs, using YouTube as my source. YouTube is an video-sharing website, where anyone can upload videos of whatever they want within legal limits. This might give rise to a large data sample (Rault et al. 2013) of dog behaviour as it is happening. Because YouTube has such a large database, it might be easier to look up a video on the internet than to contact people from different groups and organisations to ask them to enrol their dog in an experiment, or to send questionnaires to people and to hope they might answer it. Also, people participating in organized studies might be more involved with their dogs, and therefore have more well behaved dogs (Bennett and Rohlf, 2007), or be looking for help for dogs with severe behavioural problems, resulting in an unrepresentative sample of dog behaviour.

I wanted to look at aggressive behaviour as it is happening, and this might be difficult to do in a laboratory. The dog might perform differently than they would behave in a familiar setting, as a laboratory would be an unfamiliar place. Setting up scenarios that lead dogs to perform aggressive behaviour would be unethical. When using a video study, you can play back the videos as much as you want, catching behaviour you might have missed if it was not on film. The dogs might also be filmed in a familiar setting, where the dog might be comfortable and perform behaviour more naturally. Different ethological studies have already been done using YouTube videos as their medium, showings that it is possible to look at behavioural problems as it is happening without a experimental setting (Burn, 2011; Owczarczak-Garsteck et al. 2018).

1.5 Hypothesis and predictions

In this observational study, I aimed to see if there are differences in aggressive and other behaviour between small and large dogs, and to see if there's a difference in how humans behave towards small and large dogs. I also explored to see if there is an differences in aggressive or other behaviours between different breeds of dogs, between videos of dogs labelled by video posters as displaying aggressive behaviour and videos not labelled this way, and between dogs shown inside and outside. Additionally I wondered if there are other factors associated with aggressive behaviour, like whether the radio or tv is on, whether the dog is on the floor/ground or up an elevated surface, and whether the dog is restrained or not.

I hypothesised that, due to potentially greater vulnerability to accidents and attacks, the behaviour of small dogs may reflect greater threat sensitivity and need for protection than that of large dogs.

Based on this hypothesis, I predicted that dogs of small size (<10 kg) would be more likely to show signs of aggression, stress, submission and attention-seeking behaviour than dogs of large size (>15 kg). I predicted that there would be fewer videos of large dogs snapping and biting, than of small dogs. I also predicted that humans would be more likely to provoke different aggressive behaviour in small dogs than large dogs.

2. Methods

This was an observational study, where I search for different behaviour in dogs using Youtube as a medium.

2.1. Dog breeds

I chose 8 different breeds of dogs, 4 small breeds (dogs <10 kg) and 4 large breeds (dogs>15 kg) as a strategy for searching for videos of known approximate size. I chose the dog breeds based on popularity of ownership and known aggression problems (Duffy, et al. 2008; Owczarczak-Garstecka, et al. 2018). The 4 small breeds of dogs were Jack Russell Terrier (referred to as JRT), Chihuahua (referred to as Chi), Dachshund (referred to as Dac) and Yorkshire Terrier (referred to as YTD). The 4 large breeds of dogs were German Shepherd Dog referred to as (GSD), Labrador Retriever (referred to as Lab), Border Collie (referred to as BCD) and Rottweiler (referred to as Rot).

2.2. Video collecting and criteria

From the time period November 2018 to March 2019, I sampled 310 videos. I had a control group and a group referred to as the "angry" group. The control group was used to show a range different behaviour, everything from relaxing to playing, but it could also include aggressive behaviour. The angry group was used to show different aggressive behaviours. I chose videos from the video sharing website YouTube, by using the searching term "[dog breed]" for the control group, for example: Chihuahua. For the angry group I used the search term "[dog breed]" and "angry", for example: Angry Chihuahua. I had to pick a search word that reflected the aggressive behaviour I wanted to observe, but at the same time keep in mind that videos were uploaded by laypeople. The word angry is a common word, was useful for finding videos showing aggression and got a lot of hits on YouTube. I only included one video per user on YouTube, and only one video of the same dog. When the video showed more than one dog of the same breed, I choose the dog that was the easiest to differentiate and, in the angry group, the dog showing aggressive behaviour. For each search, I selected the first 20 videos that fitted the criteria for each group. The sample of 20 dogs per breed and search type was aimed at ensuring a sample size large enough for analysis.

The exclusion criteria for both control and angry group were as follows: dog appeared to be under 1 year old; compilation videos (several different clips of different dogs in one video);

videos without sound, or with music or voice-over covering the original sound (where one could not hear the dog or the human); agility videos; training videos in which someone was training a dog to perform a specific behaviour on command and giving treats (food); videos that were longer than 5 minutes or shorter than 10 seconds or, in the angry search, videos too short to show any aggressive behaviour; videos clearly showing a mixed breed dog, or that were labelled with or showing the wrong breed; if there was clearly no handler in the video, or if the dog could not be seen clearly; videos clearly aimed at selling the dog; birthing videos; professional videos or advertisement videos. For the angry group, I excluded videos where the dog was clearly showing play behaviour, such as play invitation and playing with objects, but I accepted videos where the dog was clearly showing possessive behaviour over an object. Dogs showing play behaviour were excluded from the angry group because their behaviour could be confused with aggressive behaviour like growling, barking, biting and snapping.

2.3. Variables

The details that were recorded for each selected video were

・The URL for the video

・Duration of the video in minutes and seconds as displayed by YouTube (xx:xx).

・Size (small or large) and breed of dog (JRT, Chi, Dac, YTD, GSD, Lab, BCD, Rot)

・Location (inside a building or outside; if both, the one where the dog spent the most time or was performing behaviours in the ethogram)

・Position of the dog (on the ground or floor; on an elevated surface including chair, bed, owner's lap/, held in a person's arms)

・Radio or tv (on/off)

・Dog wearing a collar, harness or clothes (yes or no).

・Tail docked or not

・Dog restrained in a cage, crate or carrier, on a leash, or held by a human so not free to move around (yes or no).

The behaviour of the dog was set in four categories: Aggressive, Stress, Submissive and Attention-seeking, and aspects of human behaviour were also recorded (Table 1). See ethogram (Table 2) for detailed explanation of the behaviour that were looked for.

Table 1: The behavioural variables that were looked for in the videos

Aggressive	Stress	Submissive	Attention-seeking	Human
Vigilant	Eye white	Looking away	Face licking	Human instigating
Tail up	Blinking	Withdrawing	Whimpering	Human correcting
Baring teeth	Lip licking	Tail down	Paws on body	Human touching
Short bark	Trembling	Paw lifting	Play invite	Human touching aggressive dog
Repeated barking	Panting	Presenting belly	Body licking	Hovering hand
Growling	Yawning		Tail wagging	Camera in Face
Snapping	Licking own body		Jumping	
Biting	Ground sniffing			
	Scratching			

Table 2: Ethogram of variables recorded in the study. All behaviours were scored using 1-0 sampling

Behaviour	Description
Aggressive	
Vigilant Yes=1, No=0	Head is up, ears are listening, and body is tense and alert. The dog is prepared for fight or flight if needed.
Tail up Yes=1, No=0	Tail pointing upwards in the air. If the tail is docked too short to see if it is up, or the dog is standing and the tail is not visible, scored as missing data. If the tail cannot be seen because the dog is sitting, or lying down, scored as 0, as tail up does not occur in these postures. .
Baring teeth Yes=1, No=0	Lips curled up showing the teeth. Does not include teeth showing because of a physical reason, like the dog having a cross bite.
Growling Yes=1, No=0	Low-pitched rumbling, fairly monosyllabic vocalization from the dog's throat. Making growling sounds in a situation that is not play.
Short bark Yes=1, No=0	One to three short, sharp barks with a low pitched sound.
Repeated barking Yes=1, No=0	Loud low-pitched sounds, repeated for more than 3 barks.
Snapping Yes=1, No=0	Attempts to bite, rapid opening and closing of the mouth, with teeth clamping together, but not on a target, where target refers to a person or animal, and not an object (as the latter can be play behaviour). Used as a threat signal to «back off». Might be accompanied by a bark.
Biting Yes=1, No=0	Lock teeth on a person or animal. Excludes biting objects.
Stress	
Eye white Yes=1, No=0	White in the eyes is visible.
Blinking Yes=1, No=0	Closing eyes and opening them, more than once. Excludes blinks due to someone putting something in the face of the dog.
Lip licking Yes=1, No=0	Tongue running over lip more than once during the video.
Trembling Yes=1, No=0	Involuntary muscle movements under the skin. Excludes movements due to wagging or shaking the body to remove water or other material.

