

Who Is Really In The Center Of Dog Computer Design?

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ABSTRACT

With new Animal Computer Interaction (ACI) methods and technology being created for dogs' consideration has to be given to who is in the center of the design process: the human or the dog. This paper aims to explore the problems surrounding this inquiry from the two perspectives a) the aptitude that dogs have to design technology and b) the flaws in how humans are currently designing ACI. This is discussed in a presetting of Human Computer Interaction (HCI) evolution to see whether we can transition HCI methods such as co-design and Grounded Theory Methodology (GTM) from humans to animals using their methods. Finally the philosophies behind a group Animal Computer Interaction Design (ACID) are discussed, along with a categorization of ACI technology and its relevance too who is in the center of design.

Keywords

Animal Computer Interactions, Theory, Methodology, Dog Computing, Human Computer Interaction.

1. THE BIRTH AND DEVELOPMENT OF HUMAN COMPUTER INTERACTION (HCI)

Human Computer Interaction (HCI) practices and research become known early into the 1970s as a niche area within Computer Science combining cognitive science and the human factors of engineering. The original computer interface was detached away from the computer technology processes where arcane commands and system dialogs were sent off to mainframes. Humans were just inputting information doing processes that are now archaic as they have been replaced by electronic systems. This beginning stage of HCI saw humans as a very physical object: 'man as body'. As the computers use grew into the general population masses the distance between the input and technology process shrank. With this growth HCI became a more important discipline with industry specialists starting to think more about the different aspects of computer design. With this change HCIs use of humans as a physical object became very cognitive: 'man as mind'. This development of HCI was then given further velocity by the introduction of a personalized computer allowing the populace to create individual interfaces. This nurtured into HCI principals and processes for interactive products such as User Centered Design (UCD), Universal Design (UD) and Computer Interaction (CI) to name a few. HCIs

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evolution began as very physical 'man as a body' and became very cognitive 'man as mind'. This change as of recent has progressed HCI into another phase, from cognitive to social collaborative spaces: 'man as a social member'. This move can be seen with the introduction of social media websites and forums designed for social engagement.

1.1 Expansion from humans to animals

Current computers for humans are rapidly changing beyond the keyboard and mouse both in the academic world and the consumer market to a more ubiquitous computer environment. With this rise of diverse technology for humans a concept came into fruition that animals may also benefit from personalized technology. However before this notion animals had already used computers for their input/output specialist skill sets (i.e. smell in dogs/ similar philology in chimps).

2. ANIMAL-COMPUTING LITERATURE

The most notable early use of animal-computer- interaction (ACI) was in psychology research which early on used various types of levers with animals as subjects of the studies [1]. In addition, animals have performed in circuses, fairs etc. early on the 20th century performing technology interaction in various forms. Similarly to the first stage of HCI ('man as body') this was ACI thinking about animals in a physical sense: 'dog within context'. The ACI technology made in this period focused on the input channel of the animal to computer without really considering the meaning behind the interaction. ACI was largely government based until the early 2000 when the trend started off for creating animal technology for animals (fig. 1) [2]. This grew into the first computer interaction in dogs with dog-human-computer- interaction Rover@Home [3].



Figure 1: Early ACI through wearable technology: A German Sheppard dog with computer equipment attached to its back. This is an early experiment which did not take into account the dogs requirements. [2]

The analysis of human-computer-animal interaction was then taken into a less tangible situation where the animal was instead treated similarly to a computer system and the relationship between the human subjects could be fully explored [4]. The

start of animal to human communication via technology can be comparable to the second stage of HCI ('man as mind') where the dog is thought of as more than just an input device but a cognitive animal: 'dog with an owner'. The use of animals within these studies raised ethical questions of including animals within experiments [5].

This work with the humans and animals together for the animals' advantage gave reason for animals to cooperate with their human counterpart as well as looking further in-depth at the philosophical and biological ACI [6].

The year 2004 also started a further investigation into human-pet communication via the internet [5] as its growing use was becoming more widespread. Once singular animals had been investigated, the effect of an animal's (dogs) behaviour among a group situation was scrutinized which led to further work in chickens [7]. In 2008 a computer system for dogs was developed using HCI methodologies [8] leading to the conclusion that the split in human methods to animals may be species relevant. Silvers [8] wrote about the tipping moment when realizing that could be designed for the dog as opposed to the human. Although Silvers [8] research is not the first to use HCI framework preceding work [3] has been published within the animal behaviour field for interfaces in human-animal correspondence to allow for interaction through remote locations (computers used as a proxy for interaction) but often without a computerized interaction method i.e. through enclosure.

