Data from ManyDogs 1

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Abstract

The ManyDogs 1 study is the first multi-site collaborative study of dogs' responses to human pointing. It addressed whether dogs perceive the gesture as socially communicative and are therefore more likely to follow the point when it is paired with additional social signals (ManyDogs Project, et al., 2023b). Researchers from 20 research sites across eight countries collected data from 704 dogs. Here, we present not only the behavior data on the dogs' responses to experimental pointing conditions but also guardian responses to survey questions, including the Canine Behavior and Research Questionnaire (C-BARQ©, Hsu and Serpell, 2003). This dataset allows for assessing associations among C-BARQ measures as well as connections to the experimental task data, research site metadata, and other dog and guardian characteristic data.

Keywords: Canine; Dog; Interspecies interaction; Pointing; Social communication

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(1) Background

ManyDogs is an international research consortium of scientists with a shared interest in the factors driving canine behavior and cognition (ManyDogs Project et al., 2023a). This consortium actively fosters a diverse community and formalizes a transparent and equitable process for engaging in multi-site collaborative projects related to canine behavior and cognition. In the first ManyDogs study—named ManyDogs 1 (ManyDogs Project et al., 2023b), we investigated a question of theoretical importance in canine science: Do dogs act on human pointing signals as though they are communicative social cues? Domestic dogs (*Canis familiaris*) have become a popular animal model for investigating behavioral and cognitive evolution due to their shared ecological niche with humans and because they are plentiful, easy-to-access research subjects in many parts of the world. Interest in their putatively innate ability to interact and cooperate with humans has made them particularly popular in comparative studies, especially as they appear to respond to human communicative cues—such as pointing—more accurately and flexibly than other species (e.g., Bräuer et al., 2006). Though point following behavior in dogs has been widely observed and studied over recent decades (Miklösi et al., 1998; Soproni et al., 2001; Hare et al., 2002; Kaminski & Nitzschner, 2013), there is still disagreement as to the underlying motivation for the behavior. Do dogs respond to pointing because they interpret the gesture as socially communicative (Hare & Tomasello, 1999; Soproni et al., 2001; Kaminski & Nitzschner, 2013)? Or rather, because dogs have learned to associate human pointing with food rewards (e.g., Wynne et al., 2008)?

To investigate this question, we used a big team science, single-study approach, modeled after other groups such as ManyBabies (Frank et al., 2017) and ManyPrimates (ManyPrimates et al., 2019). With this method, multiple research teams followed the same experimental protocol, sharing the high cost of behavioral data collection and striving to

implement the method in an identical manner. This approach replicated the study simultaneously in different research environments and with different populations.

Under our main hypothesis, we predicted that when dogs saw a pointing gesture paired with *ostensive* signals, such as eye gaze and dog-directed speech (i.e., calling the dog's name), they would be more likely to follow the gesture than when no such ostensive cues accompanied the point. If we observed this response across dogs, the result would lend support to the idea that explicitly communicative cues help dogs understand the intention behind the gesture. Such an outcome would suggest that dogs find ostensive cues necessary for understanding pointing, similar to human children (Behne et al., 2005). On the other hand, if no difference was observed in point following across the ostensive and non-ostensive conditions (pointing without additional cues), this outcome would suggest that dogs indiscriminately follow pointing. Such a result would suggest that dogs raised by humans may learn to associate pointing limbs with rewards and not necessarily perceive any communicative intention underlying the gesture.

In addition to testing our main hypothesis, we took the opportunity offered by multiple research teams in different sites collaborating on the same study to collect data on sources of inter-site variability that could influence the results. Often, studies by different groups produce inconsistent results (Rodriguez et al., 2021). The impact of cultural differences in scientific practice, dog training norms across regions, and of course variation in heritable traits across dog breeds have complicated replication studies conducted by isolated groups, making it difficult to pinpoint the reasons that results differ. By collecting extensive and detailed information about the testing environments and subject population, we achieved a rich and robust dataset that would support investigation about multiple influences on dogs' behavior previously out of reach.

(2) Methods

2.1 Study design

The ManyDogs 1 study used a cross-sectional, multi-method approach to collecting data. Dog guardians were recruited through the individual research sites' existing databases and via their respective outreach methods (e.g., social media). Prior to participating in the behavioral tasks at a research site, guardians completed an online survey, providing basic environment and demographic information along with a validated assessment of canine temperament and behavior—the Canine Behavioral Assessment and Research Questionnaire (C-BARQ©, Hsu & Serpell, 2003). The behavioral tasks included a short series of object-choice warm-ups that acclimated the dog to the space, followed by two experimental pointing conditions. Using a within-subjects design, dogs were tested on two different pointing cues by a trained researcher, ostensive and non-ostensive, in counterbalanced orders across subjects. Response rates to these two styles of pointing were compared within subjects, while additional between-subject variables derived from the survey data supported investigating variability in behavior as a function of demographic and environmental factors.

