Using Behavioural Information to Help Owners Gather Requirements from their Dogs' Responses to Media Technology

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The study of non-human animals' interactions with technology is referred to as Animal- Computer Interaction (ACI). Data gathering with these non- human animal users typically relies on the owner as a proxy to gather requirements and feedback from the animal's behavioural reactions. These owners, however, may provide poor information, as they are habitually not knowledgeable in animal behaviour. To improve data gathering in Dog-Computer Interaction (DCI) research, we present a Dog Information Sheet (DISH) for owners which contains known dog physical behaviours and their potential cognitive reactions. This is used to create a more informed dog owner observer in order to improve feedback in ACI. DISH's effect on owner evaluations is assessed by gauging their own dog's behavioural reactions to persuasively designed media. The findings established that when using DISH, owners were better at identifying both the behaviour perceived and at reasoning behind their dogs' reactions. However, owners using the DISH were unable to recognize the different dogs' behavioral states unless they considered themselves experts at dog behaviour. Whilst this research is centred on collecting data on dogs to improve User Experience (UX) in a Dog-Computer Interaction (DCI) context, the method presented behind the DISH can be applied to both ACI and Human - Computer Interaction (HCI) field to help interpret behaviours during requirement gathering and evaluative practices for non-vocal and limited cognitive users.

Animal Computer Interaction; Dog Computer Interaction; Data gathering; Evaluative method

1. INTRODUCTION

Non-human animals (referred to hereon as animals) have been users of technology for some time but this technology has had as its main aim the assisting of humans (Harraway 2010). In recent years, computer scientists have taken their curiosity into the animal-technology field, coining this endeavour Animal-Computer Interaction (ACI) (Mancini et al., 2014). The growth of ACI research has seen the expansion of systems and methods to mediate human-animal interactions (Vaataja & Pesonen, 2013), aid playful interactions (Pons et al., 2015), assist in the monitoring of animals (Mancini et al., 2014; Resner, 2001; Hirskyj- Douglas, 2014), help owners to care for their animal(s) (Baskin et al., 2015), help assistance animals (Robinson et al., 2014) and improve animal welfare (Carter et al., 2015). Meanwhile there has been a growth in ACI consumer products that allow monitoring (Petcube, 2016), games (CleverPet, 2016) and even media (DogTV, 2016) for our pets.

In the design of ACI systems there is a requirement to involve, at least to some extent, the animal end-user. It would be preferred if the animals themselves could contribute to the gathering of requirements and also in the evaluation of such products (Hirskyj-Douglas & Read, 2014). A significant challenge faced when designing an ACI system, likewise for some human users (Mikolajewska & Mikolajewski, 2012; Burkhard & Koch, 2012), such as very young children, (Read et al., 2002), is the users' inability to communicate through the usual channels of vocal or written exchange.

In such cases, a user's behaviour can be analysed to indicate welfare (both physical and mental) and to indicate choice and the users' decisions (Dawkins, 2004). To study behaviour, designers of ACI systems have created their own toolbox of requirement gathering tactics which include interpreting gestures and body language (Baskin et al., 2015), using body/face/eye/gaze/ trackers (Somppi et al., 2012; Pons et al., 2014; Williams et al., 2011), seeking physiological signs and vocal behaviour (Taylor, et al., 2014), gathering owner reports (Hirskyj-Douglas et al., 2013) and using animal behaviourists' opinions (Lemansoon et al., 2015).

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This paper contributes in this area of system requirement gathering and evaluation in Dog-Computer Interaction (DCI) by presenting a tool to increase a human evaluators' knowledge of behaviour in order to improve the value of human observations of the dog: DISH is a specially designed information sheet showing typical behaviours displayed by dogs particularly when interacting with technology. This new tool in DCI, aims to improve the design and testing of dog-computer systems by allowing the dog to be 'more' involved in the design by having its behavioural reactions better understood. Whilst the use of an information sheet to create an informed observer is a generalized idea, it is applied to DCI to see if it brings benefits, and if so what benefits are brought to DCI, ACI and HCI.

The DISH tool was evaluated in a study in which half the owners used DISH (group A) and half did not (group B) to compare their feedback of their dogs' reaction to persuasively designed media.

2. RELIABLLITY IN GATHERING ANIMAL REQUIREMENTS AND FEEDBACK

In designing interactive systems for dogs, methods have been taken from HCI including User Design (UD) (Resner, 2001) and Grounded Theory Methodology (GTM) (Hirskyj-Douglas et al., 2013). Body language and physiological signs have been the main means to facilitate input for communication and interaction (Pons et al., 2015; North et al., 2015; Williams et al., 2011). While the above methodologies can be used to gather requirements each has its own pros and cons. In work with humans, gestures and body language have been widely used in linguistics and psychology to express a person's intentions to communicate (Cassell, 2007), showing implicitly exploited exchange of messages shaped by, and adding to, the context (Schmidt, 2000). This is also the case in dogs where their behavioral signals, that is body movements, vocalizations and physiological signs, can lead to an understanding of their cognition (Miklosi, 2014). Within animal science behaviour has acted as a non-invasive indicator of welfare (Dawkins, 2004) both in a play context (Mintlin et al., 2012) and facially (Leach et al., 2012).