The current use of animal technology demonstrates a clear gap between the computers use and the lacking notion of design principals. However similar to the HCI formation, the problem in animal computing currently is designing technology related towards the end-user and not, as is currently practiced, the software designer. With the two paths of humans and animals use of computers so far correspondingly formed it is only progressive to presume that the technology revolution that humans face with Computer Interaction (CI) will also face Dog Computing Interaction and in fact all animals.

The space created for dog computer interaction is a novel and new area with few studies and principals emerged. Current CI for dogs focuses on corrective behaviour making the animal fit the human model so the behaviour works for humans. This approach to ACI continually exploits animals using technology for human benefit even as the concept emerged in the ACI SIG paper [9] which aimed at using HCI to empower animals. This is exploitive as the ACI models are corrective CI for the human benefit only empower the animal to aid the human. This can be seen in technology to allow the owner to remotely interact with dogs [10] often comforting the owner whilst possibly creating disembodiment issues in the dogs leading to anxiety and confusion. As current ACI technology is human centered but used by dogs the question rose: **who is the user, the dog or the human?** Following this argument in instances where only the dog is involved a key principal within UCD is to include the end-user within the design process and with the end-user currently not informed in animals, the question is raised **whose needs are ACI really meeting?**

3. METHODS ON DESIGNING CI FOR THE DOG

3.1 HCI method of Nielsen's Heuristics

HCI principals can be applied to dog CI to see if anything can be learned. Jakob Nielsen originally created 9 usability heuristics as guideline principals for interactive design in 1990 [11] based upon factor analysis. Some of these principals can be applied to animals, such as consistence in design and standards, tested through body language. Yet in ACI is impossible to apply these heuristics as dogs cannot talk so are only able to attain certain. In addition these principals were designed off a failure analysis of 249 human usability problems [12]. This data is not available in animal CI.

3.2 Co-Designing with Dogs

With roots from UCD and PD co-design focuses on the design [13]. The more enhanced the ability the co-designer has to talk to the user the larger the shared meaning becomes [13]. Thus a limited meaning in dog-human communication can limit co-designing possibilities. With disabled children Frauenberger [14] uses communicative aids, such as toys with autistic children, based upon their specific needs. Within human-dog communication communicative aids have extensively been used and more often learnt through the co-habitat environment, e.g. dogs will often bring toys to other species (often other dogs/humans) that it wants to play with to induce the interaction. Using Co-Design it could be possible to give the dog another method of voicing their opinion thus increasing the chances of constructing accurate dog requirements. Co-design, similar to GTM, could be used within dog interactive products as a methodology to enable the dog to test the product at the end of interaction but cannot be used to build the initial design scope. Testing is not that straight forward in dogs however because little is known of the cognitive understanding of what is going on.

3.3 Grounded Theory Method

One key HCI method of attaining dog requirements in animal technology is through GTM. GTM allows the construction of theory through the analysis of the data. This allows the results to dictate the next step in the research thus focuses around the results outcome and allows concept creation [15]. This method is often used in animal-computing to allow the results to develop into a framework as there is no formally conventional methods as of yet.

3.4 Body language as an input for CI

Body language is used as the primary communicator between dogs to each other and dogs and humans/animals [3]. Body language could be programmable into technology to give animals the ability to input data naturally rather than through trainable responses such as buttons. Though using body language and simply mapping out the population has few methodological rewards as it does not take the animal within its context similar to early ACI.

4. DOG DESIGNED INTERACTIVE PRODUCTS

The main challenge faced when designing dog interactive products is working out what the dog(s) would design if it was able without interpreting a dogs reactions as validating the designers own thoughts. To prevent this the human needs to be

partially excluded from the study to root out only dog requirements; but this conflicts the nature of the process because as the researcher it is impossible to fully step away from the procedure. This can be to some extent avoided by implementing a method to make sure that the dogs own input is included within the process. Dogs would be more than capable of doing this task with the requirements drawn out possibly leading to methodologies within dog centered design. If this is truly dog centered design however, then **where is the center of the design?**

Unlike the transition that took the requirements initially formed from designer but now drawn up by the end- user in order to create improved CI; this move is in animals. As a species animals are unable to possess knowledge behind the computers interface and capacity. However children use CIs without this knowledge and language, and as previously mentioned, have specific CI requirements; but this is for children above the age of toddlers. From this age most modern children have been trained to use technology inherently (i.e. red X for exit). This then raises the query: would this learning process need to be done in dogs or, as suspected, training for computers is just reminiscent of bad software design before HCI took fruition. Even now still training is required for most software yet there is a common theme among regular users of a system to learn through explorative actions, especially within play due to the nature of the interaction. It therefore could be possible to make dog-centered design more dog focused by allowing the dog to explore technologies to draw out requirements in similar manners to how humans explore and test.