2.2 Time of data collection

Data for the study were collected over 13 months, between January 2022 and January 2023. Within this time window, research sites were able to decide when to implement the protocol according to the guardian and staff availability (collection dates available in dataset).

2.3 Location of data collection

For the main study, data were collected in 20 research sites across eight countries (Argentina, Canada, Croatia, Hungary, Italy, Poland, UK, USA) on three continents

(Figure 1). In addition, an Austrian site recorded only pilot data and is not represented in this dataset. A full list and description of research sites is available in Table S1 of ManyDogs Project et al. (2023b).

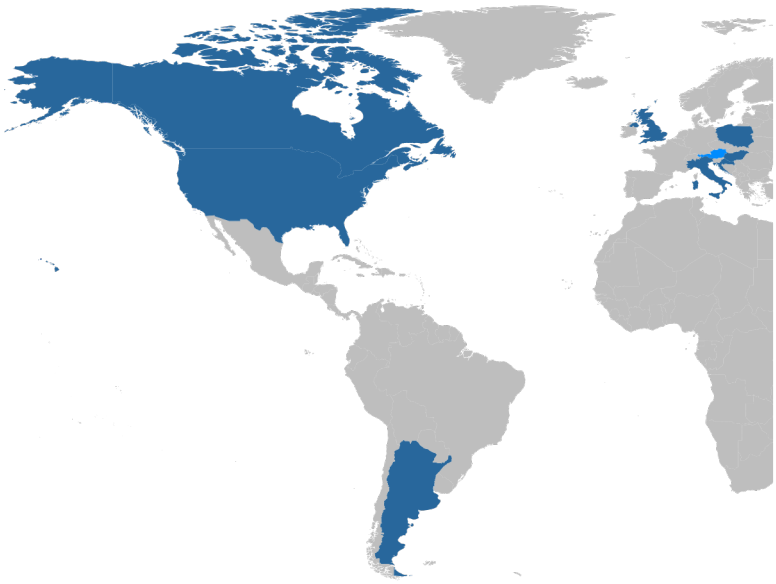

Figure 1. ManyDogs 1 data presented here were collected from 20 research sites in eight countries: Argentina, Canada, Croatia, Hungary, Italy, Poland, UK, USA. Pilot data not included in this dataset were collected from a site in Austria.

2.4 Sampling, sample and data collection

Across all sites, teams behaviorally tested 704 dogs (M:F = 334:373, mean ± SD age = 4.40 ± 3.1 years [range = 0.3-20.8]). Approximately 76.9% of the dogs were spayed or neutered, 53.8% were of single-breed ancestry (comprising 85 distinct breeds), 90.2% lived in private homes, 9.6% lived in group/kennel housing, and 0.3% lived in other housing. Complete behavioral data were collected from 455 dogs, and complete survey data were collected from 495 dogs. Guardians identified as female (81.0%), male (17.7%), and nonbinary/other (1.3%) with a modal guardian age range of 30-39 years.

2.5 Materials/Survey instruments

The guardian survey was hosted on Qualtrics (complete survey available at https://doi.org/10.17605/OSF.IO/7RWPC/). The survey included dog demographics (name, living situation, sex, neuter status, birth date, breed information, acquisition type), training information (communication style and frequency, training experience, research experience), guardian demographics (gender, age, community type), and C-BARQ. The C-BARQ trainability scale (eight items) was presented first and was included in the pre-registered analysis of pointing (ManyDogs Project et al., 2023b). After answering the trainability questions, guardians could decide to submit their responses or continue to complete the remaining six behavior assessment scales. If they continued, they answered questions about aggression (28 questions), fear (18 questions), separation-related behavior (9 questions), excitability (7 questions), attachment/attention-seeking (7 questions), and miscellaneous behavior problems (28 questions), including chasing, chewing, begging, pulling, urinating, defecating, barking, and licking. Most questions used a 5-point Likert scale with a Not Observed option. Some categories included open-ended questions for additional explanations of their dog's behavior, but we did not include them in our dataset to protect guardian anonymity.

Behavioral data were collected at individual research sites, where guardians brought the dogs in for test sessions. After the dogs acclimated to the testing room, they completed a series of warm-up object-choice tasks in which food was hidden under cups and they had to approach a cup to receive any food rewards hidden underneath (complete methods available in ManyDogs Project et al., 2023b). These tests were conducted by two individuals: an experimenter to bait and place the cups and a handler to release the dog to make a choice and recall for subsequent trials (handlers could be either trained researchers or the dog's guardian).

Sessions started with warm-up trials to familiarize the dogs to the testing procedures.