2.1 Body and Face Tracking

Body, face, eye and gaze positioning have played a part in understanding human and animal behaviour in ACI through tracking gaze (Somppi et al., 2012; Hirskyj- Douglas et al., 2014) body posture (Pons et al., 2014) and automated face reactions (Leach, et al., 2012) similarly to HCI (Jacob & Karn, 2003; Pool & Ball, 2006). Tracking movements can help researchers to understand display-based and visual information processing impacting upon the usability of a system interface (Poole & Ball, 2006). This understanding is especially needed in animals where welfare is of concern due to non-vocalisation and it can also be used to monitor pain thus preventing bad practice (Leach et al., 2012; Mintline et al., 2012).

The advancements made in HCI tracking technology have not yet been replicated in ACI but there have been a few attempts to track animals. North et al. (2015), proposed a tracking system for horses and Pons et al. (2014) proposed one for cats. Animals can be trained to use tracking systems (Sompii et al., 2012) or can be tracked wearing head mounted systems (Williams et al., 2011) but both of these strategies will influence their ordinary behaviour which we are typically aiming to measure. The limited work that has been done to date has helped researchers in allowing animals to indicate choices visually thus giving an insight into their cognition, vision and social interactions (Williams et al., 2011; Crutcher et al., 2009).

2.2 Physiological Signs and Vocal Behaviour

Physiological signs, such as heart-rate and oxytocin biomarkers, have also been shown to help gain insights into the emotional state of animals in ACI (Geurtsen et al., 2015) but they can create false markers due to exercise and arousal (Mitsui et al., 2002). Heart-rate monitoring has been used with dogs, under confined conditions, to measure variants of alerted states giving limited feedback (Vaschillo et al., 2004). It is speculated, that reading emotions in animals from physiological signs in ACI over quantifies animals' emotions when reported by the owners creating welfare concerns (Lawson et al., 2015). As such, these reports cannot be used as an exclusive measurement due to variability within animal-owners. Research has also been carried out on measuring dogs' emotions through vocal analysis (Taylor et al., 2014). This shows some promise, but requires the dog to be vocal - which is often only evident through extremes of emotions and can possibly be outside of humans' auditory range (Suzuki, 2014). In addition, as different dogs have varying vocal ranges the same pitch may represent different emotions between dogs requiring such interpretation to be personalised for the species. Research has also suggested that dogs have different dialects (accents) varying geographically, between habitats and among groups (Perla & Slobodchikoff, 2002). To combat these limitations, one study used grounded theory analysis plotting vocalizations against a known list of occurrences to guess at an indication of emotions – suggesting vocalization could indicate emotions (Briefer, 2012).

As shown through this discussion, there are clear gaps within the current methods of measuring an animals' cognition through their behavioural choices via automated, or semi-automated technological systems. One solution is to use the owner or carer of the animal to assist in filling in these method cavities to create a fuller picture.

2.3 Owner and Behaviourist Reports to give Context

When observations are made on an animal's behaviour, researchers can only guess, and not ask, what is to be understood from an animal behaving a certain way. To fully understand animal behaviour, the context behind the behaviour is needed but this is seldom fully available to an unfamiliar observer. This context goes beyond just labelling the animal's behaviour to explaining why the animal exhibits the behaviour. This scenario shifts when an owner/carer is positioned as an informed observer as he/she will be able to add the missing context from familiarity with, and 'becoming with' through conceptual frameworks, the animal (Haraway, 2010). It is this pitfall of 'becoming with', really knowing your animal as an individual, that animal behaviourists fall into through potentially over generalising behaviour. While all animal species have their own unique communication discourse, both intraspecific and interspecific, that can be categorically determined through description, it can be hard to give meaning to an observed behaviour as the same gestures can have multiple meanings (Miklosi, 2014). This co-constitutive natural/cultural dancing between animals' and humans' needs understanding and synchronicity to derive meaning that is only available to those well versed in the normal behaviour (Harroway, 2012). This is not to de-value body and gesture behaviour but is to create an enriched perspective through the different levels of understanding (see Figure 1).

Figure 1. *The two levels of understanding dogs' emotions: Level 1: What the dog is doing & the deeper Level 2: What is the dog feeling.*

This is modelled where the contextual information is only available in level 2 by fully understanding why a dog is doing an action and not just understanding the action alone. This study aims to push past seen behaviours (level 1) by asking why, and through what evidence, is the behaviour shown (level 2).

2.4 Triangulation of Feedback Methodologies

When designing an ACI system, researchers will often choose methods of inquiry that are supported by, or proposed in, previous ACI or HCI systems The ideal is to triangulate methods allowing several streams to work together from varying feedback systems, discussed above, to give the best insight into the animal's interaction (Figure 2).