Yawning Yes=1, No=0	Opening the mouth, breathing in, and closing the mouth repeated more than once. Also includes gaping where the dog does not breath in much air when opening the mouth, repeated more than once.
Panting Yes=1, No=0	Mouth open, tongue out, breathing heavy more than once. Excludes panting after running or playing, or when outside in warm sun.
Licking own body Yes=1, No=0	Dog runs tongue over its body for >1 second after an interaction with a human or other animal. Appears to be displacement behaviour rather than relaxed self-grooming.
Ground sniffing Yes=1, No=0	Dog sniffs the ground after an interaction with a human or other animal. Appears to be displacement behaviour rather than exploring.
Scratching Yes=1, No=0	Dog scratches its own body for >1 second after an interaction with a human or other animal. Appears to be displacement behaviour rather than scratching because of an itch.
Submissive	
Looking away Yes=1, No=0	Turning head or eyes to look in a different direction, trying to remove itself from a situation, person or object facing the dog without leaving. Excludes turning to look at something.
Withdrawing Yes=1, No=0	Removing or trying to remove the whole body from a situation by walking away, flinching, jumping, struggling or pulling away even if escape by walking away is not possible because the dog is restrained in some way.
Tail between legs Yes=1, No=0	Tail tucked between legs. If the tail is docked too short to see if it is up, or not visible when the dog is standing, it is scored as missing data. If the tail cannot be seen because the dog is sitting or lying down, scored as 0, as the dog would not be giving tail signals in those postures.
Paw lifting Yes=1, No=0	Lifting one paw off the ground and holding it in the air (not resting the limb on something). Appears that the dog is hurt, handicapped or submissive. Intention movement to withdraw or avoid (i.e. for self-protection).
Present belly Yes=1, No=0	Lying on the back presenting the belly with paws in the air or to the side, appearing harmless. Excludes situations where the dog appears to solicit belly rubs from a human.
Attention-seeking	
Play invite Yes=1, No=0	Includes play bow (putting the forelimbs in front and bowing the upper body), rapidly twisting or rotating the body or head, sliding, bouncing, yipping, engaging in tug of war, giving short, quiet, modulated breathy-sounding growls, giving short quiet relatively high pitched exhalations during play.
Body licking Yes=1, No=0	Runs tongue over body of human excluding the face.
Face licking Yes=1, No=0	Runs tongue over the lips or face of a human more the once.
Tail wagging Yes=1, No=0	Tail or hindquarters moving laterally. Can be rapid or slow movements. If the hindquarters cannot be seen, scored as missing.
Whimpering Yes=1, No=0	High pitch vocalisations, excluding growling or barking.
Jumping Yes=1, No=0	Jumps in the air with two or four legs. Includes jumping to catch a toy or tug object, and jumping in rough and tumble play.

Paws on body Yes=1, No=0	Dog puts one or two forefeet on a person intentionally (not by chance). Can be nudging the person with paws or jumping on the the person.
Human	
Human instigating Yes=1, No=0	Human deliberately provokes aggressive behaviour of the dog. By touching it when resting/sleeping/feeding, teasing it by holding food or a toy or other desired object in front of the dog's face and then pulling it away, or talking in an excited or aggressive way to evoke a reaction from the dog.
Human correcting Yes=1, No=0	Human attempts to correct unwanted aggressive/anxious behaviour of the dog by telling it to stop, saying no, or giving it a command.
Human touching the dog Yes=1, No=0	Human is touching, stroking, patting, tickling, holding or lifting the dog, when it is not aggressive or nervous.
Human touching aggressive dog Yes=1, No=0	Human is touching, stroking, patting, tickling, holding or lifting the dog, when it is aggressive (growling, barking, showing teeth, snapping or biting) or nervous (showing eye white, blinking, looking away, lip licking, yawning, paw lifting, submissive behaviour, withdrawing, trembling and tail between legs).
Hands above head Yes=1, No=0	Human hovering their hands over the dog body, head or face, evoking a reaction from the dog.
Camera in face Yes=1, No=0	Human putting the camera in the face of the dog, closer than 15 cm, evoking a reaction.

2.3. Behaviour sampling and recording methods

A pilot study was done beforehand to establish the behaviours I would focus on. Behaviour was chosen based on previous knowledge of aggressive and other behaviours in dogs, as described in Serpell (2017) and other sources, and then the ethogram definitions and data collection procedures were refined based on the behaviour observed in the pilot video observations. I then collected data for analysis using 1-0 sampling for each behaviour shown by the focal dog in the video.

2.4. Observer reliability

I checked most of the videos twice on different days to make sure they were analysed consistently, to ensure within-observer reliability and to exclude observer drift.

2.5. Statistics

Analysis were done by SAS (Statistical Analysis System), 9.4 software for Windows. I used a generalized linear model, with a logit link function with the explanatory variables being size (large vs small), size by breed, search type (control vs angry) and location (inside vs outside), to look for associations between the response variables, which were the different behaviours in the ethogram (Table 2). Most of the variables were binary distributed, with the

result recorded as either occurring (scored as 1) or not occurring (scored as 0) in the video. Associations with video duration was evaluated using gamma distribution with log link function, since duration was a continuous variable measured in seconds. Least squared means were calculated. Pairwise comparisons were made between the different combinations of the explanatory variables and these were adjusted for multiplicity using the TUKEY option (adjusted p values). Total counts of different behaviours for the aggregated response variables (Aggressive total, Stress total, Submissive total and Attention-seeking total) were calculated using the Poisson distribution with the log link function. The significance threshold was set at $p<0.05$.

2.6. Ethical statement

YouTube is in the public domain and all data were collected anonymously so I did not have to apply for approval from the Norwegian Data Protection Service or obtain consent from dog owners. No experimental procedures were performed on animals and so I did not need approval from the Norwegian Animal Research Authority .

3. Results

3.1. General factors

There were 310 videos analysed, with 10 videos from the goal of (n=20) missing on angry BCD because there were not enough angry videos found to analyse. I looked for associations between the different behaviour between size (large vs small), within breed, within group (control vs angry) and location (inside vs outside). Here, I describe the significant associations detected (see Table 3 for statistics on all analysed variables). Significant pairwise comparisons between breeds are also described below (Adjusted p<0.05).

The duration of the videos did not differ between size, size by breed or location, but did differ between the search type groups, with videos being longer in the control group (Table 4).

For being held, the statistical model did not converge but, numerically, being held was seen in (mean±SE) 21.9±3.3 % of the small dog videos as compared to 0±0 % of the large dog videos. Small dogs were more likely to be on an elevated surface (including being held in a person's arms) than large dogs (Fig. 1). Dogs in the angry group were more often filmed while on an elevated surface than dogs in the control group, and dogs were also more often filmed while on an elevated surfaces inside than outside (Table 4).

When it came to being restrained, there was no consistent difference according to size, but restrained did differ between breeds (Fig. 1), with two small breeds, Chi and Dac, being the most often restrained. Dogs in the angry group were also more likely to be restrained than those in the control group, and when outside than inside (Table 4).

The radio or TV was more likely to be on in the angry group than in the control group.
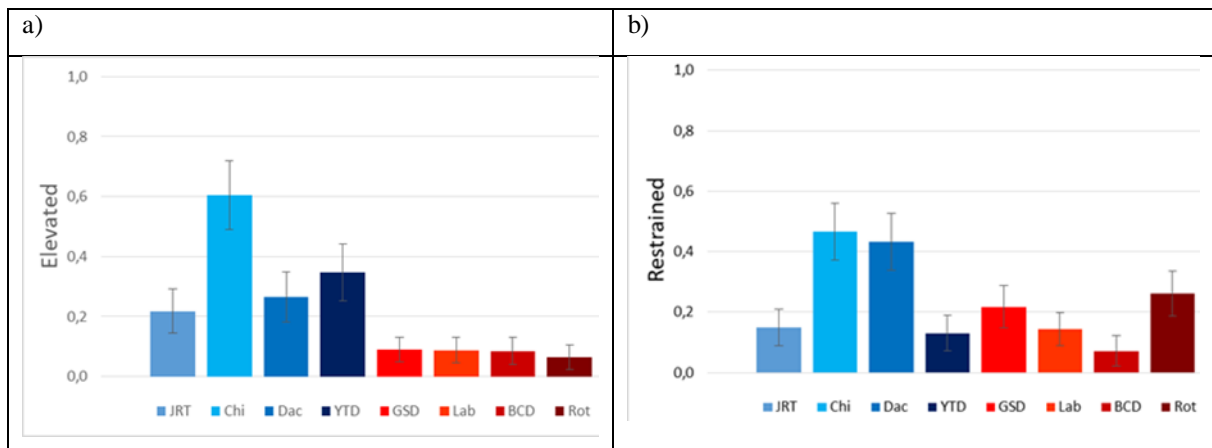
Fig. 1. Proportion of videos (back-transformed least squares mean±SE) showing dogs (a) on elevated surfaces (including being held in a person's arms) and (b) restrained (i.e. on leash, held by a human, or in cage, crate or carrier) according to dog size (small, blue; large, red) and breed (Jack Russell Terrier, JRT; Chihuahua, Chi; Dachshund, Dac; Yorkshire Terrier, YTD; German Shepherd Dog, GSD; Labrador Retriever, Lab; Border Collie, BCD; Rottweiler, Rot).