4.1 Would dogs need to be trained to use computers?

Training of dogs can be done through explorative methods, for example a trainer would tell a dog to push a button and they would try different actions until the dog is rewarded with a treat. With this repetition the animal would connect the action and reaction that the human desires (the previously mentioned humanization category). This is the key problem with current ACI as it is Animal-Human-Computer-Interaction as it perpetually includes the human, with the animals often not being consulted but unnaturally humanized. How can it be accurately Animal-Computing when the end goal is human?

4.2 Problems with current ACI

A methodology that has little training and draws out true requirements would not humanize (one of the three categories mentioned before) a response but aim to try and focus on the animal's needs. This is where the true problem of ACI lies, even if a computer was taught to react to a dogs body language with the humans interpretation, in order for an action-reaction scenario to take place the dog still needs to understand the premise of the technology thus be trained by it. This training is already happening as while computing alone is our creation it has become so ubiquitous that, especially in the first world, it is not a dogs decision to use or not to use technology they are confronted and already trained with it. This is most notable in the occurrence of dogs watching TV with an industry being created around the phenomenon. Dogs have become ritually humanized through breed to meet human needs, and now our choice or keeping them as pets. They take part in human transport, work and play. While the ideal still exists to create technology for dogs without training,

in order for the dog to understand the initiative of the designed technology a certain amount of explorative work has to be taken upon the dog. This points to the fact that no animal CI is without training but is a difference between explorative and humanization training?

The question is whether within the end-goal of the technology is human or dog centered. If the goal is human then the dog will not naturally explore the technology thus it is humanization as the human wants the dog to use it. This interpretation could explain why most current ACI technology uses working dogs due to their internal humanization of working practices being pre-trained in human devices thus using human made technology daily (i.e. diabetic dogs use within the open university). While the use of technology with working dogs is valid AHCI/ACI its approach ignores the vastly large populous of domesticated dogs that are in also in need of welfare from CI technology in two other categories: play and domestication.

5. Current CI methodologies in dogs

On lens to look at interactive design in dog CI are by using three possible divisions: domestication, humanization or play.

Domestication is cultivating animals to traits that are desirable to the human. This is often done in animals to allow a peaceable environment with humans. The domestication design choice presents itself in activities made to customize dogs to the human habitat such as [16] television programs to accustom the dog to hazardous sounds and visuals that dogs could possibly fear or are currently unknown (i.e. thunder, road works etc.) (Fig. 2).



Figure 2: Dogs watching dog-designed videos seen to accustom themselves to certain sounds or sights [16].

Humanization includes educational and correctional behavior to mold the dog to fit into human requirements. This trains the animal to interact like a human to enable the animal to act more civilized in our habitat. The majority of dog CI technology uses this approach, where the dog has to perform a task with the computer for a reward. An illustration of humanization is using iCPooch [18] an interactive product which let dogs talk to their owners remotely over the device and dispenses treats (fig.3).

The last technology is for *play*, such as ball throwers and games. Play is activities which an animal does for enjoyment and recreation rather than a serious purpose. Designing for play however can be tricky to define as the work play relationship in dogs is based on human standards so it is tough to diagnose. An example of playful dog CI is App for Dogs [16] on the iPad where the dog can use their paw to paint or play other games with or without their owner (Fig.4). Play is used within this work as researchers, such as Homo- Lundens, point out the importance of play as an activity that appeared within animals before culture was developed and without humans teaching animals [19].



Figure 3: ICPooch an interactive two way video and food dispensing device for dogs and cats. [17]



Figure 4: App for dogs called Dog App which lets dogs paint and play other activities without the owner [18]

In order to fully design for dogs the human variable needs to be excluded and solely the dogs' requirements exclusively mapped. Whilst domestication and humanization are important for a healthy sociable dog they are mostly human desires often excluding the dogs real requirements. In order to appropriately design with dog(s) the playful activity is the motivation behind this work so that the dog is the sole end-user thus allowing the research to get closer to understanding a dogs cognitive and usability needs by excluding the present predominate human.