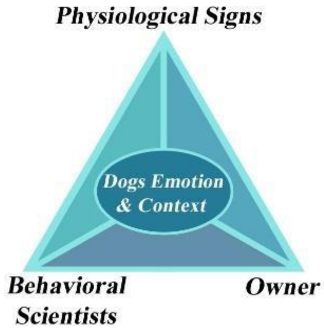

Figure 2. *The key method to attaining dog emotions, cognition and the wider context behind the given emotion is a triangulation between physiological signs, the owner and behavioural scientists.*

2.5 Motivation for DISH

It is this drive to increase the feedback from the (dog) user by including and informing the (owner) observer, that has led to a new tool (DISH) to enhance the interpretation abilities of the observer: This tool aims to strengthen one of the corner stones of DCI feedback (owner) thus creating a stronger foundation for DCI systems. As the ACI field is relatively new, exploratory studies like this, are important to not only put the dog in the centre of the technological system but also to lay a foundation for ACI from the person who knows the animal the best; the owner.

2.6 How to Measure Reliability in ACI

Reliability, the degree of systematic bias of a method and what quantifies as reliable feedback and methods, needs to be questioned especially with non-verbal users such as are found in ACI. Reliability has been considered in HCI through testing the validity of end-user requirements, by testing design and making sure the methods cover a wide range of concepts (Jong & Schellens, 2000; Lambie et al., 1998). The main concern in ACI, similarly to HCI, is: 'does a method really measure what it intended to measure?'. To answer this, numerous studies must be done through the appliance of concept application across varying scenarios and users. However, the recently established ACI field is lacking this historic application. In addition, unlike with most humans who can vocalize or scribe their opinions, in ACI there is no entirely reliable way to measure emotive opinions against the data for legitimacy. It is therefore an exploratory process to test and evaluate methods continually and methodologically, especially as the field grows richer.

3. DOG INFORMATION SHEET (DISH)

The DISH is a three-page guide of dog behavioural information largely based on RSPCA (2015) guidelines of dog behaviour and with a qualified practicing vet adding detail to the information. DISH focuses on those aspects of behaviour noted in Baskin et al.'s (2015) study of typical behaviours of dogs using tablets, and from Hirskyj-Douglas et al., (2013) study of behaviours of dogs when interacting with monitors. Emotions included in DISH are those seen to be held in dogs (Coren, 2015; Miklosi, 2014; Albuquerque et al., 2016). In the DISH guide, dog behaviour is considered against nine emotions, these being: confused, stressed, frightened, sick, bad-tempered and angry, anxious and worried, excited and finally playful. Each section contains pictures of a dog in that emotional state and gives bullet points on typical behaviours to give an overall representation (Figure 3).

***Figure 3**. A section from the Dog Behavioural Information Sheet (DISH) showing typical behaviour from Bad-tempered and Angry dogs.*

The third page of the DISH shows dog facial expressions for different emotions using pictures taken from Bloom & Friedman's (2013) work that evidenced that dog owners can generally recognize emotions of their dogs from the face alone. These emotions included happy, sad, afraid, surprised, disgusted and angry. By including facial and body pictures, as well as physiological and vocal signs it was hoped to reinforce to the human participants (owners) that behaviour signs demonstrated by a dog are linked to cognitive emotions; thus creating a deeper understanding of dog behaviour.

3.1. Emotions and dogs

Historically dogs have been considered to be as machines; lacking emotions and being programmable (Cottingham, 1978). Nowadays some ecologists believe dogs to hold complex emotions, comparing their cognition to a 24-month old child (Coren, 2016; Darwin, 1872; Topal & Gacsi, 2012;) Dogs are reported to be able to recognise emotions in humans and in other dogs (Albuquerque et al., 2016). Modern affective neuroscience backs up these claims (Anderson & Adolph, 2014; Pankseep, 1998) but the study of this field is young and there are still diverse opinions held within animal neuroscience and behaviour as to what complex emotions a dog can experience.

The analysis of emotions within dogs first takes a biological standpoint of physiology and then a secondary layer of analysis and recognition. Emotions can be registered through different parts of the brain through technology such as Positron Emission Tomohraphy (PET) scanners (National Library of Medicine, 2016). Recognition of emotions has been done in facial expressions both dog-human and human-dog (Buttleman &Tomasello, 2013). However, the interpretation of signs that convey emotions is subjective and is in accordance, to varying degrees to the humanistic view of the dog; be it anthropomorphic, babymorphic or lupomorphic (Topal & Gacsi, 2012). While anthropomorphism does exist under this scope of animal recognition this is not a reason to elude complex (secondary) emotions, especially when current and historic literature and research supports dogs holding complex emotions.