3.2. Aggressive behaviour

The behaviour tail up was different between search type groups, with dogs being more likely to have their tail up in the control group than the angry group. Dogs were also more likely to have their tail up outside than inside (Table 4).

Teeth baring differed between breed, with JRT being more likely to bare teeth than YTD and BCD, and Chi being more likely to bare teeth than YTD (Fig 2). Dogs in the angry group were more likely to bare teeth than dogs in the control group. In addition, dogs were more often filmed baring teeth when inside than outside (Table 4).

Small dogs were more likely to growl than large dogs in the videos, and there was also a breed difference in growling, with JRT and Chi more likely to growl than GSD and BCD (Fig. 2). There was no difference in either short bark or repeated barking when it came to size and size by breed. However, repeated barking differed by search type and location. Dogs in the angry group were more likely to bark repeatedly than control dogs, and dogs were more likely to bark repeatedly when outside than inside (Table 4).

Small dogs were more likely to snap than large dogs. Snapping was also different between breeds, with Chi being more likely to snap than GSD and Rot (Fig. 2). Snapping was more likely to be seen in the angry group than in the control group. For biting, the statistical model

13

did not converge but, numerically, biting was seen in (mean±SE) 11.9±2.6 % of the small dog videos as compared to 2.7±1.3 % of the large dog videos. When considering snapping and biting together, small dogs were more likely to snap and/or bite than large dogs, with Chi being more likely to snap and/or bite than YTD, GSD, Lab, BCD and Rot (Fig. 2). Additionally, dogs in the angry group were more likely to snap and/or bite than the control dogs (Table 4).
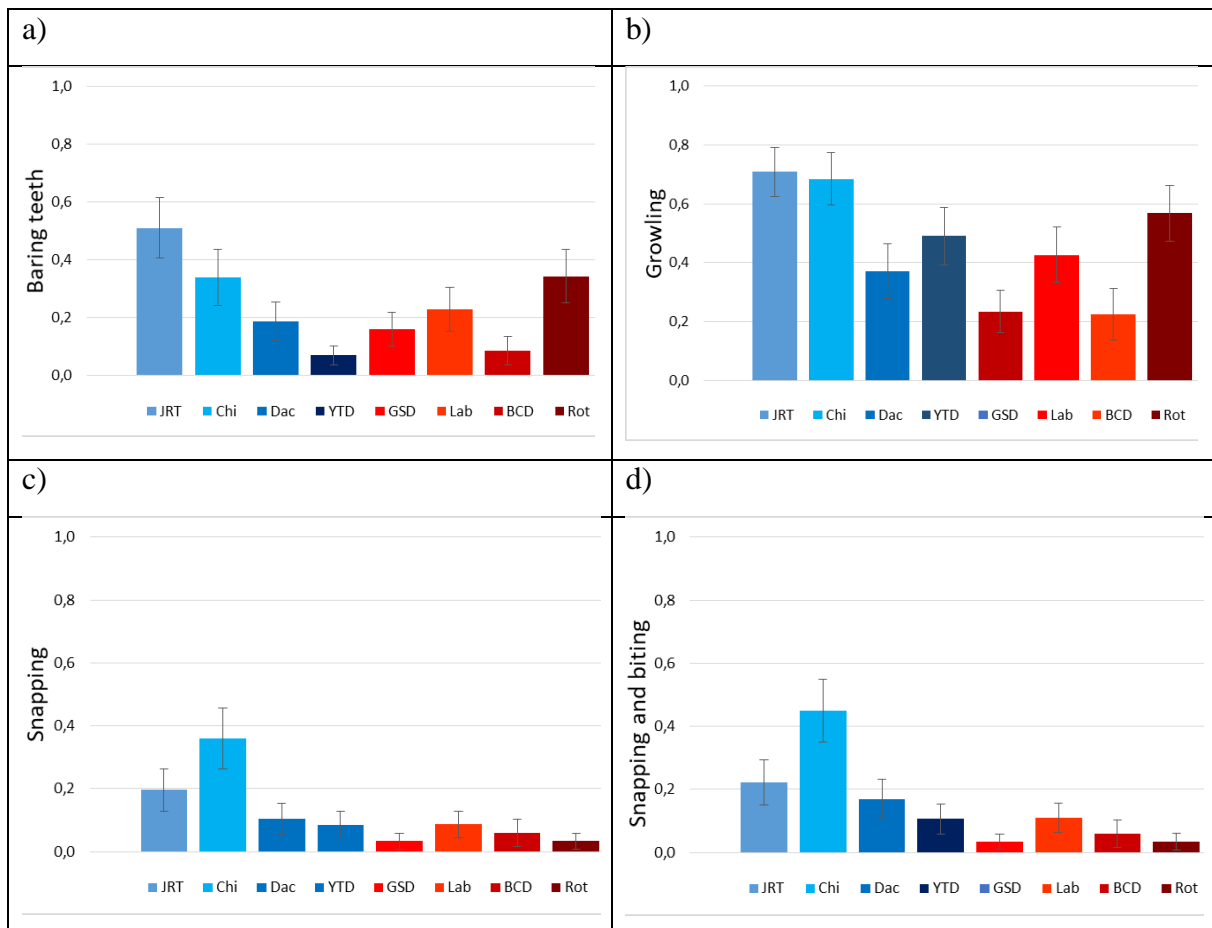

Fig. 2. Proportion of videos (back-transformed least squares mean±SE) showing dogs (a) Baring teeth, (b) Growling, (c) Snapping, and (d) Snapping or biting according to dog size (small, blue; large, red) and breed (Jack Russell Terrier, JRT; Chihuahua, Chi; Dachshund, Dac; Yorkshire Terrier, YTD; German Shepherd Dog, GSD; Labrador Retriever, Lab; Border Collie, BCD; Rottweiler, Rot).

When adding all the aggressive behaviour together (giving a score of 1 for each type of aggressive behaviour shown), I saw that small dogs showed more types of aggressive behaviour than large dogs, with JRT showing a higher total compared to YTD, GSD and BCD (Fig. 3). There was also more total aggressive behaviour in the angry group than in the control group, when scored either as proportion of videos in which any of the aggressive behaviours occurred /1-0 sampling) or as the total number of types shown (Table 4).
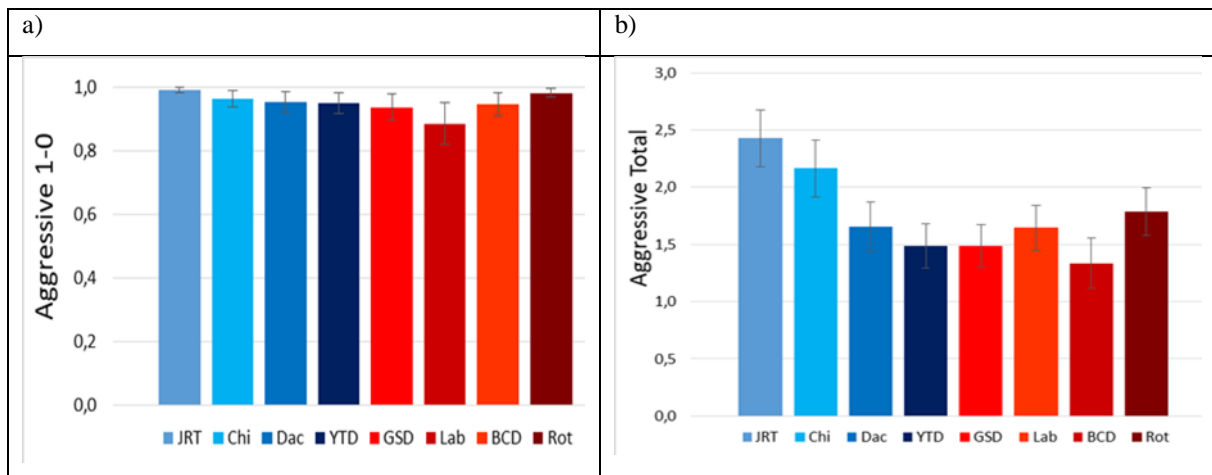
14

Fig. 3. Proportion of videos (back-transformed least squares mean±SE) showing dogs (a) Agressive (1-0), (b) Aggressive total (sum of vigilant, tail up, baring teeth, short bark, repeated barking, growling, snapping, biting) according to dog size (small, blue; large, red) and breed (Jack Russell Terrier, JRT; Chihuahua, Chi; Dachshund, Dac; Yorkshire Terrier, YTD; German Shepherd Dog, GSD; Labrador Retriever, Lab; Border Collie, BCD; Rottweiler, Rot).