These involved trying to find a food reward placed under a single cup (one-cup warm-ups with four out of seven trials correct) or under one of two cups (two-cup warm-ups with four out of size trials correct). Once meeting the completion criteria, the dogs moved on to two experimental condition sessions with eight trials per condition (condition order counterbalanced between subjects). In the non-ostensive condition, the experimenter cleared their throat to get the dog's attention, showed them the food, and placed food underneath one of two cups behind a visual barrier. They then removed the barrier, gazed at the ground in front of them, cleared their throat again, and pointed to the cup with the food using a contralateral momentary point. In the ostensive condition, instead of clearing their throat, the experimenter said "[dog name], look!" in an engaging voice and they made eye contact with the subject instead of looking at the floor. The two conditions were separated by a one-minute play break and re-familiarization with the testing situation. After the two experimental conditions, the dogs completed an odor control condition with a similar set-up as the ostensive condition, except no point cue was given. The control was intended to determine whether the dogs were using olfactory instead of visual cues to solve the task.

2.6 Quality control

Collecting high-quality data was a key objective of ManyDogs 1. To validate the study design and analysis plan, we conducted a pilot experiment at a single site with 91 dogs. We pre-registered the pilot study at the Open Science Framework (https://osf.io/gz5pj/). The pilot data are not included in this dataset.

For the primary study presented here, we pre-registered the hypotheses, methods, and analysis plan as a registered report at *Animal Behavior and Cognition* (https://doi.org/10.31234/osf.io/f86jq). Because this study involved multiple sites running the same protocol, we sought to ensure consistent implementation across sites. During a researcher training phase, participating sites were required to submit videos of their team

performing the protocol, as well as the full set of videos from the first dog tested. Two project administrators reviewed the videos for all sites and provided feedback on each site's implementation to improve consistency across sites.

Behavioral tests were video recorded and experimenters also live-coded the dog's responses on paper. Data were compiled across sites through a data entry survey hosted on Qualtrics. Using a survey protected the resulting data file from errors associated with directly editing the file. To measure inter-rater reliability of the live coding of experimental sessions, each site had a research assistant blind to the project's focus recode a subset of sessions. This recoding resulted in an overall Cohen's kappa of 0.98 with individual sites ranging from kappa = 0.92-1.00.

2.7 Data anonymization and ethical issues

Each research site participating in this study obtained approval from their respective institutional ethics committee (see Table S1 of ManyDogs Project et al., 2023b). All guardians gave informed consent to participate and were free to discontinue from the study at any time.

All identifiable information has been removed from the dataset, including replacing dog names with ID numbers.

2.8 Existing use of data

A portion of the guardian data collected for the ManyDogs 1 study was used and published in:

ManyDogs Project, Espinosa, J., Stevens, J.R., Alberghina, D., Barela, J., Bogese, M., Bray, E., Buchsbaum, D., Byosiere, S.-E., Cavalli, C., Dror, S., Fitzpatrick, H., Freeman, M.S., Frinton, S., Gnanadesikan, G., Guran, C.-N.A., Glover, M., Hare, B., Hare, E., Hickey, M., Horschler, D., Huber, L., Jim, H.-L., Johnston, A., Kaminski, J., Kelly, D.,

Kuhlmeier, V.A., Lassiter, L., MacLean, E., Ostojic, L., Pelgrim, M.H., Pellowe, S., Salomons, H., Santos, L., Silver, Z.A., Silverman, J.M., Sommese, A., Völter, C., Walsh, C., Worth, Y.A., Zipperling, L.M.I., Żołędziewska, B., and Zylberfuden, S. G. (2023). ManyDogs 1: A multi-lab replication study of dogs' pointing comprehension. *Animal Behavior and Cognition*, 10(3), 232-286. https://doi.org/10.26451/abc.10.03.03.2023

(3) Dataset description and access

The dataset contains 704 observations of 158 variables described in a codebook and Table 1. The dataset contains variables supplied by a survey as well as experimental variables. Data provided by each dog's guardian include demographic information about the dog and guardian, responses to questions about the types and frequencies of the dog's training activities, and answers to the C-BARQ.

In addition to the data provided by guardians, experimental variables are included in this dataset. These include information about experimental conditions, proportions of correct choices under ostensive and non-ostensive conditions, whether the correct and chosen option were on the right side of the dog, and whether the dog completed the experiment and was used in the analysis.

3.1 Repository location

The dataset for this study is available on the Open Science Framework at https://osf.io/7rwpc/ (DOI: 10.17605/OSF.IO/7RWPC) and on GitHub at https://github.com/ManyDogsProject/md1_datapaper.

3.2 Object/file name

The file name for the dataset is `manydogs_etal_2024_data.csv` and the codebook is `manydogs_etal_2024_codebook.csv`.

3.3 Data type

This dataset includes processed data from the ManyDogs 1 study. We have removed identifiable information, recoded data values for consistency, renamed and reordered columns for clarity, and combined survey data submitted by guardians via Qualtrics and behavioral data submitted by research teams via Qualtrics.

3.4 Format names and versions

The dataset and codebook are provided in a comma-separated (`.csv`) plain text format. There is one version of the dataset with no anticipated additional versions, as data collection has ended.