In order to structure this work towards dogs known emotive states, the emotions that dogs do not appear to possess (guilt, pride and shame) are not used within this study (Coren, 2015). In comparison to humans, the emotions that dogs hold are suspected to be of denser but still intricate complexity (Coren, 2006; Drummond, 2004). In ACI, dogs holding varying complex emotions have been widely reported (Baskin et al., 2015; Westerlaken & Gualin, 2014). Overall whilst research is unable to say defiantly what emotions a dog accurately has, or even if they are scalable towards humans; this exploration is important in not only understanding dog cognition but also building up the dog users requirements creating better UX.

4. METHOD

This study aims to help optimize the owners' interpretation of the way their dogs react to technology by improving the information that is gathered from owners' observations of their dogs. To see if understanding dog behavioural information could improve owners' responses a Dog Information Behavioural Sheet (coined DISH) was developed. The two hypotheses of this study were that:

(i) With additional information owners will provide more useful focused information on their dogs' reactions.
(ii) The Information Sheet (DISH) would influence the owner's interpretation of the observed (dog) behaviour helping to provide context to behavioural reactions

(group A vs. B).

Owners and their dogs were invited to participate in the study. These owners were then paired up with others who had matching dog breeds, to prevent breed specific behaviours, and consequently split into two groups, A and B. Group A was given the DISH to read before the study while group B was not (Figure 4).

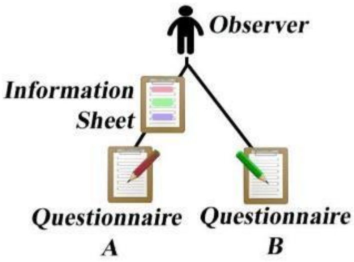

***Figure 4**. The method of providing only one set, A, of observers (dog owners) with the Information Sheet (DISH) while being evaluated on the same questionnaire*

Both groups were then asked to watch a 2-minute-long video with their dog(s) in their homes and report, during that exercise, on how their dog behaved using a formatted questionnaire. Their answers were then evaluated between groups (A & B) as well as a whole to evaluate the influence of the DISH on owner reports on dog behavioural reactions.

4.1 Human Participants

Dog owners were gathered in numerous ways to avoid geo-location differences. The main way of gathering owners was through the researcher's university. Other methods included word-of-mouth, Facebook dog groups and the researchers' website. The dog owners were told of the A/B groupings with an indication that one group got an information sheet and one did not. They were not told about the contents of the DISH. There were 20 human participants, with a 14 female to 6 male ratio. The majority of participants came from England but there were also participants from Israel, the Netherlands and Canada.

4.2 Dog Participants

For the dog to participate within the study, the owner firstly had to verify that the dog was fit to participate with no behavioural problems which could influence the study. The owner was also told that if the dog had adverse behaviour at any point during the activity, and become agitated, the video and study should be stopped: no owners reported this. As some of the dog-owners participating within the study had more than one dog, there were more dogs than human participants within the study to allow each owner to have fair treatment for each of their dogs. Such owners were given the option to do the study on only one dog, but all multiple dog-owners chose to include all their dogs. For the purposes of the analysis for this paper, to maintain research validity, only one questionnaire was analysed in each of these double dog instances and this was chosen as being the first data submitted. Therefore, a total of 31 dogs took part in the study but only 20 dogs' data was considered. As explained earlier, all dog participants were paired with similar breeds to limit effects of dog breed specific results. As different dog breeds were historically bred for different purposes; they have different physiological autonomy and psychological behaviour affecting both their reaction to and intake of media (Stork et al., 1995).

4.3 Video Formation

The video that was used in the study was specifically designed to induce three non-distressing emotions in the dogs: excited, confused and relaxed. These three different emotions were chosen to see if the owners could identify responses to the emotions in their dog. The chosen video had short clips, attention inducing sounds (such as toy squeaks and dog barks) and majored on real dog video clips having found that dogs preferred to watch other dogs (Hirskyj-Douglas et al., 2014). The three emotions were induced through both visual and auditory sound. Classical music has been shown to relax dogs (Wells et al., 2002) so was used for the relaxing segment along with slow moving scenery, excited barks and squeaks were used for the excited segment to stimulate the dog and confused dog howls and dogs were used for the confused segment. To stimulate the dogs' emotions visually, video of dogs portraying the emotion that the video was trying to stimulate were also used; assuming dog's ability to recognize and sometimes mirror emotions (Hirskyj-Douglas & Read, 2014; Schwab & Huber, 2006; Albuquerque et al., 2016). Only real clips (not animated or cartoon) were used as dogs typically do not respond to cartoon images (Coren, 2015).

