Canine Behavior and Genetics Project

University of Pennsylvania

The Canine Behavior and Genetics Project report on noise reactivity and problem solving / University of Pennsylvania:
As many of you know, the Canine Behavior and Genetics Project (www.k9behavioralgenetics.net – please note new website) has been examining the patterns of noise reactivity and noise phobia in dogs. We have concentrated primarily on one group of dogs – herding dogs – and mainly on 3 breeds in that group: Australian shepherds, Border collies, and German shepherds. We have split from the UCSF group and are now working with a number of other collaborators, so please see our website for details.

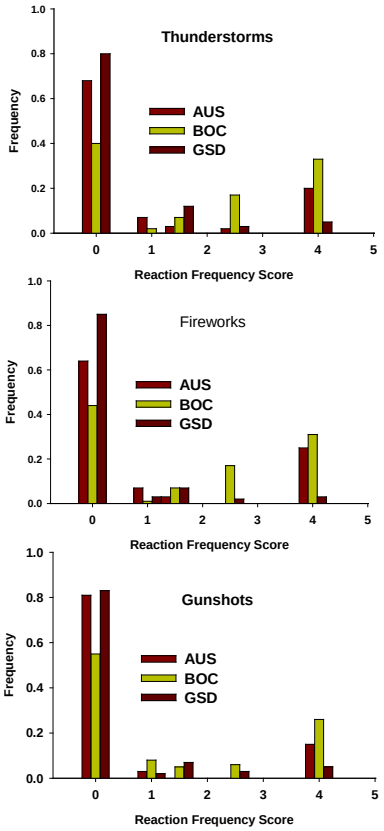
We chose the group – herding dogs – because so many dogs who work in any capacity (e.g., sniffing out explosives, people, contraband, acting as a service dogs, herding, et cetera) come from this group. Many of these breeds should also share some genetic origins so we don't have to worry about misleading variation in a small sample that could be the result of being selected for different types of tasks (e.g., being a hound not a herding dog). We chose these breeds for a number of reasons:

1. they are frequently used world-wide in the job categories mentioned;
2. they have 'working' / 'performance' subgroups (e.g., herding, agility, et cetera);
3. their breed groups have concerns about noise reactivity and performance, and there is some published information about noise reactions within these breeds;
4. they should share some overlapping genes related to task, which may make it easier to learn if the groups share genes associated with noise reactivity;
5. Dr. Overall has rescue Aussies and has many clients who have dogs from these breeds who are concerned about noise reactivity in their dogs.

The initial study was a year long and produced a lot of information. Our original task was to evaluate 60 dogs of each of the 3 chosen breeds, and obtain DNA samples from them to decide if further pursuit of questions about noise reactivity and noise sensitivity (can some dogs hear different sounds than others, and is ability to detect certain noises related to a noise sensitivity). In the end, we had 211 Border collies, 165 Aussies, and 93 German shepherds (some of whom were full-time detection dogs) in our sample.

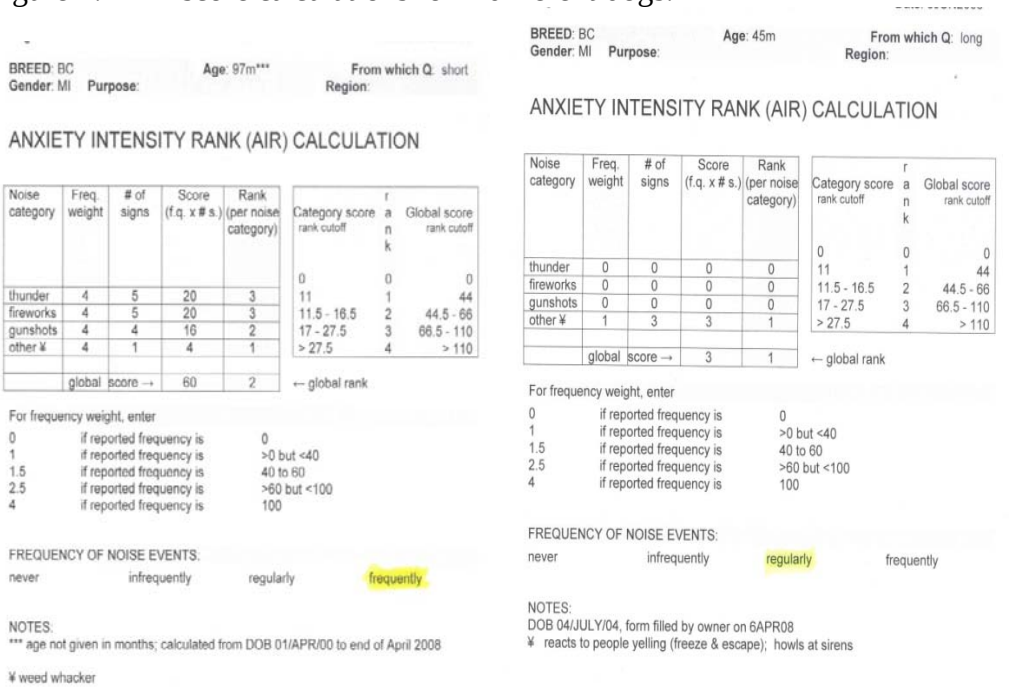
One of the most interesting findings was the extent to which the population of Border collies sampled reacted to storms compared with the other breeds. Figure 1 shows that Border collies reacted more severely (react 100% of the time and >60% of the time) than did the other breeds.