3.5 Language

The variable names and text values are in English. Though data were collected in other languages (Croatian, Hungarian, Italian, Polish, and Spanish), the Qualtrics surveys were coded to save responses in English.

3.6 License

3.7 Limits to sharing

The dataset is freely available for download on the Open Science Framework. There are no limits to sharing beyond those described in the license.

3.8 Publication date

The dataset was uploaded to the Open Science Framework on 2024-02-06.

3.9 FAIR data/Codebook

This dataset is *findable* through the persistent identifier on the Open Science Framework (DOI: 10.17605/OSF.IO/7RWPC), *accessible* through free availability on Open Science Framework and GitHub, *interoperable* by using plain-text CSV data files, and *reusable* with the CC-BY 4.0 license. Metadata are included as codebook here (Table 1) and with the data on Open Science Framework and GitHub.

(4) Reuse potential

The original data from ManyDogs 1 (ManyDogs Project et al., 2023b) focuses on dog responses in the two-alternative object-choice task across warm-up, ostenstive, non-ostenstive, and odor control trials. In addition, that dataset includes basic demographics on the dog and guardian, as well as the mean trainability score from the C-BARQ. The current dataset adds information on dog origin and household, dog training experience, guardian communication practices, and the complete C-BARQ profile. The C-BARQ data are quite rich, with sections on training, aggression, fear, separation-related behavior, excitability, attachment and attention seeking, and miscellaneous problem behaviors. Thus, this dataset allows for assessing associations among all of the C-BARQ measures as well as connections to the experimental task data and the other dog and guardian characteristic data.

A key strength of this dataset is its diversity. The data were collected by 20 different research sites in eight countries, allowing the assessment of site effects as well as cultural differences. In addition, while most dogs are kept in private homes, the dataset also includes a subset of dogs kept in group housing at working dog facilities. Finally, breed is included, allowing the exploration of breed differences.

Though the current dataset has expanded survey information about dog and guardian characteristics, the behavioral task data have been summarized at the level of mean choices per subject and experimental condition rather than including individual trial data. Thus, the trial data are not available for analysis in the current dataset. However, the trial data are available in the original dataset, so it is possible to merge the current and original datasets using dog ID as the primary key to gain access to the trial data. An additional limitation is that, though the C-BARQ training survey questions were compulsory for all guardians, the remaining questions were optional to ease the survey burden. As a result, 512 of the 704 guardians elected to continue on to the optional questions (though not all completed the survey).

Contribution Statement

The authors made the following contributions. Julia Espinosa: Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Project administration, Supervision, Writing - original draft, Writing - review & editing; Elizabeth Hare: Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Software, Validation, Writing - original draft, Writing - review & editing; Daniela Alberghina: Investigation, Validation, Writing - original draft, Writing - review & editing; Brian Perez: Investigation, Validation, Writing - original draft, Writing - review & editing; Jeffrey R. Stevens: Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Software, Supervision, Visualization, Writing - original draft, Writing - review & editing.

For the original ManyDogs 1 study, data were collected by: D. Alberghina., H.E.E. Alway, J.D. Barela, E.E. Bray, S.-E. Byosiere, C.M. Cavalli, L.M. Chaudoir, C. Collins-Pisano, H.J. DeBoer, L.E.L.C. Douglas, S. Dror, M.V. Dzik, B. Ferguson, L. Fisher, H.C. Fitzpatrick, M.S. Freeman, S.N. Frinton, M.K. Glover, J.E.P. Goacher, M. Golańska, M. Hickey, H.-L. Jim, D.M. Kelly, V.A. Kuhlmeier, L. Lassiter, L. Lazarowski, J. Leighton-Birch, K. Maliszewska, V. Marra, L.I. Montgomery, M.S. Murray, E.K. Nelson, L. Ostojić, S.G. Palermo, A.E. Parks Russell, M.H. Pelgrim, S.D. Pellowe, A. Reinholz, L.A. Rial, E.M. Richards, M.A. Ross, L.G. Rothkoff, H.Salomons, J.K. Sanger, A.R. Schirle, S.J. Shearer, J.M. Silverman, A. Sommese, T. Srdoc, H. St. John-Mosse, K. Vékony, Y.A. Worth, L.M.I. Zipperling, B. Żołędziewska, and S.G. Zylberfuden.

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Conflict of Interest

The author(s) declare no conflict of interest associated with the publication of this manuscript.