4.4 Questionnaire Design

The questionnaires for group A and B were identical aside from the beginning statement reminding group A to read the DISH before completion. The questionnaire was three pages long and split into dog information, owner information and dog behaviour. Dog information asked for basic data about the dog – breed (to help grouping), name (for identification) and age and sex (to check for confounds). Owners were asked to report their knowledge of dog behaviour in a 5 point Likert scale (excellent – poor) and whether or not they had done 'dog-training' (assuming this could be a confound). The final two pages of the questionnaire asked questions about the dog's reaction to the presented media. To create clarification, the terminology 'interested' was defined at the beginning of this section to 'refer to the dog having or showing curiosity, fascination or concern'. The owner was then asked how interested the dog was in the video using a 3 point Likert scale (very interested/interested/not interested), with a follow up open ended question asking the owner how they knew the dog was or wasn't interested. This question was asked to try and get the owners to clarify and expand on their reasoning behind their dogs' (dis)interest leading to a deeper understanding of the context (Figure 1). To illicit the owner to specify key behavioural words a further question was asked of the owner to report any body language signals. After this another question was asked of the owner to report overall how the dog reacted and then, as above, what body language signals indicated this. The final question was an open ended blank box comment section about their dogs' behaviour to try and capture all of the owners' interpretations. Some owners also chose at this point to video their dogs' reactions to aid their memory and to show the researchers for analysis. The full questionnaire and videos are available on the researcher's website http://acid.uclan.ac.uk/study/DISH.

5. RESULTS

The study was carried out by the dog-owners in their own homes during June-September 2015. Given the low number of participants, the results are explored as a first empirical starting point to validate DISH. The oldest dog to participate was 15 years and the youngest was 1 year 1 month. The mean dog's age was 5 years old, with 5 years 6 months being the average in group A and slightly younger at 4 years 6 months in group B. The breed of dogs included within the study were Golden Retriever, Cocker Spaniel, Labrador, Poodle, Jack Russell, Chihuahua, Schnauzer, King Charles Caviler, Wheaten Terrier Poodle and Sharpie.

5.1 The Study Sample

The owners' mean knowledge on dog behaviour (5 point Likert) was 'very good' (4/5), with group A reporting a mean of 'very good' and group B having a lower mean of knowledge with 'average' (3/5). Interestingly, no owner rated themselves below average in knowledge of dog behaviour with answers only ranging from average to excellent (2 owners rated 5/5). Overall 45% of dog owners had gone to dog behaviour classes or events, with 50% of these falling in group A and 30% in group B.

Generally, the owners saw the dogs as interested in the video content with group A on the whole being interested (3 not interested, 4 interested and 3 very interested) and B also being interested (3 not interested, 4 interested and 3 very interested). This data suggests that the two groups, A and B were essentially quite similar.

There appeared to be no relationship between the age of the dog and its perceived interest in the media. However, the four dogs that were over the age of 75 months (6 years 3 months) were all interested in this video (Figure 5). Given the low number of such dogs this cannot really be considered an effect.

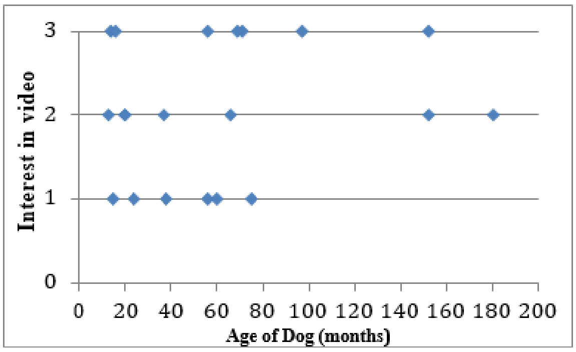

Figure 5. *A graph showing the relationship between the age (in months) and the perceived interest in the media as reported by their owners (1- Not Interested, 2- Interested, 3- Very Interested).*

The results are analysed by keywords that the owner mentioned, context given by the owner towards the behaviour the dog displayed and finally towards the two hypotheses mentioned above.

5.2 Key Word Analysis

To study the open ended questions; keywords of dogs' behaviour, also mentioned in DISH, were counted both totally and within groups (A/B) (see Table 1-5). As shown in Tables 1-6, although group A was given the DISH and reported a higher confidence in their own knowledge of dog behaviour, group B produced more keywords (B had 73 while A had 61).

5.2.1 Eye and Ear Reactions

Table 1. *Table showing number of times owners, split into groups A and B, used key dog behavioural words in relation to eye reactions. Total number 26: 14 in group A (54%), 12 in group B (46%).*

	Group A	Group B	Total
Eye Reactions			
Eye Contact/ looking at me	2	5	7
Eye movement	1	0	1
Wide eyes	2	1	3
Closed eyes	1	0	1
Eye rolling (whites of eyes)	1	0	1
Looking/ staring at screen	7	5	12
Eyes focused	0	1	1

The owners noticed a diverse number of eye reactions reporting them in different levels of detail from 'looking at the screen' to the quite specific behaviour of 'eye rolling'. The more generalized behaviours, such as 'looking', 'eye contact', were reported more than more complex behaviours such as 'wide eye', also known as whale eye, when the whites of the dogs' eyes are showing.

Ear reactions were the most noticed category with a number of phrases being used to describe similar or the same behaviour (Table 2). As ears in dogs are rather emotive, external, and frequently move dependent on their behaviour, this is an easily noticeable trait in the same way the wagging of a dog's tail is.