Figure 1: Reactions to thunderstorms, fireworks and gunshots by Australian shepherds (AUS), Border collies (BOC), and German shepherd dogs (GSD) with respect to frequency of response. Reaction frequency scores were as follow: 1-never reacts; 2-reacts >0-40% of the time; 3-reacts 40-60% of the time; 4-reacts 60-<100% of the time; 5-reacts 100% of the time.



To compare how reactive dogs were we constructed something called an Anxiety Intensity Rank, or AIR score. AIR scores are a number that accounts for the number of signs a distressed dog shows and the frequency with which they show them. Calculations for 2 very different Border collies – 1 very reactive, 1 non-reactive - are shown below (Figure 2).

Figure 2: AIR score calculations for 2 different dogs.



BREED: BC Age: 97m*** From which Q: short
Gender: MI Purpose: Region:

ANXIETY INTENSITY RANK (AIR) CALCULATION

Noise category	Freq. weight	# of signs	Score (f.q. x # s.)	Rank (per noise category)
thunder	4	5	20	3
fireworks	4	5	20	3
gunshots	4	4	16	2
other ¥	4	1	4	1
	global	score →	60	2

Category score rank cutoff	rank	Global score rank cutoff
0	0	0
11	1	44
11.5 - 16.5	2	44.5 - 66
17 - 27.5	3	66.5 - 110
> 27.5	4	> 110

← global rank

For frequency weight, enter

0	if reported frequency is	0
1	if reported frequency is	>0 but <40
1.5	if reported frequency is	40 to 60
2.5	if reported frequency is	>60 but <100
4	if reported frequency is	100

FREQUENCY OF NOISE EVENTS:
never infrequently regularly frequently

NOTES:
*** age not given in months; calculated from DOB 01/APR/00 to end of April 2008

¥ weed whacker

BREED: BC Age: 45m From which Q: long
Gender: MI Purpose: Region:

ANXIETY INTENSITY RANK (AIR) CALCULATION

Noise category	Freq. weight	# of signs	Score (f.q. x # s.)	Rank (per noise category)
thunder	0	0	0	0
fireworks	0	0	0	0
gunshots	0	0	0	0
other ¥	1	3	3	1
	global	score →	3	1

Category score rank cutoff	rank	Global score rank cutoff
0	0	0
11	1	44
11.5 - 16.5	2	44.5 - 66
17 - 27.5	3	66.5 - 110
> 27.5	4	> 110

← global rank

For frequency weight, enter

0	if reported frequency is	0
1	if reported frequency is	>0 but <40
1.5	if reported frequency is	40 to 60
2.5	if reported frequency is	>60 but <100
4	if reported frequency is	100

FREQUENCY OF NOISE EVENTS:
never infrequently regularly frequently

NOTES:
DOB 04/JULY/04, form filled by owner on 6APR08
¥ reacts to people yelling (freeze & escape); howls at sirens

Notice that in Figure 2, the 2 dogs are of very different ages. This observation led us to ask if the breeds differed by age and score. In other words - are older dogs more affected than younger dogs? In fact, Border collies had the highest scores of any breed (and so were more affected) and those in the sampled population were significantly older than were the sampled dogs of the other 2 breeds. However, when we looked within breeds and asked if older dogs were more affected than younger dogs, there was no affect of age, *except* for the German shepherds where older dogs were *less* affected than were younger dogs! Remember, this does not mean that affected dogs will not get worse with exposure and time – they likely will. We are sampling a group of dogs at one point in time, and not following them across time, so we must conclude that our sampled populations differed in age and extent to which they were affected (e.g., average AIR score), but that we do not know the mechanism for this association.

Table 1: Ages of dogs sampled. Ages are in months. N=number of dogs, SE=standard error, CI=confidence interval. Mean is the average age of the groups of dogs.