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References

Behne, T., Carpenter, M., & Tomasello, M. (2005). One-year-olds comprehend the communicative intentions behind gestures in a hiding game. *Developmental Science*, *8*(6), 492–499. https://doi.org/10.1111/j.1467-7687.2005.00440.x

Bräuer, J., Kaminski, J., Riedel, J., Call, J., & Tomasello, M. (2006). Making inferences about the location of hidden food: Social dog, causal ape. *Journal of Comparative Psychology*, *120*(1), 38–47. https://doi.org/10.1037/0735-7036.120.1.38

Frank, M. C., Bergelson, E., Bergmann, C., Cristia, A., Floccia, C., Gervain, J., Hamlin, J. K., Hannon, E. E., Kline, M., Levelt, C., Lew-Williams, C., Nazzi, T., Panneton, R., Rabagliati, H., Soderstrom, M., Sullivan, J., Waxman, S., & Yurovsky, D. (2017). A collaborative approach to infant research: Promoting reproducibility, best practices, and theory-building. *Infancy*, *22*(4), 421–435. https://doi.org/10.1111/infa.12182

Hare, B., Brown, M., Williamson, C., & Tomasello, M. (2002). The domestication of social cognition in dogs. *Science*, *298*, 1634–1636.

Hare, B., & Tomasello, M. (1999). Domestic dogs (Canis familiaris) use human and conspecific social cues to locate hidden food. *Journal of Comparative Psychology*, *113*(2), 173–177. https://doi.org/10.1037/0735-7036.113.2.173

Hsu, Y., & Serpell, J. A. (2003). Development and validation of a questionnaire for measuring behavior and temperament traits in pet dogs. *Journal of the American Veterinary Medical Association*, *223*(9), 1293–1300. https://doi.org/10.2460/javma.2003.223.1293

Kaminski, J., & Nitzschner, M. (2013). Do dogs get the point? A review of dog-human communication ability. *Learning and Motivation*, *44*(4), 294–302. https://doi.org/10.1016/j.lmot.2013.05.001

ManyDogs Project, Alberghina, D., Bray, E. E., Buchsbaum, D., Byosiere, S. E., Espinosa, J., Gnanadesikan, G. E., Guran, C.-N. A., Hare, E., Horschler, D. J., Huber, L., Kuhlmeier, V. A., MacLean, E. L., Pelgrim, M. H., Perez, B., Ravid-Schurr, D.,

Rothkoff, L., Sexton, C. L., Silver, Z. A., & Stevens, J. R. (2023a). ManyDogs Project: A big team science approach to investigating canine behavior and cognition. *Comparative Cognition & Behavior Reviews*, *18*, 59–77. https://doi.org/10.3819/ccbr.2023.180004

ManyDogs Project, Espinosa, J., Stevens, J. R., Alberghina, D., Barela, J., Bogese, M., Bray, E., Buchsbaum, D., Byosiere, S.-E., Cavalli, C., Dror, S., Fitzpatrick, H., Freeman, M. S., Frinton, S., Gnanadesikan, G., Guran, C.-N. A., Glover, M., Hare, B., Hare, E., … Walsh, C. (2023b). ManyDogs 1: A multi-lab replication study of dogs' pointing comprehension. *Animal Behavior and Cognition*, *10*(3), 232–286. https://doi.org/10.26451/abc.10.03.03.2023

ManyPrimates, Altschul, D. M., Beran, M. J., Bohn, M., Caspar, K. R., Fichtel, C., Försterling, M., Grebe, N. M., Hernandez-Aguilar, R. A., Kwok, S. C., Llorente, M., Motes-Rodrigo, A., Proctor, D., Sánchez-Amaro, A., Simpson, E. A., Szabelska, A., Taylor, D., Mescht, J. van der, Völter, C. J., & Watzek, J. (2019). Collaborative open science as a way to reproducibility and new insights in primate cognition research. *Japanese Psychological Review*, *62*(3), 205–220. https://doi.org/10.24602/sjpr.62.3_205

Miklösi, Á., Polgárdi, R., Topál, J., & Csányi, V. (1998). Use of experimenter-given cues in dogs. *Animal Cognition*, *1*(2), 113–121. https://doi.org/10.1007/s100710050016

Rodriguez, K. E., Herzog, H., & Gee, N. R. (2021). Variability in human-animal interaction research. *Frontiers in Veterinary Science*, *7*, 619600. https://doi.org/10.3389/fvets.2020.619600

Soproni, K., Miklósi, A., Topál, J., & Csányi, V. (2001). Comprehension of human communicative signs in pet dogs (Canis familiaris). *Journal of Comparative Psychology*, *115*(2), 122–126. https://doi.org/10.1037/0735-7036.115.2.122

Wynne, C. D. L., Udell, M. A. R., & Lord, K. A. (2008). Ontogeny's impacts on human-dog communication. *Animal Behaviour*, *76*(4), e1–e4. https://doi.org/10.1016/j.anbehav.2008.03.010