Table 2. *Table showing number of times owners, split into groups A and B, used key dog behavioural words in relation to ear reactions. 13 in group A (48%), and 14 in Group B (52%): totalling 27 instances.*

	Group A	Group B	Total
Ear Reactions			
Cocking/ twitching/ pricked pinching/ up ears	11	13	24
Ears pinned back	1	0	1
Ears down / pinned down	1	1	2

Nevertheless, mostly owners only noticed the pricking of dog's ears and not the other behaviours mentioned in the DISH, such as pinning back/down.

5.2.2 Facial and Head Reactions

Table 3. *Table showing number of times owners, split into groups A and B, used key dog behavioural words in relation to Facial and Head reactions. Total: 25 instances, group A 12 (48%) and group B 13 (52%).*

	Group A	Group B	Total
Facial/ Head Reactions			
Lifting/ raising head	4	0	4
Turing away showing disinterest/looking away	7	7	14
Head to the side/ tilted	0	3	3
Disinterested face	1	0	1
Head turning	0	1	1
Facial reactions	0	1	1
Head back	0	1	1

Owners here noticed a number of different feedback behaviours from the dogs with most owners noticing disinterest or turning away (see Table 3). Group B identified more behaviours (5) than group A (3) but they were described in general ways such as 'facial reactions' (group B) instead of specifying the type of facial reaction 'disinterested face' (group A) (Table 3).

5.2.3 Vocal Reactions

For the most part owners noticed the vocal reactions from their dogs as their dogs reacted to the dog(s) in the video that were howling and barking (Table 4). Group B reported notably more vocalizations than group A. The one owner, who noticed that their dog was whining, did also notice quite scared behaviour from her dog reporting him as fearful.

Table 4. *Table showing number of times owners, split into groups A and B, used key dog behavioural words in relation to vocal reactions. Total 15: 4 total in group A (27%), 11 in group B (73%).*

	Group A	Group B	Total
Vocal Reactions			
Whining	1	0	24
Howling	2	6	1
Barking	1	5	2

5.2.4 Body Reactions

Table 5. *Table showing number of times owners, split into groups A and B, used key dog behavioural words in relation to body reactions. 18 in g roup A (43%), 23 in group B (57%); totalling 41 instances.*

	Group A	Group B	Total
Body Reactions			
Tail wagging	5	3	8
Walking away	2	4	6
Grab object on TV	1	0	1
Sat stiff/tense	1	1	2
Changing position/ turned body	0	3	3
Ran in circles	0	2	2
Froze in position/ held ground	2	3	5
Calm demeanour	0	1	1
Sat upright	0	1	1
Skating feet/ tapping toes	1	0	1
Approaching screen	4	5	9
Not engaging	1	0	1
Stopped watching	1	0	1

Body reactions were the most notable behaviour by owners, with approaching the screen and tail wagging repeatedly seen (Table 5). A lot of these body reaction keywords were in relation towards the media such as 'walking away', 'approaching screen' and 'stopped watching'.

5.2.5 Summary of Key Word Analysis

The most used words given by dog owners were 'cocking of the ears' (also called pinched, pricking and twitching) followed by 'turning away' and then 'looking/staring at the screen'. These latter two most noticed behaviours are not surprising as they are concerned with the dogs' interactivity with the screen which the owners believed to be important to the study: looking and not looking at the media. The most words used were around the dog's body reactions with once again, the highest mean mentioning of words per section being in the ear reactions. This shows that owners are more likely to notice the reactions of the ears as well as reactions to what they perceive the study to be about, in this case media. Owners were less likely to notice specific eye movements, the dog's facial reactions and demeanour as shown by a score of 1 (Table 1).

5.3 Contextual Analysis

As mentioned before, the behaviour alone needs context to provide more in-depth information. For instance, a dog walking away from the screen could indicate a number of emotional factors from boredom to fear. Some examples of contextualization given behind the emotions within the study were:

> 'when the squeaky noises and dogs howling started he raised his head and cocked it to one side (behaviour) as if trying to make sense of the sounds and it seemed to get him excited (context)'

> 'She pinned her ears back (behaviour) to show that she was concentrating and assessing the situation (context).'

To further investigate this, each time an owner mentioned a behaviour in the questionnaire, analysis was done to see if contextualization was given; both through owners individually and within groups (Table 2). As Tables 1-6 show, group A although using fewer behavioural language words, did provide a deeper context behind the words given with a mean of 74% when compared to group B who had a lower mean of 44% (Table 6).

Beyond attention: excitement, confusion and relaxation, almost all of the owners reported that their dogs were less interested in the second half of the video than the first half. Some dogs did maintain attention throughout, but only two owners unpicked levels of attention in terms of the 'designed in' emotional responses of excited, confusion and relaxation.

This low level of reporting may have been partly down to owners probably believing that the study was solely concerned with measuring the dog's overall attentiveness.

