

Beyond Patting: The Role of Attention in Expanding the Human-Pet Robot Relationship

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Abstract. Companion animals can provide a sense of social support to isolated people, including the aged, providing physiological and psychological benefits. Although pet-like robots have been developed they have focused on patting response behaviours which represent only a small part of the human-pet relationship. In this paper we explore aspects of human-pet robot interactions that might benefit from the application of attention models; including feelings of shared experience, dependence, constant availability, and non-judgemental support.

1 Introduction

Pet ownership has consistently been shown to have positive physiological and psychological benefits to human health. The health savings due to pet ownership were estimated at \$988 million for Australia for the 1994-95 financial year [7]. Unfortunately some of the most socially isolated people who would most benefit from a companion animal are also the most ill equipped to care for them. This could potentially be unhygienic for the person and life threatening for the animal. Australia is facing an aged care crisis with increasing numbers of vulnerable elderly and decreasing numbers of aged care workers. The Australian department of Health and Ageing estimated that the aged care workforce will need to double or triple by 2050 [2]. At the CSIRO, Australia's government research organisation, we are currently developing pet therapy robots that both monitor the health of aged care patients and provide social support.

Interacting with animal-like robots has been shown to have social and psychological benefits [19] and foster social interaction [11] in aged care patients. The robot interactions have been limited to simple expressions and sounds triggered by touch. In recent models they have included the ability to respond to the robot's given name. Studies have not been conducted to show if these interactions are enough to foster long term engagement and therefore benefit. There is also ethical concern that these robots have a possible infantilisation effect on aged care patients [17] and that any suggestion that it is a true relationship is a deception.

Studies with companion robots for the elderly have only scratched the surface in simulating pet relationships. In this paper we explore the human-pet relationship in more detail and the role of attention in reproducing the necessary behaviours.

2 The Human-Pet Relationship

Married or co-habiting couples demonstrate stronger health and longer life expectancy than those who are divorced or single [12]. Animals have an important role in the lives of people in transition; for example the newly married, divorced or widowed [14]. A lack of social support is a significant risk factor for subsequent physical and psychological problems [18]. Companion animals are a social support in and of themselves, but also act as facilitators of social interactions between other human beings [3]. Beck and Katcher [3] suggest that sharing our lives with companion animals promotes a sense of safety and consistency.

“by encouraging touch and giving humans a loving creature to care for, the interaction with animals stimulates physical reactions that are very necessary and important in humans. [4]”

To expand the relationship with pet robots beyond their responding to touch we need to investigate what it means to be a ‘loving creature for someone to care for’. Attachment theory suggests that humans have a need to protect and be protected [1]. Pets depend on humans as children rely on parents for their continual care, protection from danger, and explanation on their behalf because of their lack of language. Further to this many older pet owners regard their pet as a symbol of independence [6]. This symbol allows them to manage the process of becoming increasingly dependent on other humans for their needs; including financial. The pet is dependent on them, and therefore they are not at the lowest step on the social hierarchy. This ‘need to be needed’ can manifest itself even more strongly giving a socially isolated person a reason to get up in the morning and a reason to take care of themselves effectively [20].

As social supports pets may reduce loneliness and contribute to a general sense of well-being in their owners [16]. Study results report that as social supports their benefits include their [5]:

- constant availability
- non-judgemental support
- unconditional love

This sense of non-judgemental support may be explained by pets appearing to be indifferent to our physical appearance, social status, material possessions, relative intelligence, and conversation skills. People that feel rejected, a burden, or invisible to society may find the relationship and support they need in an animal.

Simulating unconditional love may be a controversial prospect at best, but many of the other perceived advantages might benefit from the application of attention models; including feelings of shared experience, dependence, constant availability, and non-judgemental support.

3 Attention

3.1 Shared Experience

Shared experience is an important aspect of the feeling of sharing your life with another. Kaplan and Hafner [10] describe joint attention as a shared intentional relation to the world. This extends beyond ‘simultaneous looking’ and is an active bilateral process. Joint attention is intentionally directed perception that involves one or more parties trying to achieve a goal. Kaplan and Hafner [10] specify four stages of joint attention that will be used to describe pet robot requirements:

- **Attention detection** - eg. tracking the other agent’s behaviour and gaze.
- **Attention manipulation** - eg. pointing gestures and words.
- **Social coordination** - eg. turn-taking and role-switching.
- **Intentional stance** - eg. interpreting other’s intentions, including those different from one’s own.