Table 1

Data codebook for ManyDogs 1 study data

Category of Variable	Variable Name	Question Text	Possible Response Values
Dog Demographics	`date`	Timestamp for completion of questionnaire	YYYY-MM-DD HH:MM:SS
	`site`	What location are you going to visit?	accc, auburn, bccc, bdl, cchil, cci, crumun, dcc, duke, eltebuda, icoc, ldbtdc, manitoba, other, queensu, tdc, ucs, umessina, urijeka, uwarsaw, yale
	`subject_id`	What is your dog's assigned subject ID?	Text entry
	`owned_status`	What is the dog's living situation?	Group housing (e.g., working dog kennel), Private home, Other
	`birthdate`	Date of birth	YYYY-MM-DD
	`sex`	What is your dog's sex?	Female, Male
	`desexed`	Has your dog been spayed or neutered?	Yes, No
	`purebred`	Is your dog purebred?	Yes, No
	`breed`	What breed is your dog?	Multiple choice; 95 breeds represented
	`breed_registry`	Is your dog registered with a kennel club in your country?	Yes, No
	`mixed_breed`	Is your dog a mix of known breeds?	Yes, No
Training and Communication	`communication_method`	How do you typically communicate with your dog? Select all that apply	Acoustic (clicker or whistle), Gesture (hand gestures, pointing), Verbal (spoken words), Other

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	`gesture_frequency`	How frequently do you use hand gestures (such as pointing or waving) to communicate with your dog?	Never, Seldom, Sometimes, Usually, Always, Not observed
	`gaze_follow`	My dog follows pointing gestures with it's gaze immediately	Never, Seldom, Sometimes, Usually, Always, Not observed
	`training_type`	Indicate the frequency with which your dog has participated in each of the following types of training/activity in the past 12 months. Select all that apply.	Agility, Ballsport (flyball), Conform (Conformation), Discdog, Herd (Herding/sheepdog trials), Hunt (Game hunting/tracking), Music (Musical freestyle), Neighbor (Good neighbor class), Obedience1 (Basic obedience), Obedience2 (Advanced obedience), Pullsport (Skijoring/Canicross/Bikejoring), Puppy (Puppy class), Rallyo (Rally obedience), Scent, Search_rescue, Service, Therapy, Other
	`training_freq_puppy`	Puppy class frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_neighbor`	Good neighbor class frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	`training_freq_obedience1`	Basic obedience frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_obedience2`	Advanced obedience frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_rallyo`	Rally obedience frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_music`	Musical freestyle frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_agility`	Agility frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_flyball`	Flyball frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_disc`	DiscDog frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_conform`	Conformation frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_scent`	Scent detection frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_search`	Search and rescue frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	`training_freq_sled`	Sled pulling/cart pullin frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_pullsport`	Skijoring/Canicross/Bikejoring frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_therapy`	Therapy/ambulance dog frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_service`	Specialized service training frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_hunt`	Game hunting/tracking frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_herd`	Herding/sheepdog trials frequency of participation in the last 12 months	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_other1`	Other frequency of participation in the last 12 months (1)	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_other2`	Other frequency of participation in the last 12 months (2)	Never, Weekly, >1 week, <1 month, 1-2 month
	`training_freq_other3`	Other frequency of participation in the last 12 months (3)	Never, Weekly, >1 week, <1 month, 1-2 month

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	`lab_exposure`	Has your dog participated in research studies before at this or another location/institution?	Yes, same site; Yes, different site; No; Unsure
	`research_experience`	What type of research tasks has your dog participated in during previous visits to research centers?	Choice tasks, Cup tasks, Human point, Other
	`other_household_dogs`	Does your dog currently live with other dogs?	Yes, No
	`num_household_dogs`	If yes, how many?	Number
Guardian Demographics	`years_owned`	Approximately, how many years have you owned your dog?	Number
	`origin`	How did you acquire your dog?	Breeder, Relation, Rescue, Shelter, Other
	`guardian_gender`	With which gender do you most identify?	Male, Female, Other, Prefer not to say
	`guardian_age`	How old are you?	Under 20, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79, 80+, Prefer not to say
	`environment`	What type of environment do you and your dog live in?	Rural, Suburban, Urban, Prefer not to say
C-BARQ Trainability	`cbarq_train_1`	When off the leash, returns immediately when called	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_train_2`	Obeys the “sit” command immediately	Never, Seldom, Sometimes, Usually, Always, Not observed

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	`cbarq_train_3`	Obeys the "stay" command immediately	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_train_4`	Seems to attend/listen closely to everything you say or do	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_train_5`	Slow to respond to correction or punishment	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_train_6`	Slow to learn new tricks or tasks	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_train_7`	Easily distracted by interesting sights, sounds, or smells	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_train_8`	Will "fetch," or attempt to fetch, sticks, balls, or objects	Never, Seldom, Sometimes, Usually, Always, Not observed