Table 6. *Table showing number of times owners using key dog behavioural words in context split into group A & B. A mean of 74% compared to B who had 44%.*

Contextualisation's Given			
Group A		**Group B**	
Owner 1	89%	Owner 11	40%
Owner 2	83%	Owner 12	44%
Owner 3	44%	Owner 13	25%
Owner 4	100%	Owner 14	36%
Owner 5	60%	Owner 15	40%
Owner 6	88%	Owner 16	75%
Owner 7	60%	Owner 17	20%
Owner 8	60%	Owner 18	50%
Owner 9	86%	Owner 19	86%
Owner 10	71%	Owner 20	20%

This can be seen in Table 5 with highly mentioned words such as 'engaging', 'approaching screen', 'walking away' and 'not watching the screen' all being based around being or not being attentive to the screen as opposed to the content on the screen. The two owners who gave more detail were the only two that rated themselves as 'Excellent' at dog behaviour and were both from group A (owner 6 & 9). Owner 6 recognized stimulation and confusion:

> 'squeaky noises seemed to get excited... dogs howling started he raised his head and cocked it to one side and if trying to make sense of the sounds...'

Owner 9 recognized excited and relaxation:

> ''In the second half she was less attentive started to close her eyes near the end…the second half seemed calmer''

This is not to say that the other owners did not notice their dog's different behaviour patterns but they were not reported. This is clearly a challenge for designers of interactive media for dogs where the aim might be to relax or stimulate a dog – clearly these reactions would need to be observable in any evaluation.

5.4 Main Findings

As shown in Table 6, with an information sheet, in this case the DISH, observers appeared to give more contextual information providing more useful data to help design and evaluate systems. Without the behavioural information (provided in the DISH), the spectator seemed more likely to report body language signals but without context providing less useful data. This shows that the method of educating the informal observer may be suited to be used in nonverbal situations as a technique. In the current study the mood (or emotional state) of the dog was rarely captured which suggests that more work needs to be done to facilitate this process.

6. DISCUSSION

As this study was optional to join and required owners to show their interest, there is a natural bias towards owners that were interested in dog behaviour. There was also a bias towards owners who thought their dog watched TV, as many participants stated they did not think their dog would be useful as they 'didn't pay attention to the TV'. As the study was about the evaluation of the owner's ability to report the behaviour of the dog, it was not a requirement that the dog had to be known to watch TV and this was stated. As anthropomorphism can occur when evaluating animal behaviour from a human perspective, with pet owners often seeing their dog as almost human (Vaschillo et al.,2004) possible babymorphism, further question behind the emotions reported were asked to try and gain context. It should be noted that there could also be owners who were anthropocentric, and believed their pet dogs could not possibly understand the media and thus may have dismissed the dog's interaction.

6.1 Participant Analysis

In regards to the interest shown by the dog in the study no correlation was found between the age of the dog and its interest in the media (Figure 5). All of the owners reported an average or above average confidence about their knowledge on dog behaviour despite a majority of them not recognizing (or not reporting) the emotions behind the behaviour. Only 10% of owners noticed two states of behaviour by their dog from the media. Group A self-rated slightly higher than group B in terms of knowledge brought into the study and their performance on the complex task of contextualizing emotions was better (Table 6).

6.2 Word Analysis

In Table 1, words that the owner used were analysed and grouped. The grouping of these words is rather interesting, as each owner has their own dialect to describe behaviour e.g. pinches, pricked, cocked etc. The words were grouped together when they appeared to be describing the same behaviour however each descriptive word could mean a different behaviour by each owner. This issue in future studies could be solved by analysing videos of the dogs' behaviour, or by asking the owner further questions regarding their answers. The DISH influenced the owner's reporting of dog behaviour by helping to provide context to behavioural reactions (group A vs. B). In keyword analysis (Tables 1-6) participants in group B were able to identify more behaviours than those in group A using DISH. As a group, A gave more context (Table 6), which was what the DISH was designed for, by classifying behaviours in context of emotions to give a deeper understanding for the expression. This may be the reason why fewer behaviours were given by Group A as they were busy providing context resulting in a depth vs frequency situation. Another possibility is that behaviours were analyses of a whole such as the comment made by an owner of group A vs. B:

> 'Turned away from the TV when showing a scene he wasn't interested' – Group A
>
> 'His facial and ear reactions' – Group B

In these instances, the keywords used would be less, as shown above with facial & ear movement providing 2 keywords vs. turned away only providing 1 keyword but still giving further contextual information. Overall the number of keywords used evidences that an owner is able to identify behaviour in their dogs, with the mean of 7 keywords used between groups. This shows that all owners are proficient, through observations, of reporting on their dogs' behaviour, even if at a basic level; regardless of expertise of dog behaviour or of previous training. However, there is a direct link between the owners' own confidence with dog behaviour, their awareness of their dogs' emotions, and their knowledge on how they are displayed, even habitually, through body language. This was shown by the two owners (owners 4 and 19) giving extensive contextual information about their dogs (Table 6) while being the two owners who reported the highest level of confidence in dog behaviour. This could be due to the owners already having a good understanding of the link between dogs' behaviour and emotional cognitive state. The findings here suggest that the DISH helps to give important context behind behavioural reactions thus improving requirements gathering in dog-computer-interaction.