3.3. Stress behaviour

Showing the white of the eye did not differ between size, but did differ between breed. Chi were more likely to show eye white than Dac, GSD and Lab (Fig. 4). Eye white was more likely to be seen in the angry group, and more likely to be seen inside (Table 4). There was no difference in blinking between small and large dogs, but there was a breed difference. Chi were more likely to blink than Dac, YTD, GSD, Lab, BCD and Rot (Fig. 4). Blinking was also more likely shown inside than outside (Table 4).

Lip licking was more likely to be performed by small than large dogs. There was a difference between breeds, with Chi being more likely to lick their lips than Lab (Fig. 4). Lip licking was more likely to occur in the angry group than control, and more likely to be seen inside than outside (Table 4).

When adding all the stress behaviour together (giving a score of 1 for each type of stress behaviour shown), I saw that there were no difference between small dogs and large dogs. Chi however, were more likely to show more types of stress behaviour than Dac, YTD, GSD and Lab (Fig. 4). The dogs in the videos were more likely to show more total stress behaviour in the angry group, and more likely to show more total stress behaviour inside when scored either as proportion of videos in which any of the stress behaviours occurred (1-0 sampling) or as the total number of types shown (Table 4).
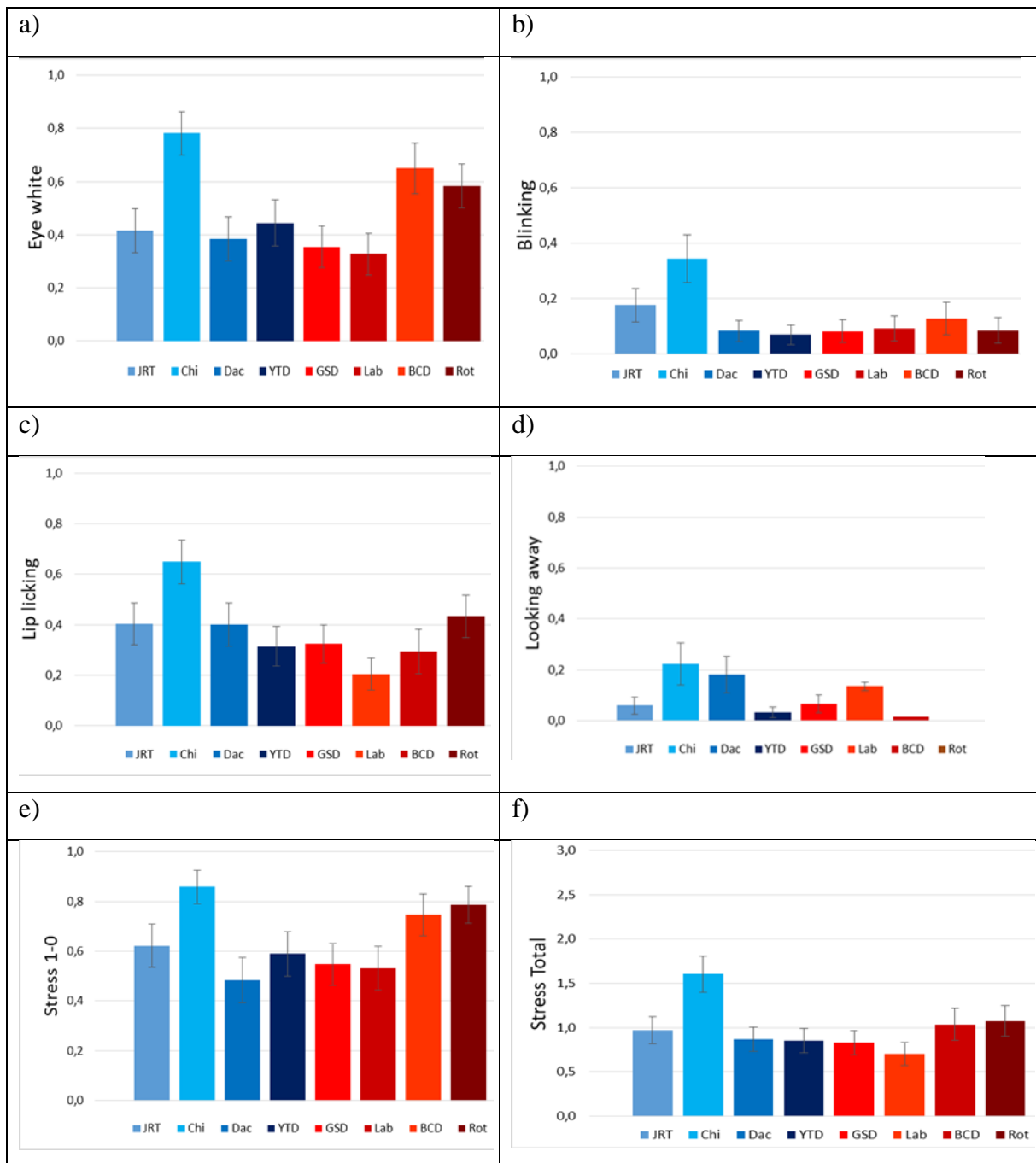
15

Fig. 4. Proportion of videos (back-transformed least squares mean±SE) showing dogs (a) Eye white, (b) Blinking, (c) Lip licking, (d) Looking away, (e) Stress 1-0, (f) Stress total (Sum of eye white, blinking, lip licking, trembling, panting, yawning, licking own body, ground sniffing, scratching) according to dog size (small, blue; large, red) and breed (Jack Russell Terrier, JRT; Chihuahua, Chi; Dachshund, Dac; Yorkshire Terrier, YTD; German Shepherd Dog, GSD; Labrador Retriever, Lab; Border Collie, BCD; Rottweiler, Rot).

3.4. Submissive behaviour

There was no difference in small and large dogs when it came to looking away, but there was a difference in breed (Fig. 4). Dogs were more likely to looking away more often in the angry group, and more often inside (Table 4).

When adding all the submissive behaviour together (giving a score of 1 for each type of submissive behaviour shown), I saw no difference between size. However, there was a difference between breed. What is noteworthy was that Rot showed little submissive behaviour (Fig. 5). Dogs in the videos showed a higher total number of submissive behaviours in the angry group, and when inside. They were also more likely to show at least 1 type of submissive behaviour in the angry group, and when inside than outside (Table 4).