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
Opt-Out Point	`continue_cbarq`	Thank you so much for your answers! At this point in the survey, you have completed the minimum amount required to participate in ManyDogs Study 1 and can choose to submit your information now by selecting "Submit my info now". If you would like to tell us more about your dog, we would love to hear all about them! We have prepared several more questions about their behaviour that you can answer by selecting "More questions please", this will take approximately 12-15 minutes.	Yes (Continue to take full C-BARQ), No (Decline to complete full C-BARQ)
C-BARQ Aggression	`cbarq_aggression_1`	When verbally corrected or punished (scolded, shouted at, etc) by you or a household member.	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	`cbarq_aggression_2`	When approached directly by an unfamiliar adult while being walked/exercised on a leash	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	`cbarq_aggression_3`	When approached directly by an unfamiliar child while being walked/exercised on a leash	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	cbarq_aggression_4	Toward unfamiliar persons approaching the dog while s/he is in your car (at the gas station for example).	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_5	When toys, bones or other objects are taken away by a household member	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_6	When bathed or groomed by a household member	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_7	When an unfamiliar person approaches you or another member of your family at home.	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_8	When unfamiliar persons approach you or another member of your family away from home.	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_9	When approached directly by a household member while s/he (the dog) is eating	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_10	When mailmen or other delivery workers approach your home.	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	cbarq_aggression_11	When his/her food is taken away by a household member.	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_12	When strangers walk past your home while your dog is outside or in the yard.	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_13	When an unfamiliar person tries to touch or pet the dog.	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_14	When joggers, cyclists, rollerbladers or skateboarders pass your home while your dog is outside or in the yard.	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_15	When approached directly by an unfamiliar male dog while being walked/exercised on a leash	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_16	When approached directly by an unfamiliar female dog while being walked/exercised on a leash	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	cbarq_aggression_17	When stared at directly by a member of the household.	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_18	Toward unfamiliar dogs visiting your home.	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_19	Toward cats, squirrels or other small animals entering your yard.	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_20	Toward unfamiliar persons visiting your home.	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_21	When barked, growled, or lunged at by another (unfamiliar) dog.	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_22	When stepped over by a member of the household.	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	cbarq_aggression_23	When you or a household member retrieves food or objects stolen by the dog.	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_24	Towards another (familiar) dog in your household (leave blank if no other dogs).	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_25	When approached at a favorite resting/sleeping place by another (familiar) household dog (leave blank if no other dogs).	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_26	When approached while eating by another (familiar) household dog (leave blank if no other dogs).	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
	cbarq_aggression_27	When approached while playing with/chewing a favorite toy, bone, object, etc., by another (familiar) household dog (leave blank if no other dogs).	No aggression, Mild aggression, Moderate aggression, High aggression, Serious aggression, Not observed
C-BARQ Fear	cbarq_fear_1	When approached directly by an unfamiliar adult while away from your home	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed
	cbarq_fear_2	When approached directly by an unfamiliar child while away from your home	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	cbarq_fear_3	In response to sudden or loud noises (e.g. vacuum cleaner, car backfire, road drills, objects being dropped, etc.)	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed
	cbarq_fear_4	When unfamiliar persons visit your home	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed
	cbarq_fear_5	When an unfamiliar person tries to touch or pet the dog.	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed
	cbarq_fear_6	In heavy traffic	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed
	cbarq_fear_7	In response to strange or unfamiliar objects on or near the sidewalk (e.g. plastic trash bags, leaves, litter, flags flapping, etc.)	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed
	cbarq_fear_8	When examined/treated by a veterinarian.	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed
	cbarq_fear_9	During thunderstorms, firework displays, or similar events.	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed
	cbarq_fear_10	When approached directly by an unfamiliar dog of the same or larger size.	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed
	cbarq_fear_11	When approached directly by an unfamiliar dog of a smaller size.	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	cbarq_fear_12	When first exposed to unfamiliar situations (e.g. first car trip, first time in elevator, first visit to veterinarian, etc.)	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed
	cbarq_fear_13	In response to wind or wind-blown objects.	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed
	cbarq_fear_14	When having nails clipped by a household member.	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed
	cbarq_fear_15	When groomed or bathed by a household member.	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed
	cbarq_fear_16	When having his/her feet toweled by a member of the household.	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed
	cbarq_fear_17	When unfamiliar dogs visit your home	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed
	cbarq_fear_18	When barked, growled, or lunged at by an unfamiliar dog.	No fear, Mild fear, Moderate fear, High fear, Extreme fear, Not observed
C-BARQ Separation	cbarq_separation_1	Shaking, shivering, or trembling	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_separation_2	Excessive Salivation	Never, Seldom, Sometimes, Usually, Always, Not observed

