METAZOA LUDENS: MIXED REALITY INTERACTIONS AND PLAY FOR SMALL PETS AND HUMANS

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Introduction

Metazoa Ludens is a revolutionary system that enables humans to play computer games with small animals in a mixed reality environment. The desire to create this human-pet computer game system illustrates a way to reverse the trend of the growing lack of quality time spent between humans and their pets. Hence, the aim is to create a media interface capable of remote human-animal interaction, which takes into consideration the different physiological and psychological make-up between humans and their pets, and the way they may interact with the interface.

Human-animal interaction offers many benefits for both humans and animals [4, 2]. While digital media interaction has been greatly enhanced by the advancement of technology, such interactions are generally restricted to human-human interaction and not extended to promote inter-species interaction. Furthermore, the advancement of technology itself is changing the way people live, demanding longer working hours in order to match up with the higher level of efficiency. Due to this general change in the professional lifestyle [6], humans are out of the house for longer hours and often pets are generally neglected. With this negligence, pets will be deprived of the love and care they require from their human families [7]. Hence, Metazoa Ludens intends to fill in the niche which has been lacking, to provide a way to promote human-animal interaction, locally or remotely, while making use of high-technological advancements to create an environment that augments and enhances such interactivity.

This new interface gives a different form of game play and connectivity between humans and small animals relative to existing ones. With this mixed reality game system, different forms of interaction may be introduced where the small animals (like hamsters) are allowed to "chase after" the human owners in a digital world, hence instead of empowering the pets they get caught up in a compromised situation. Metazoa Ludens hopes to place the hamster on an equal level in the virtual world (which is impossible in the physical world) and allow interaction between human and hamster through a digital interface in a mixed reality manner which is different from the conventional human-animal interaction.

Related Works

Current human-animal interaction between owners and their pets mostly involve simple games to the likes of fetch which do not utilize sophisticated technology. Poultry.Internet [7] and Cat Toy [3] are some interactive systems developed using sophisticated technology for remote human-pet interactions. However, these systems provide only a one-way interaction, and do not allow the owner to interact with their pets in a more emotional and intimate manner.

Building upon all these pet-human interactive systems, Metazoa Ludens brings on a new form of human-animal interaction by extending and augmenting previous systems to allow bidirectional interaction between pet owners and their pet hamsters via playing computer games (locally or remotely). In addition, it incorporates beneficial aspects (such as exercises) to the pets with a built-in method of positive reinforcement, to motivate the pets into performing positive behaviors as well as in the promotion of the awareness of digital human-animal interaction.

Metazoa Ludens

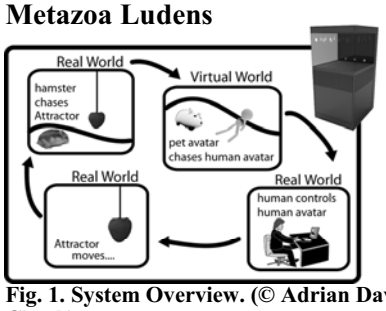

Fig. 1. System Overview. (© Adrian David Cheok)

In the real world within the big running space of the system, the hamster chases after a physical movable arm on a moldable surface area. The movement of the hamster is then translated into the movement of a pet avatar in the virtual gaming space which is shared by the human. The human controls the movement of a human avatar in the virtual gaming world, which is actually controlling the movement of the physical attractor in the real world. Thus, this loop (see Fig. 1) enables the merging of two realities, both human's virtual reality and the animal's physical reality via the Metazoa Ludens system. Further details, pictures and videos of the system can be found at metazoa.mixedrealitylab.org

The system is made up of 3 subsystems. Firstly, there is a camera subsystem which will take care of the camera tracking of the hamster. Secondly, a hardware subsystem to send signals to the stepper motors that will in turn control the actuators and the three degree of freedom mechanical robotic arm, and communicate to the client using Internet. Lastly there is a game subsystem which processes the 3D real-time graphics of the virtual gaming world as well as the game play

The basic game concept behind Metazoa Ludens game is a predator and prey chase game, nevertheless playing with your favorite pet hamster over the digital screen and being chased by them adds more intrinsic values to the game play. While not trying to replace conventional human-pet interaction, this way of playing game with the aid of a digital system definitely adds more variety to the way a pet owner may play with their small pets.

Design of Metazoa Ludens

Remote interaction: Metazoa Ludens aims to provide easy remote connectivity between humans and their pet hamsters using existing Internet infrastructure. This is to ensure owners are still connected to their hamsters even when they are physically apart.

Pets' choice: It is important that the hamsters are given a choice to play the game. One way for it to communicate its choice is to create a tunnel, from its cage to the structure for game play. It is then able to "select" whether to play or not by moving to and fro between the cage and the structure through the tunnel.