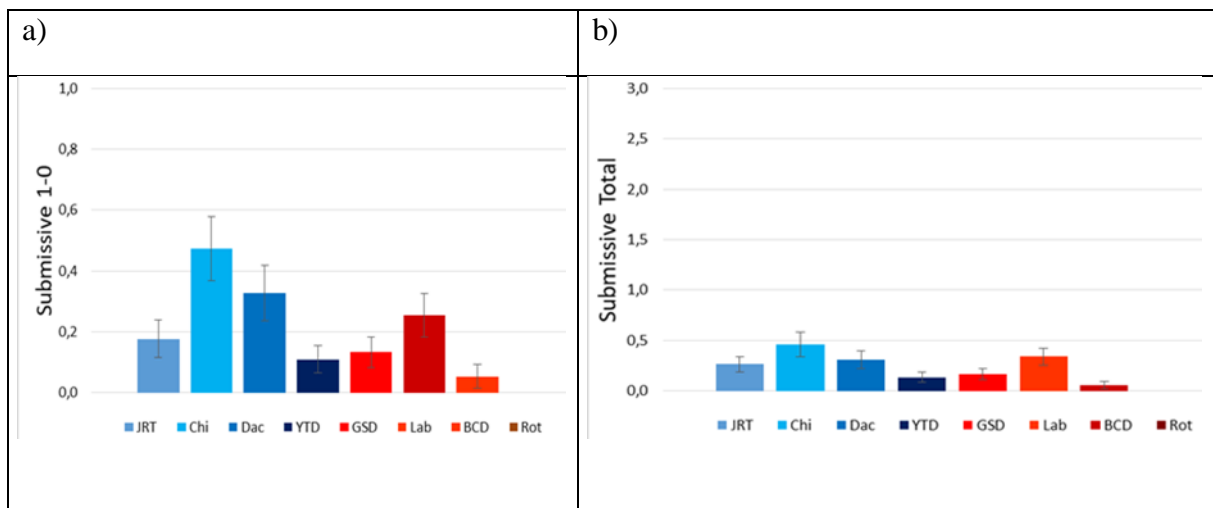**Fig. 5.** Proportion of videos (back-transformed least squares mean±SE) showing dogs (a) Submissive 1-0, (b) Submissive total (Sum of looking away, withdrawing, tail down, paw lifting, presenting belly) according to dog size (small, blue; large, red) and breed (Jack Russell Terrier, JRT; Chihuahua, Chi; Dachshund, Dac; Yorkshire Terrier, YTD; German Shepherd Dog, GSD; Labrador Retriever, Lab; Border Collie, BCD; Rottweiler, Rot).

Table 3. Results from generalised linear model of 310 videos

Dependent variable[1]	Body size (large vs small)		Size x Breed		Search type (control vs angry)		Location (outside vs inside)	
	$F_{1, 300}$	P	$F_{6, 130}$	P	$F_{1, 130}$	P	$F_{1, 130}$	P
Video duration	0.05	0.832	1.83	0.093	54.53	<0.001	0.50	0.478
Elevated	29.08	<0.001	1.67	0.128	18.86	<0.001	26.18	<0.001
Restrained	3.25	0.072	3.06	0.006	27.38	<0.001	10.42	0.001
Radio/TV on	0.00	0.966	1.23	0.291	11.40	0.001	0.00	0.968
Tail up	1.25	0.264	1.11	0.358	5.06	0.025	16.37	<0.001
Baring teeth	0.81	0.370	3.93	0.001	63.00	<0.001	9.79	0.002
Growling	8.46	0.004	2.88	0.010	67.34	<0.001	3.32	0.069
Short bark	0.21	0.649	1.62	0.134	3.20	0.075	1.55	0.214
Repeated barking	1.27	0.260	2.03	0.062	17.12	<0.001	27.64	<0.001
Snapping	9.28	0.003	2.17	0.046	23.30	<0.001	0.07	0.787
Snap or bite (1-0)	13.86	0.002	2.52	0.021	25.59	<0.001	0.17	0.682
Aggressive (1-0)[2]	2.20	0.139	1.75	0.109	19.79	<0.001	3.23	0.074
Aggressive (total)[2]	4.55	0.034	2.42	0.027	81.61	<0.001	1.69	0.195
Eye white	0.29	0.588	3.38	0.003	4.18	0.042	22.03	<0.001
Blinking	1.63	0.203	2.59	0.018	0.89	0.347	5.60	0.019
Lip licking	4.62	0.032	2.16	0.047	14.31	0.002	5.81	0.017
Stress (1-0)[3]	0.01	0.905	2.33	0.033	12.05	0.001	25.05	<0.001
Stress (total)[3]	1.56	0.213	3.68	0.002	4.21	0.041	19.07	<0.001
Looking away	0.00	0.964	3.12	0.006	23.98	<0.001	9.16	0.003
Submissive (1-0)[4]	0.00	0.962	3.28	0.004	26.73	<0.001	4.18	0.042
Submissive (total)[4]	0.00	0.967	3.31	0.004	26.02	<0.001	7.79	0.006
Whimpering	0.18	0.670	2.67	0.016	13.80	0.002	2.89	0.090
Paws on body	0.04	0.840	0.31	0.931	11.45	0.001	0.83	0.362
Play invite	0.00	0.948	0.85	0.533	22.95	<0.001	3.40	0.066
Tail wagging	1.49	0.224	2.68	0.015	30.26	0.002	8.79	0.003
Jumping	0.03	0.865	1.01	0.420	15.68	<0.001	0.08	0.775
Attention seeking (1-0)[5]	0.98	0.323	1.45	0.196	43.91	<0.001	3.26	0.072
Attention seeking (total)[5]	0.83	0.364	2.90	0.009	83.72	<0.001	0.00	0.988
Human instigating	0.36	0.551	5.30	<0.001	73.71	<0.001	15.79	<0.001
Human touching dog	2.15	0.144	1.85	0.089	0.29	0.588	6.80	0.010
Human touching aggressive dog	10.27	0.002	2.27	0.037	62.98	<0.001	15.54	0.001
Camera in face	0.43	0.515	2.38	0.029	26.46	<0.001	17.09	<0.001

[1]Behavioural variables measured as proportion of videos in which dogs showed each behaviour. N=20 videos/breed/search type, except Border Collies (missing 10 angry videos). Behaviours too rare for statistical analysis not shown.
[2]Includes vigilant, tail up, baring teeth, short bark, repeated barking, growling, snapping, biting
[3]Includes showing eye white, blinking, lip licking, trembling, panting, yawning, licking own body, ground sniffing, scratching
[4]Includes looking away, withdrawing, tail between legs, paw lifting, submissive behaviour
[5]Includes face licking human, whimpering, paws on body, play invite, body licking human, tail wagging, jumping

Table 4. Proportion of videos (back-transformed least squares mean±SE)

Dependent variable[1]	Control		Angry		Inside		Outside	
	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
Video duration	0.073	0.004	0.044	0.002	0.058	0.003	0.055	0.004
Elevated	0.099	0.028	0.301	0.06	0.447	0.043	0.055	0.025
Restrained	0.101	0.025	0.381	0.048	0.128	0.027	0.321	0.058
Radio/TV on	<0.001	0.008	<0.001	0.043	0.132	0.029	<0.001	<0.001
Tail up	0.375	0.042	0.246	0.039	0.192	0.029	0.452	0.056
Baring teeth	0.062	0.018	0.516	0.051	0.329	0.044	0.125	0.038
Growling	0.202	0.034	0.737	0.041	0.533	0.044	0.385	0.062
Repeated barking	0.11	0.026	0.34	0.048	0.086	0.02	0.403	0.061
Snapping	0.034	0.013	0.223	0.043	0.097	0.025	0.086	0.031
Snap or bite (1-0)	0.044	0.015	0.253	0.046	0.12	0.028	0.102	0.035
Aggressive (1-0)[2]	0.705	0.042	0.996	0.004	0.942	0.029	0.972	0.017
Aggressive (total)[2]	1.142	0.086	2.581	0.144	1.608	0.094	1.832	0.146
Eye white	0.431	0.045	0.560	0.048	0.666	0.036	0.327	0.053
Blinking	0.132	0.023	0.101	0.027	0.184	0.03	0.070	0.027
Lip licking	0.269	0.038	0.488	0.047	0.460	0.038	0.291	0.052
Stress (1-0)[3]	0.539	0.045	0.751	0.041	0.801	0.023	0.467	0.058
Stress (total)[3]	0.864	0.076	1.075	0.092	1.329	0.085	0.698	0.089
Looking away	0.006	0.248	0.04	1.625	0.041	1.648	0.006	0.244
Submissive (1-0)[4]	0.016	0.705	0.085	3.422	0.057	2.361	0.025	1.067
Submissive (total)[4]	0.02	0.951	0.064	3.054	0.056	2.709	0.02	1.072
Whimpering	0.174	0.036	0.048	0.017	0.129	0.029	0.067	0.025
Paws on body	0.162	0.031	0.041	0.016	0.10	0.023	0.069	0.025
Play invite	0.26	0.039	0.010	0.007	0.080	0.028	0.039	0.018
Tail wagging	0.678	0.04	0.340	0.044	0.40	0.038	0.62	0.057
Jumping	0.250	0.036	0.075	0.022	0.135	0.026	0.148	0.037
Attention-seeking (1-0)[5]	0.804	0.033	0.420	0.045	0.565	0.04	0.696	0.054
Attention-seeking (total)[5]	1.693	0.108	0.524	0.061	0.941	0.072	0.943	0.098
Human instigating	0.228	0.038	0.871	0.031	0.744	0.04	0.406	0.068
Human touching	0.256	0.038	0.283	0.042	0.361	0.035	0.194	0.043
Human touching aggressive dog	0.027	0.011	0.416	0.057	0.268	0.044	0.052	0.022
Camera in Face	0.120	0.026	0.37	0.047	0.379	0.039	0.117	0.033