Yonezawa et. al [21] concluded from experiments with a stuffed toy robot that joint attention affected human interactors positively only when combined with methods for maintaining eye contact. This is likely also applicable to pet-like interactions.

Shared experience can involve shared response to abnormal events. These events might include loud noises, new visitors, or extreme weather conditions. These in turn could trigger curiosity behaviours, or simulating appropriate responses, such as heat seeking in cold weather. This could be implemented in a ‘simultaneous looking’ sense in which both parties simply react to similar events. Reliable attention detection might allow the robot to respond to events that it cannot detect itself. However, including social coordination and intentional stance behaviours to involve an interpretation of the owner’s reaction to the event might elevate this to a shared experience. For example, behaviours that might be interpreted as ‘Did you hear that?’ and ‘Should I be concerned?’.

Habituation and sensitisation models allow an agent to autonomously adapt to its environment.

“Individuals do not receive a positive or negative feedback for their responses from the environment. Instead, they measure the effectiveness of their responses based on their internal judgement of the significance of the repeated stimulus.” [13]

However, to create shared experience it may be necessary that the dominant party (the pet owner) guides habituation and sensitisation in the robot. Humans and pets are not social equals, and pets are expected to learn our rules and ways of living. The pet must look to the human to determine the appropriate response to events; both normal and abnormal.

3.2 Dependence

The goal for much of robotics is to increase their autonomy to the stage where human intervention is not required. In the case of the human-pet robot relationship dependence may be a necessary requirement.

Attention manipulation is a candidate for providing the sense of the dependence of the pet robot deemed necessary for attachment. The robot should be able to direct the human to any needs or fears it might have until they are appropriately met.

A simple system to implement would be to require the owner to charge the robot's batteries. The robot then ceases to function when the owner neglects it. This does not have the same responsibility as not feeding a living creature, as the robot would be essentially unharmed if allowed to run flat. Potentially the robot could lose any personalisation it has acquired to provide incentive.

Another approach would be to foster empathy in the owner that increases their desire to keep the robot safe. Imitation has been shown to be linked with empathy [8]. Social coordination is required to play imitation games that could assist in this process.

3.3 Constant Availability

It is a simple matter to program a robot to be always present at the owners home. However to appear 'constantly available' there are technical challenges in reliability to consider. The robot would need to be technically robust and easy to keep charged. In addition the robot would need to reliably find and provide attention for the owner. It is unlikely that pet owners are referring to the availability as an inanimate object might have, in that they can lay their hands on it at any time, but more that the attention is there any time they need it. The robot should then have a system that accurately sense when their attention is required and provide it at a priority to other tasks. In practice this may involve sensing when the owners social needs are not being met and make itself available for patting or company.

It is suggested that animals feel empathy as they appear to be affected by the emotional distress of others. Animals may become agitated or distressed by another's distress, and act to eliminate the stressor or soothe them [15]. The robot actively making itself available when the owner is distressed may extend this to a more animal-like interaction. At its simplest this is an attention detection problem, but emotional events may be harder to recognise than physical ones.

3.4 Non-Judgemental Support

Because of the requirement to program perceptive and discriminatory behaviours into our robots, in a sense we gain 'non-judgemental support' for free. The robot will only pay attention to the characteristics of their owners that they are explicitly told to. What we program the robot not to pay attention to may be as beneficial as what we do. For robots that are also acting as physiological

and psychological health monitors it may be important to track and report on these without appearing to be disapproving. It may be that animals are able to express concern, interest, and attention in a manner that is non-invasive and non-patronising. One of the design decisions to be made in a health monitoring robot is whether it should be verbal or non-verbal.

Reproducing the non-verbal attention of pets may be necessary to generate feelings of non-judgemental support. Puppies that have had little to do with humans are able to follow gaze and pointing gestures, whereas wolves cannot. This suggests the process of domestication has resulted in skills in interpreting human social cues. Dogs themselves use gaze, body orientation, and pointing cues to establish joint attention [9].

4 Conclusion

Pets provide us with a relationship that extends far beyond the affection we give and they receive. Joint attention methods such as attention direction, social coordination, and intentional stance may assist in elevating these interactions to the sense of a shared life and social support.

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