6. Philosophy behind ACID

Through this discussion it has become apparent, that like HCI, there is no perfect solution to designing technology for dogs, but without the exportation of a their needs this is not possible. Unless this is explored a dogs needs are just an imprint of our own desires and thoughts upon their needs. We believe that technology can be made that allows a dog to explore computers, like humans did, to find accurate requirements by excluding focusing on dog's needs. Humans will always be involved as the computers creators but by making the dog the center of the design gradually by building up requirements this can be transferred across more into dog-centered while becoming more usable. For example a version of dog CI can be done through a small study to gain understanding into appropriate dog requirements in order to improve their welfare. While a dog will never write a list of software requirements they will give their needs tellingly through body language, their species version of written language and other signposts which will later be discovered and explored.

The position taken by Animal Computer Interaction Design (ACID) group at the University of Central Lancashire (UCLan) is to design exclusively for the dog to create this version ACI and

not human driven ACI which proposes at benefitting the dog but that ultimately creating poorly suited technology. This method is different as it purposes designing technology where the animal is at the center of the design. This methodology of dog CI is coined **Naturally Derived Dog Computer Interaction (NDDCI)**. This NDDCI philosophical approach of exclusively designing for dogs taken is a radical one as part of the general populace and ACI community will always see dogs as just simply animals. However, we see it as a simple and logical progression of dog CI.

This NDDCI methodology however is not convenient for ACI for the human, unless it stimulates and calms down the dog, but what ACI would be like if it was more dog centered. The three categorizations previously mentioned (humanization, domestication and playful) of dog CI are varying levels of dog to human centered design (fig. 5).

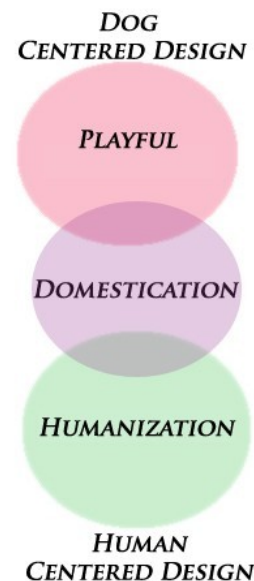


Figure 5: Our framework of dog Computer Interaction (CI) categorizations within Interaction Design (ID)

It would be difficult to argue dog- humanization as somewhat that the dog desires as these are purely human centered and beyond the dogs needs. From a dogs perspective a dog would never wish to be a human but just a dog. Domestication of training behaviors, on the other hand, can be taken from both dog and human requirements. Dogs are naturally pack occurring animals and at the beginning point dogs could be happier with domestication as they have aspirations of wanting to be part of the family. Playful CI however evokes naturally occurring playful behaviour which is inherently more dog-centered as it occurs within a dogs ordinary life. Equally though play could be human focused if the human wants the dog to play. This opens up questions if playful CI was dog provoked what would the dog like it to be and what does incite playful behavior? Playful behavior nonetheless is just one element that can be used to get closer to animal- centered design but is used within this research.

This problem has been encountered in Children Computer Interaction (CCI) where self initiated play is often not what the adult wants but what the children want: just to be kids. This is the true hole that ACI has fallen into without consideration of who the user really is and where the center of the design really lies. Animal technologies will continue to be designed for humans to

no avail for animal welfare. This is evident from the questions being raised around ACI on how animals are using technology rather than the progressive subject of why they choose to use man-developed machinery.

7. Conclusion

There is a clear parallel between early HCI software development and current ACI research where there was a realization of the importance of the user being involved in CI design. This alteration seen in humans is hoped to occur in designing for dogs where technology developed for their use are designed based on their actual needs. It is only by letting dogs explore technology through their own eyes and not the human gaze that these needs can be shifted into cognition and methodologies can be created – coined **Naturally Derived Dog Computer Interaction (NDDCI)**. In order for the center of the design to be the dog, then the dog has to be naturally motivated to use the technology itself. We have created three framework categories of animal-interaction: humanization, domestication and playful. By using this framework more insight can be given to the design focus and answers be given to see if the interaction is human focused, dog focused, or as more often seen somewhere in-between. While playful is just one method within this categorization with methodological development expectantly this method will grow to include more explicit detail and data.

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