[1]Behavioural variables measured as proportion of videos in which dogs showed each behaviour. N=20 videos/breed/search type, except Border Collies (missing 10 angry videos). Behaviours too rare for statistical analysis not shown.
[2]Includes vigilant, tail up, baring teeth, short bark, repeated barking, growling, snapping, biting
[3]Includes showing eye white, blinking, lip licking, trembling, panting, yawning, licking own body, ground sniffing, scratching
[4]Includes looking away, withdrawing, tail between legs, paw lifting, submissive behaviour
[5]Includes face licking human, whimpering, paws on body, play invite, body licking human, tail wagging, jumping

3.5. Attention-seeking behaviour

There were no size difference in any of the attention-seeking behaviour. When adding all the attention-seeking behaviour together (giving a score of 1 for each type of attention-seeking behaviour shown), there was still no difference in size. However there was a difference in between breeds, with Rot being the least likely to show attention-seeking behaviour in the videos (Fig. 6). There was also more total attention-seeking behaviour in the angry group than in the control group, when scored as as total types of attention-seeking behaviours shown (Table 4).
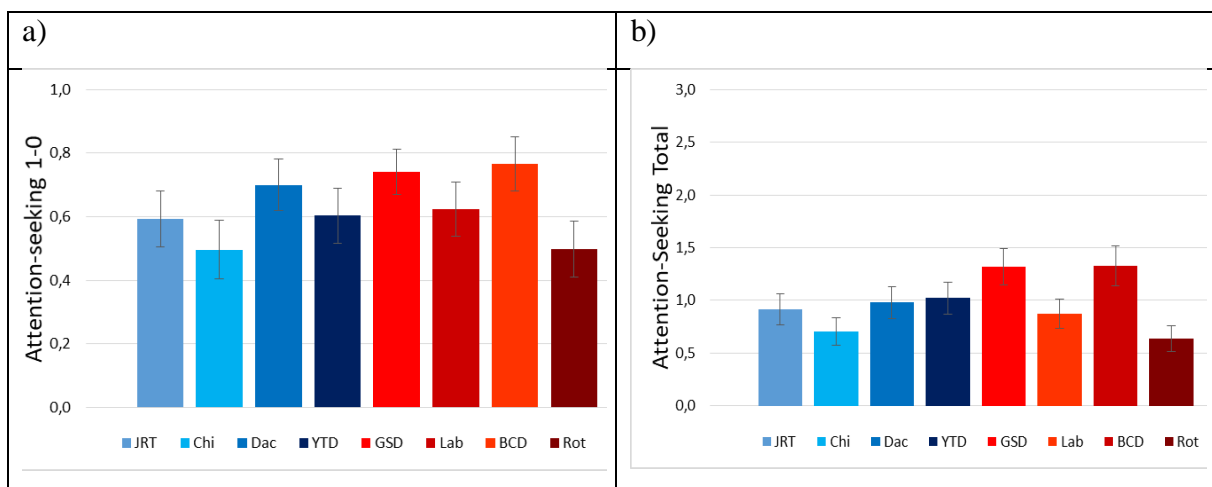
Fig. 6. Proportion of videos (back-transformed least squares mean±SE) showing dogs (a) Attention-seeking 1-0, (b) Attention-seeking total (Sum of face licking, whimpering, paws on body, play invite, body licking, tail wagging, jumping) according to dog size (small, blue; large, red) and breed (Jack Russell Terrier, JRT; Chihuahua, Chi; Dachshund, Dac; Yorkshire Terrier, YTD; German Shepherd Dog, GSD; Labrador Retriever, Lab; Border Collie, BCD; Rottweiler, Rot).

3.6. Human behaviour

Humans were seen instigating aggressive behaviour in similar numbers of small and large dogs, but there was a difference across breeds, with humans being most likely to instigate aggressive behaviour in YTD, BCD and Rot, and the least in GSD (Fig. 7). Humans were more likely to instigate aggressive behaviour in the angry than control dogs, and inside than outside (Table 4).

There were no differences in overall likelihood of a human touching the dog depending on dog size, breed or search type group, though touching was more likely inside then outside. However, there was a difference when it came to touching an aggressive dog, which was more likely if the dog was small than large. There was a breed difference as well (Fig. 7). Humans

were more likely to touch aggressive dogs in the angry than control group, and inside than outside (Table 4).
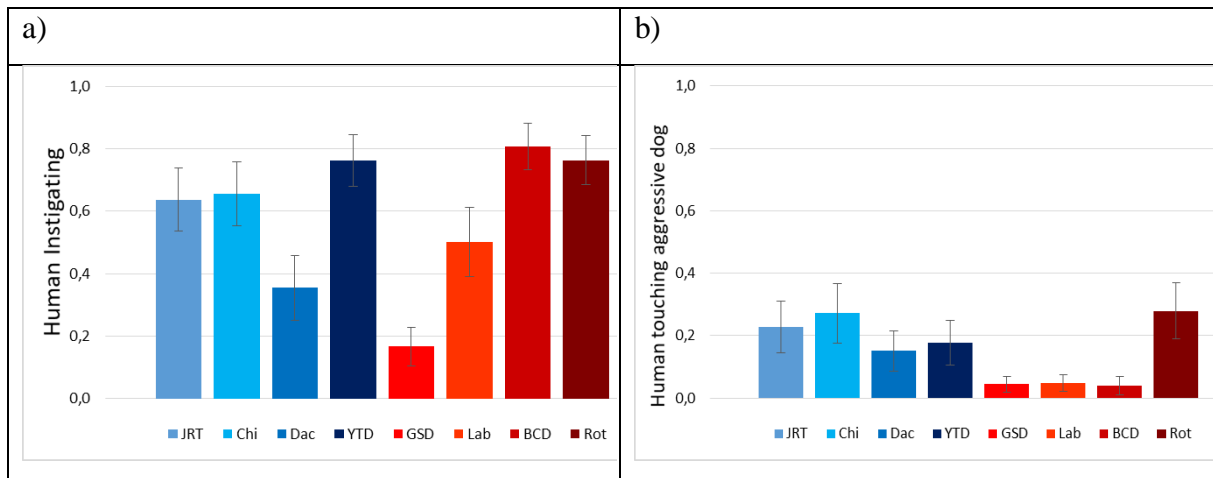

Fig. 7. Proportion of videos (back-transformed least squares mean±SE) showing dogs (a) Human instigating, (b) Human touching aggressive dog total according to dog size (small, blue; large, red) and breed (Jack Russell Terrier, JRT; Chihuahua, Chi; Dachshund, Dac; Yorkshire Terrier, YTD; German Shepherd Dog, GSD; Labrador Retriever, Lab; Border Collie, BCD; Rottweiler, Rot).

4. Discussion

4.1 General factors

I am missing 10 videos from the angry group about BCD. Since BCD have a high activity level, the owners might have to train them more so that they do not develop behavioural problems or stereotypes (Riemer et al. 2016; American kennel club, 2019a.). Since I did not find a lot of angry videos of BCD, it might mean that BCD owers post videos using other titles, and I might find more videos of BCD using words like agility, herding or barking.

The videos in the control group were more likely to be longer, than in the angry group. When videos are longer there are more chance to see more behaviour than if the videos are shorter. Since the angry group videos are shorter it might mean that I would see less behaviour, than what I did in the control groups. But in my excluding criteria I made sure that videos were not short enough for me to not see enough behaviour. The reason for the control group videos to be longer may be because they show a lot of different behaviour and activities that would last longer, than for example aggressive behaviour.

Small dogs were more likely to be on elevated surfaces than large dogs (including those being held and sitting in the owner's lap), which is supported by Westgarth et al. (2008) who reported that small dogs were more likely to be on furnitures or in the owner's lap, than large dogs. An elevated surface could be anything from a chair or sofa to a bed. These are humans territories. Allowing the dog to sit or lie there can cause conflict between the dog and owner, which is consistent with the finding that dogs on elevated surfaces were more likely to be filmed in the angry group than the control group. The dog might show resource guarding when a human approaches (Borchelt, 1983). Also, if a dog is being held against its will, which is more possible with a small dog that is less strong than a large dog, this can cause conflicts.