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	`cbarq_separation_3`	Restlessness/agitation/pacing	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_separation_4`	Whining	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_separation_5`	Barking	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_separation_6`	Howling	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_separation_7`	Chewing/scratching at doors, floor, windows, curtains, etc	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_separation_8`	Loss of appetite	Never, Seldom, Sometimes, Usually, Always, Not observed
C-BARQ Excitability	`cbarq_excitability_1`	When you or other members of the household come home after a brief absence.	No excitability, Mild excitability, Moderate excitability, High excitability, Extreme excitability, Not observed
	`cbarq_excitability_2`	When playing with you or other members of your household.	No excitability, Mild excitability, Moderate excitability, High excitability, Extreme excitability, Not observed
	`cbarq_excitability_3`	When the doorbell rings.	No excitability, Mild excitability, Moderate excitability, High excitability, Extreme excitability, Not observed

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	cbarq_excitability_4	Just before being taken for a walk	No excitability, Mild excitability, Moderate excitability, High excitability, Extreme excitability, Not observed
	cbarq_excitability_5	Just before being taken on a car trip	No excitability, Mild excitability, Moderate excitability, High excitability, Extreme excitability, Not observed
	cbarq_excitability_6	When visitors arrive at your home.	No excitability, Mild excitability, Moderate excitability, High excitability, Extreme excitability, Not observed
C-BARQ Attachment/Attention-Seeking	cbarq_attachment_1	Displays a strong attachment for one particular member of the household	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_attachment_2	Tends to follow you (or other members of household) about the house, from room to room	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_attachment_3	Tends to sit close to, or in contact with, you (or others) when you are sitting down	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_attachment_4	Tends to nudge, nuzzle or paw you (or others) for attention when you are sitting down	Never, Seldom, Sometimes, Usually, Always, Not observed

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	`cbarq_attachment_5`	Becomes agitated (whines, jumps up, tries to intervene) when you (or others) show affection for another person	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_attachment_6`	Becomes agitated (whines, jumps up, tries to intervene) when you show affection for another dog or animal	Never, Seldom, Sometimes, Usually, Always, Not observed
C-BARQ Miscellaneous Behavior Problems	`cbarq_miscellaneous_1`	Chases or would chase cats given the opportunity	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_miscellaneous_2`	Chases or would chase birds given the opportunity	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_miscellaneous_3`	Chases or would chase squirrels, rabbits and other small animals given the opportunity	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_miscellaneous_4`	Escapes or would escape from home or yard given the chance	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_miscellaneous_5`	Rolls in animal droppings or other 'smelly' substances	Never, Seldom, Sometimes, Usually, Always, Not observed
	`cbarq_miscellaneous_6`	Eats own or other animals' droppings or feces	Never, Seldom, Sometimes, Usually, Always, Not observed

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	cbarq_miscellaneous_7	Chews inappropriate objects	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_8	Mounts' objects, furniture, or people	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_9	Begs persistently for food when people are eating	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_10	Steals food	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_11	Nervous or frightened on stairs	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_12	Pulls excessively hard when on the leash	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_13	Urinates against objects/ furnishings in your home	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_14	Urinates when approached, petted, handled or picked up	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_15	Urinates when left alone at night, or during the daytime	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_16	Defecates when left alone at night, or during the daytime	Never, Seldom, Sometimes, Usually, Always, Not observed

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	cbarq_miscellaneous_17	Hyperactive, restless, has trouble settling down	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_18	Playful, puppyish, boisterous	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_19	Active, energetic, always on the go	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_20	Stares intently at nothing visible	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_21	Snaps at (invisible) flies	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_22	Chases own tail/hind end	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_23	Chases/follows shadows, light spots, etc.	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_24	Barks persistently when alarmed or excited	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_25	Licks him/herself excessively	Never, Seldom, Sometimes, Usually, Always, Not observed
	cbarq_miscellaneous_26	Licks people or objects excessively	Never, Seldom, Sometimes, Usually, Always, Not observed

Table 1

Data codebook for ManyDogs 1 study data (continued)

Category of Variable	Variable Name	Question Text	Possible Response Values
	`cbarq_miscellaneous_27`	Displays other bizarre, strange, or repetitive behavior(s)	Never, Seldom, Sometimes, Usually, Always, Not observed
Behavior Testing	`status`	Status of subject in experiment	Error (Experimental error invalidated session), Incomplete (Subject did not complete session, invalidating it), Included (Valid session used in analysis)
	`first_condition`	Which experimental condition was experienced first	Nonostensive, Ostensive
	`onecup`	Warm-up trials with one cup	Proportion correct trials
	`twocup`	Warm-up trials with two cups	Proportion correct trials
	`nonostensive`	Non-ostensive experimental trials	Proportion correct trials
	`ostensive`	Ostensive experimental trials	Proportion correct trials
	`odor`	Odor control trials	Proportion correct trials
	`right_side_ost`	Right side correct in ostensive condition	Proportion of trials with right side correct
	`right_side_nonost`	Right side correct in non-ostensive condition	Proportion of trials with right side correct
	`right_choice_ost`	Right side chosen in ostenstive condition	Proportion of trials choosing right side
	`right_choice_nonost`	Right side chosen in non-ostensive condition	Proportion of trials choosing right side