	N	mean	SE	95% CI
AUS	**59**	**58.00**	**5.60**	**11.21**
BOC	**81**	**79.95**	**5.01**	**9.98**
GSD	**58**	**42.85**	**3.07**	**6.14**

There were 2 main foci of this study:

1. Could we characterize the behavior of the dogs in repeatable and reliable way? In other words, could we phenotype the dogs?
2. Were there genetic associations that correlated with phenotype?

The answer to the first question, as shown above, was a resounding "yes"! So we used the AIR scores to divide the dogs into dogs who were fairly severely affected and for whom we had great confidence in the extent to which they were affected, and those who were relatively unaffected, and for whom we had great confidence that they were unaffected.

The group at UCSF then used a new gene chip technology (Affymatrix chips) to look at mapped regions of the canine genome and statistical associations with the phenotypic distinctions we had identified. These types of association studies will always suggest associations, and part of the trick is to decide is they are truly statistically remarkable and biologically meaningful. We now think that we have a handful of regions that likely meet both these criteria. If we are right, we may be looking at genetic regions involved in how information is processed and transmitted at the molecular level, and how efficiently this can be done. To be sure, we need a sample size 2-3 times that of the original study.

The pilot project was a success. Now we need to both increase the sample size while also asking about the implications of how well dogs process information by assessing performance and problem solving ability.

Accordingly, we are continuing to sample DNA from dogs of these breeds, and we have added another breed, Belgian malinois, as a focus. We have also decided to opportunistically get information and DNA from any other breed we can, either if they truly work (e.g., if we are visiting a detection dog group and they have a Labrador retriever who works, we will get information and a blood sample from that dog) or if they show up at a show where we are collecting samples, and are ready, willing, and able to participate, we will include that dog (e.g., the Jack Russell terrier at an agility trial).

As a result, ***we still need lots of dogs and lots of information.***

So, ***if you participated before*** (and we will be contacting you, but please feel free to contact us also – your confidentiality is completely respected), ***we need you*** to complete a much longer questionnaire that is also being completed by those who have detection dogs of all kinds (the *WDQ_Questions for assessment of detectionK9s_petversion reduced_31July09.doc/pdf)*. This questionnaire seeks to evaluate how dogs react to the world around them.

If you have never participated, we need you!
This may be the only time that such a study gets done; with the current state of our economy, getting funding is difficult and continued funding for this study is not

guaranteed. Getting as many dogs as possible to participate and provide us with data is therefore extremely important. Results of this study are meant to benefit both working and pet dogs and their owners. Without such studies, the help from research that we all want will not be possible. This is why we really need your help.

The long pet working dog questionnaire (the *WDQ_Questions for assessment of detectionK9s_petversion reduced_31July09.doc/pdf)* is available on your group's website and on our website (www.k9behavioralgenetics.net) as a Word document (on which you can type your answers) which you can attach to an email to send via regular mail, and as a pdf which you can complete using a pen, and either send us by mail or scan and send via email as an attachment. The mailing address is on the questionnaire. We ***also*** need for you to provide us with pedigrees, if you have them.

The questionnaire has very clear instructions and a good, detailed explanation of the study. We make a big deal about it being long, but it will take you only about 45-60 minutes to complete….depending on how complex your dog is. Those of us working on this study have completed the questionnaires for our own dogs.

When you complete the s questionnaire you will also get a chance to see what other aspects of the study participation might interest you.

We are currently testing working detection dogs with a problem solving test that takes an hour and asks how dogs respond to different types of questions. If we can gain access to 8 dogs in 1 day or 15 in 2 days, we could actually administer the test to dogs in your club. We need a relatively quiet area out of the elements, electricity, and the help of the dog's people. Indoor agility/training facilities can be perfect. It takes about an hour to test the dog….a little less if we already have a DNA sample.

These studies have been funded with grants to Dr. Overall by various agencies in the government that fund work on military and working dogs, including detection dogs. One of our goals is to ensure that dogs who work as detection dogs have the tools to do as safe a job as they can and that their handlers have up-to-the-moment information that will allow them to treat their dogs as humanely as possible. If you have ever been with a dog who is afraid of storm, during a storm, you know that they suffer. Our ultimate goal is to understand the genetic and molecular basis of the reactivity that causes the suffering so that we can prevent and/or better treat it in both pet and working dogs. Both of these studies have been approved by the University of Pennsylvania's Institutional Animal Care and Use Committee (IACUC), and government equivalents, to ensure they meet the Public Health Service standard for humane care.

Many thanks for your interest and help!!! Additional information is available at our website (www.k9behavioralgenetics.net), including downloadable pdfs of some useful and pertinent articles.

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