Restrained refers to dogs prevented from moving freely by, for example, leashes, cages or being held. When a dog is restrained, it might feel that it has less control over a situation than if not restrained. Dogs were more likely to be restrained in the angry group than in control, which may indicate that dogs are more likely to be aggressive in a situation where they are restrained. Chi and Dac were the breeds that were most likely to be restrained by being held in

the videos. Dac have a very long and slender body, and you have to be careful when you are holding them so that you do not harm their spine (American Kennel Club, 2019c.). I did not note if they were holding the dog the proper way, but Dac owners should know how to hold their pets correctly, or not hold them at all. Dogs do not need to be held, as they are not human babies but can voluntarily come up in a person's lap, or be carried when they are tired from a long walk (American Kennel Club, 2019b.).

A TV or radio was more frequently playing in the background in the angry group videos than in the controls. Burn (2018) also noted that the TV and computer were more frequently playing when she was analysing tail-chasing videos of dogs. Loud noises or blinking from the TV or radio may be a stressor for the dogs though, as Burn (2018) also noted, the owner may have happened to be watching TV or working on the computer when the behaviour occurred, and the behaviour did not occur because of it.

4.2 Aggressive behaviour
Tail up was more likely to be seen in the control group, and when dogs were outside. Tail up can be a dominance sign or a sign that the dog is alert, and it can also be that the dog is excited (Becker, 2012; Serpell, 2017 pp.141). This makes it hard to interpret in this study, since I only looked for its presence or absence, and not the behaviour sequence in each video

Baring teeth did not differ between small and large dogs, but did differ between breeds. JRT were more likely to bare teeth than YTD and BCD, and Chi were more likely to bare teeth than YTD. Baring teeth was more likely in the angry group, and more likely when dogs were inside. Baring teeth can be a threat signal (Hasiri et al. 2013). JRT and Chi were both two breeds that bared teeth and that were also more likely to snap and bite, supporting the idea that it is a threat signal. Rot were also likely to bare teeth, but were less likely to snap and bite, suggesting that the signal might work better in larger dogs if they are perceived to be more scary.

Growling was performed more by small dogs. There was a breed difference as well, with JRT and Chi being more likely to growl than GSD and BCD. In the Owczarczak-Garstecka et al. (2018) study, growling was closely followed by snaps and/or bites, so growling can also be a threat signal. Small dogs are more likely to be difficult to notice and people might take them

23

less seriously, so it is not surprising that they were more likely to show growling, snapping and biting. Rot were also likely to growl when baring teeth but showed less snapping and biting, suggesting that people might act more careful in response to this behaviour in large dogs.

Short bark did not differ between any of the groups. Short bark was defined as one to three sharp short bark in a low pitched sound, and appeared to serve as a warning signal across all breeds (Pet Safe, The Paw Print Blog, 2019). Repeated barking was more likely to occur in the angry group, and more likely outside. Barking is an important form of communication in dogs, and can occur in different contexts (JuarbeDiaz, 1997). Although barking can differ between breeds, with some breed barking more than others (JuarbeDiaz, 1997), the likelihood of repeated barking did not differ between breeds in this study. Owners may have been more tolerant of barking outside than inside, since barking can be loud. The dog might be outside as a guard dog although, large dogs are mostly used as guard dogs and I did not see a different in size so this might not be the case (Borchelt, 1983; JuarbeDiaz, 1997). Barking is one of the behavioural problems that gets most reported by dog owners, as Kobelt et al. (2003) reported. Although, in that study they were talking about dogs left outside while the owners were at work, while in my study there was always a handlers present.

There were a difference between snapping and biting between small and large dogs as I predicted, with small dogs being more likely to snap and bite. This might be because humans push the boundaries more with the small dogs, and are not afraid of the risk of bites from a small dog, as their bites can impose less serious damage than those of a large dog. It can also be that people might hesitate to put out videos of large dog biting, to not get reported or because a bite from a large dog can become very serious. This might result in a bias towards small dogs snapping and biting in videos, and a wrong representation of large dogs not snapping and biting in videos. In all the videos, I could not see serious puncture wounds on the humans that got bitten, and it might be that a person would not post a video if the bite were serious. Owczarczak-Garstecka et al. (2018) did a study on dog bites using YouTube, and their sample consisted of mostly large dogs, with GSD, Lab and Chi being the most popular breeds in the videos. The Chi that I observed in the videos were the breed that were most likely to bite and snap compared to rest of the breeds in my study, Owczarczak-Garstecka et al. (2018) also showed that Chi were one of the breeds more likely to bite. German Shepherd was the breed least likely to snap and bite in the videos I observed, which

is inconsistent with Owczarczak-Garstecka et al. (2018) study. Although, they used search words like "dog bite" and "dog attack", that will show different results than those that I found with my search words being "angry" "breed name".

As I predicted, small dogs were more likely to show more aggressive behaviour in total, than large dogs. There were a breed difference as well with JRT being most likely to show aggressive behaviour in total. Chi was also a breed that showed a lot of aggressive behaviour in total. In Duffy et al. (2008) study, JRT, Chi and Dac, were dogs that scored high for aggression in all the different contexts of aggression, which is consistent with my findings. Large dogs might get away with showing less aggressive behaviour, leading to people stopping bothering them, and small dogs might have shown more diverse and escalated aggressive behaviour when mild threat signals were not effective in causing people or other dogs to go away. In this study, the dogs were more likely to show aggressive behaviour than stress-related or submissive behaviour.

4.3 Stress behaviour
Showing eye white did not differ between size, but did differ between breeds. Chi were more likely to show the white in the eye than Dac, GSD and Lab. The angry group dogs were more likely to show eye white more than control. Previous work with calves indicated that eye white is often associated with stress (Sandem et al. 2002), which fits with my finding because aggression in dogs is often related to fear (Luescher and Reisner, 2008), and corresponding activation of a physiological stress response. Dogs showed more eye white inside than outside. The reason for this association is unclear although, my results show that dogs were more likely to show a variety of potential stress signs when inside than outside including showing eye white. However, showing the eye white can be a sign of arousal, which can also occur during play (Sandem et al. 2002). The eye white can also be shown when the dogs is looking up, down, or to the sides. Therefore, not all occasions when the eye white is visible are linked to stress.

Blinking did not differ between small and large dogs, but did differ by breed. Chi were most likely to blink of the breeds. Blinking did not differ between search type groups, which might indicate that it was not a sign of stress in all of the videos. Although blinking was defined in the ethogram as blinking more than once, without someone making them blink, they might just be blinking normally without it being a stress sign. Dogs blinked more inside than

outside, which might indicate that the air is dryer inside, making them lubricate their eyes more by blinking. However my results show that dogs were more likely to show a variety of potential stress signs when inside than outside including blinking, which could mean that blinking was associated with stress in that context. Stracke et al. (2011) saw eye blinking as prominent when testing a Pavlov sling to restrain laboratory Beagle dogs, but it was not a sign of acute stress in their study based on other studies done by Harmer and Williams (2003) and their control group. Indicating that blinking is used as a mild sign of stress.

Lip licking was more likely to be performed by small dogs than large dogs, and differed between breeds. Chi were more likely to lick their lips than Lab. Lip licking was also more common in the angry group than the control group, and in dogs located inside than outside. Stracke et al. (2011) saw less lip licking by laboratory Beagles than other stress-related behaviours in the study, and less lip licking than Beerda et al. (1997) saw in stressed dogs being exposed to acoustic signals. Beerda et al. (1997) wrote that there might be individual differences in who shows stress responses like lip licking. In my study lip licking were one of the stress signs that was most used by the dogs, and since lip licking also differed between breeds, it might not just be a individual difference.

I did not see enough dogs (<11) showing trembling, panting, yawning, licking own body, ground sniffing or scratching own body or environment to analyse these behaviours statistically. This might be because these behaviours occur more in dogs that have more serious welfare problems. The owners might not film these behaviours as they might be embarrassed by how people would react to seeing seriously ill or distressed dogs. Behaviour like trembling and panting might have also been difficult to detect in the videos, because of low video resolution or because the dog performed other behaviour making it hard to detect more subtle movements. Also Mariti et al. (2012) showed that dog owners could identify behaviour like trembling and panting as indicator of stress, and so if they know the signs of stress they might stop the behaviour from happening, or stop filming when they see these behaviours.