This method also presents a way for correlating DCI behaviour. This provides the important Level 2 (Figure 1) analysis of not only what the dog is doing, but also what the dog is feeling. Without the DISH the majority of owners, reported on their dog's behaviour without adding essential context of the reasoning behind the behaviour.

It is not known why owners with the DISH were better able to identify Level 2 (Figure 1) contextual information nor why some owners (4 & 19, Table 6) were inherently better at identifying their dog's behaviour. It is hypothesized this could be due to how long the owner has had the dog (or dogs) or to the empathy that the owner has for the dog. This has been shown in research relationships with humans, where empathy generated through a relational process, with interpreter and participant, affects the understanding of the research enlightening the context and data (Jones & Ficklin, 2012).

No owner within the study, with or without DISH, was able to identify dog reactions to all the three stages of the video: excited, confused and relaxed. Two of the dog owners in group A (with DISH), were able to identify two different stages of the video linking them to the reaction of their dogs' behaviour and emotions. Both of these owners identified the excited state which is possibly easy to spot as it is about getting the dog's attention and exciting it with clear behaviour patterns. One owner identified the confused state; the other relaxed. As these owners were in group A and had seen the DISH, they may have had a deeper contextual awareness., Haraway (2010) writes of this as 'becoming with' which is not just seeing behaviour but questioning why the behaviour takes place and identifying what this tells us about an emotional state.

Overall, unless the owners are very observant with excellent knowledge of dog behaviour, they are unable to identify different emotions displayed by their dog in reaction to the media. In this case the DISH does not help, as it does not consider cause and effect. In this situation, unlike the previous one, measuring dogs' reactions media is hard to observe.

6.3 How to improve DCI, ACI and HCI

ACI takes areas of HCI and transforms them towards its own needs, this can iteratively be looped back into HCI for peripheral users of systems. Within this work an approach is taken to try and increase the effectiveness of the observations made applied to a user who cannot vocalize the interaction (in this case a dog in an DCI system). This approach of owner consultation has taken place in previous DCI studies (Baskin et al., 2015; Lemanson et al., 2015). The goal of this work, to enhance the possibility for the conveyance of dogs' feedback through their owners, is also shared by users of those systems whose designers face similar communication problems relying on a proxy for interpretation (e.g. users such as babies and users with cognitive disabilities). By creating synergy between the two fields of ACI and HCI, a conversation about creative solutions could be opened up to empower people and animals as well as the ACI and HCI field. It is in this way that this work is designed not only to empower animals, but to empower marginalised humans as well. The role of dog-owner has been comparable to parent-child relationship behavioural wise (Topal & Garsci, 2012), with many dog owners seeing their dogs as an extension of family, often babymorphic. Using the DISH methodology, but transferring it to child or baby behaviour, may help gather requirements from those fringe users that require a proxy to gather superior in-depth emotive information as shown here. This method would also work with non-verbal adults in a similar way and could be tailored towards specific known behaviours and disabilities. In regards to HCI it can be especially useful to have this method of informing the observer, with a tool, when there is a distinct lack of knowledge by the observer or in situations where the user is non-verbal and the observer can offer valuable insight.

Once again, as found here, an information sheet may help here to focus the proxy-observer and empower them through information creating informed observers. This study highlights the need to study DCI behaviour in context to better interpret a dog's feedback when using technology and to ensure that the user requirements and experience (UX) are better understood. This can be accomplished through the use of the DISH when gathering dogs' emotive responses to media. While it is unsure as to why the DISH helps to give more context, it does appear to focus the observer to give valuable information from a hard to source subject. Overall, DISH helps to enable the observer to have a more serious role within DCI, equipping them for the observation.

7. CONCLUSION

This study explores gathering non-verbal users' emotions and contextual behaviours in reaction to media by empowering an observer through an information sheet (DISH). Evidence is presented how dog owners, as informed observers, were able to identify behavioural signals of their dogs, but with the addition of an extra behavioural information sheet (DISH), were then able to give further contextual information (33% more) on both the emotion of the dog and on why the dog was displaying that emotion. This contextual behaviour is important in understanding how a user engaged with a system. However, unless the observer perceived themselves as excellent at dog (or the users) behaviour the owner was not able to identify their dogs' emotional reaction to persuasive media (excited, confused and relaxed). This study highlights the importance of including dog-owners within Animal Computer Interaction (ACI) studies to help gather requirements and evaluate technology filling in the missing current evaluation gaps in ACI. This work adds both to the ACI field and the HCI field, with the applied method possibly being used for non-verbal or limited cognitive users and on other animals to gather requirements.

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