Small dogs and large dogs did not differ in total stress behaviour shown, but there were differences between breeds. Chi were more likely to show more of the behaviours included in the total stress behaviour category than, Dac, YTD, GSD and Lab. This could indicate that Chi is a breed that easily gets stressed or that humans were more likely to behave towards Chi

in ways that provoke a stress response. The dogs in the angry group had higher total stress scores than the dogs in the control group, suggesting that dogs that were aggravated showed more stress signs. Dogs also were more likely to show more stress behaviours when inside than outside. This might be because there are individuals or objects indoors that stress the dog. I saw that the radio/TV was more likely to be "on" inside and in the angry group, suggesting that this might be a stressor for the dog, or indirectly because the dog was frustrated by lack of attention from an owner who is focused on the radio or TV. Beerda et al. (1997) found that dogs showed stress signals when using noise as a stressor. Although I do not know the sound frequency for the noise in the videos, and do not know if it is loud enough to evoke stress, or other behaviour in the dogs.

4.4. Submissive behaviour

Looking away did not differ according to dog size although there was a breed difference, with Chi being more likely to look away than YTD. Looking away was defined as turning head to try removing itself from a situation, person or object facing the dog, excluding turning to look at something. But it might be possible that the dog was just looking in another direction. The dogs in the angry group were more likely to look away than control group, possibly to avoid a stressful situation, and dogs were also more likely to look away when inside than outside. Dogs showed more stress and submissive behavior inside, so it is possible that they looked away to avoid a stressful situation and not just by chance.

There were too few dogs (<11) showing withdrawing, tail down, paw lifting and presenting belly to enable statistical comparisons. Although withdrawing was defined as trying to get away even though the dog is restrained, it may have been difficult to detect this behaviour in the videos. Tail down can also be difficult to detect as dogs in many videos were sitting or lying down and therefore did not display different tail postures.

The sum of all submissive behaviours shown did not indicate differences between the two sizes of dogs, but did indicate breed differences. Chi were more likely to show submissive behaviour than YTD. Rot did not show submissive behaviour in any of the videos, and GSD and BCD also showed little submissive behaviour. Rot, GSD and BCD are all bred to be herding dogs (American Kennel Club, 2018a.d.; American Kennel Club, 2019e.), which might make them less likely to show submissive behaviour as they are supposed to control other animals. YTD was bred as a rat hunter (American kennel club, 2019f.), and McGreevy

(2013) discussed that aggressive temperament might have been selected for at the same time as short legs for small dogs to hunt underground and in tight spaces. This might give an explanation for YTD showing little submissive behaviour. Although there are studies looking at differences between breeds (e.g. Duffy et al. 2008), more studies could be done. The angry group dogs had higher total submissive behaviour scores, suggesting that these dogs were more likely to show signs that they were uncomfortable in situations where the humans perceived them as angry. Dogs were more likely to show submissive behaviour inside than outside, indicating that there might be more conflicts at home that make dogs uncomfortable. The humans may scare the dog, scold it, or perform other behaviour that leads to a submissive response by the dog.

4.5 Attention-seeking behaviour

There were no differences in the attention-seeking behaviour when it came to size or breed of the dog. I predicted that small dogs would show more attention-seeking behaviour towards humans, so as to be more noticed by them and, and McGreevy (2013) showed that small dogs were more likely to show attachment and attention seeking towards their owners. During domestication, humans have selected dogs for more puppy-like behaviour (behavioural paedomorphism), and this might be shown in all dogs explaining why human attention-seeking behaviour did not differ between sizes or breeds (Serpell, 2017, pp.23-29; Morey, 1994). Dogs in the angry group showed less attention-seeking behaviour than dogs in the control group, as to be expected in that dogs showing aggressive behaviour presumably wanted humans to move away.

4.6. Human behaviour

Humans did not instigate aggressive behaviour in the small dogs more than the large dogs as I had predicted, but there were a difference between breeds. Human were more likely to instigated aggressive behaviour with JRT, Chi, YTD, BCD and Rot. Humans were less likely to instigate aggressive behaviour with GSD. Sarenbo (2019) looked at dogs seized by the swedish authorities and, Rot and GSD were some of the dog breeds more likely to be euthanized because of aggression. Why humans would instigate aggressive behaviour in Rot in the videos is unknown. Human were more likely to instigate aggressive behavior in the angry group, which is not surprising as dogs show more aggression, stress and submissive behaviour in the angry group. Human were also more likely to instigate aggressive behaviour

inside than outside, which may be a correlation with dogs showing more stress and submissive behaviour inside.

There were too few videos for analysis of data on humans correcting the "bad behaviour" of their dogs, suggesting that they might not have looked at the behaviour as bad, or thought it was funny or did not care about the behaviour, and therefore did not attempt to correct the dog.

There were no difference in human touching the dogs depending on size, breed or search type, but human were more likely to touch the dogs when inside than outside. When the handler and dogs are outside there might not be time for tactile contact as they might walk or play together or the touching may not be captured on the video. Humans were more likely to touch an aggressive dog if it was small than large. This fits with my prediction, with humans seeing small dogs as less of a threat, and that might be because small dogs are perceived to cause less damage if they bite. There were a breed difference as well with human being more likely to touch aggressive Rot, just as much as the small dogs. Humans were also more likely to instigate aggressive behaviour in Rot, which is surprising since Rot is a large dog who is know to be aggressive (Sarenbo, 2019). Handlers and Rot might have a special bond that would be interesting to look deeper into in further studies although, Sarenbo (2019) found one case of a Rot that was not delighted to see its owner after a shelter visit.

Hovering the hand over the dog's head and pushing the camera into the face were two of the provoking behaviours humans did towards the dog, in addition to touching them. There were too few data for the "hands above" analysis, but there was a difference in breed when it came to camera in face. Humans were more likely to put the camera in the face in the angry group than in control group, suggesting that this was provoking for the dog. They also were more likely to put the camera in the face of the dog when inside than outside. This was probably because the dog was more likely to be located further away from the person with the camera when outside, giving less opportunity to put the camera in the dog's face.

There might be different reasons for why the human would provoke the dog. They might do it because they think it's funny or because they think they are playing. People might get too little education about dog behaviour, and not recognise signs that the dog is stressed or aggressive. If so, more education about dog behaviour would be needed so dog owners could

29

behave more appropriately towards their dog. Burn (2011) study on tail chasing dogs on Youtube showed that most people in the video and in the comments found the behaviour as funny, and only 2.3% of the comments suggested the behaviour to be clinical. Mariti et al (2012) showed that dog owners could correctly identify high indicators of stress, but that they lacked knowledge of more subtle signs of stress. Dogs were reported as less stressed, by owners that lacked the knowledge of subtle stress behaviors, than other dogs. Tami and Gallagher (2009) found that people had difficulty to differentiate between play and aggression, and submission and friendliness.

In none of the videos did I see any dogs that were clearly neglected. Every dog looked healthy, except one dog that was identified in comments by the poster as being ill or handicapped (one case of an YTD with osteoarthritis).

4.7. Further studies

In this study, I only looked at associations between the scores for the different behaviour variables and dog size, breed, search type and location. I did not look at the behavioural sequence in the video, or the frequency of each behaviour. It would be interesting to see if the results presented here based on 1-0 sampling would be consistent with results on the frequency and sequence of behavioural events shown in each video to see if there is a difference in how small and large dogs act.

I included four breeds in each dog size category to assess whether there were any general associations between size and behaviour that could not be simply related to selection for different characteristics in different breeds. This observational study shows that there might be some general differences in aggressive behaviour between small and large dogs but also that there are breed differences. There are also several other variables to account for when it comes to the behaviour of dogs. It was not possible to collect systematic data on the sex of the dog, age (apart from excluding puppies), if they were intact or neutered, their background in regards to health problems or what training they had received just based on review of the videos posted online. Such factors have been recorded in other studies and have indicated differences in behaviour related to these variables as well (Arhant et al. 2010; Westgarth et al. 2008; Bennett and Rohlf, 2007; Kobelt et al. 2003).

5. Conclusion

I have found that small dogs are more likely to show aggressive behaviour than large dogs, and that humans are more likely to touch the small dogs when aggressive. These findings suggest that the observed behavioural differences between small and large dogs were mediated by differences in the behaviour of humans towards the dogs, leading to escalated aggressive behaviour in the small dogs. I found breed differences in aggressive, stress and submissive behaviour that might indicate that some breeds are more predisposed to different behaviour than other breeds. More studies can be done on the behaviours of dogs on an individual and breed level.

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List of tables

List of figures