Pet interface: Metazoa Ludens should not only benefit humans but also hamsters. By incorporating mild exercise for them, the system will become beneficial for the hamsters' health and well being. Regular exercises will prevent the hamsters from being obese and thereby reduces the possibilities of obese-related diseases.

The Hamsters

Health benefits to the hamsters: A trial test was carried out to assess the benefits

of the system through regular exercise to the hamsters. All hamsters had their mean Body Condition Scoring (BCS) taken at the first week of the experiment. For six weeks, the metabolizable energy requirement (MER) [8] from each hamster was calculated daily and the amount of food they were given each day was in accordance to the MER. The hamsters were allowed to play Metazoa Ludens for an hour each on every weekday for the period of six weeks. At the end of the sixth week their mean BCSs were taken again.

Metazoa Ludens was found to be able to change the BCS of the subject hamsters over the study period. Further statistical analysis of the mean BCS showed that the mean BCS of hamsters after 6 weeks of using Metazoa Ludens tend towards the optimal BCS score for hamsters.

Pets' Choice: Besides studying the health benefits of hamsters, a separate study was carried out to measure the motivation of the hamsters to play Metazoa Ludens. In this study the method of Duncan [5] was adapted to assess the strength of preference of the hamsters towards Metazoa Ludens.

The study was carried out for four weeks and the mean percentage for the number of times each hamster chose to play Metazoa Ludens in the 1st week was compared to that in the fourth week. It was shown that the mean number of times taken for the hamsters to play the game per day increased over the study period. Further statistical analysis showed that this increase was a 60 percent increment. As it is shown that the hamsters increasingly chooses to play Metazoa Ludens during the study period, we conclude that the hamsters have a positive desire to play Metazoa Ludens.

Designing for Human-Animal Interaction System

A set of design guidelines used to describe human-animal interaction system and the interactions involved can be developed from the built of Metazoa Ludens. This will provide possible insights for future human-animal interaction systems to be developed and the benefits would be faster and better designed systems. Knowledge learnt from Metazoa Ludens can thus be reused and applied onto these new systems.

Five design dimensions which are to be thought of as design choices human-animal interaction system are presented. The dimensions are: habitat design, ease of use, interactivity, pet's choice and animal's gratification. Existing human-animal interaction systems are ranked upon the five axes, each axis having been divided into five bands from low to high. Based on the clustering of these systems, four design patterns for human-animal interaction system are thus obtained. They are:

Restricted Interface accounts for systems like Cat Toy [4]. Such systems score fairly well in four of the dimensions except for Interactivity. Interaction is mostly one-way, from the human to the animal, the animal has no means to interact directly to the human. Such systems are mostly intended to have a restricted one-way interface focusing on the human's interaction with the animal.

Discretionary Contact accounts for systems like Poultry.Internet [7]. Such systems score fairly well in four of the dimensions except for Pet's Choice. Despite the animals having little choice in participating in this interaction nevertheless it is noted that gratification or benefits for the animal is high. Such systems are mostly intended for the human to contact the animal at the human's discretion.

Digital Live Display accounts for systems like Infiltrate [9]. Such systems score very well in Habitual Design and Ease of Use while scoring very low for the remaining dimensions. These systems generally focus on being a means of digital live display for the human with little emphasis on the animal's choice to interact, their interaction with the human and their gratification from such systems.

Interactive Connection accounts for Metazoa Ludens. This archetype scores very well in all dimensions except for Habitual Design. This archetype focuses on bidirectional interaction as well as the animal's choice to play and its gratification, it also ensures the ease of use of the system by the animal. Such systems are mostly intended for equal emphasis on interaction between the human and the animal for connection.

In an ideal situation any such systems to be built should be high in all five dimensions and take into account the well being of the animal just as the human's has always been considered. Consideration of their interaction with the system should be intuitive to the animals. Most importantly the animal's choice to use the system and their gratification from using the system should be essential and not taken for granted.

Future Works

Other possible computer games with pets may be made possible, like Jellyfish Trone whereby the movements of the jellyfish may correspond to that of the worm/snake in the Trone-like game environment and Chicken Pacman whereby movements of real chicken walking in a real maze corresponds to the movements of the ghost in the virtual world chasing after the Pacman controlled by a human player. This would allow varied human-pet interactions with different types of pets enhanced by technology.

Conclusion

Metazoa Ludens presents a mixed reality game which allows game play between humans and small animals over the Internet. This system not just allows a novel game play but allows humans and hamsters to interact meaningfully and effectively with a mixed reality system. This type of interaction offered gives the enrichment and enhancement of the experience as brought about by digitalized system. While not trying to replace conventional interaction between humans and small animals, its aim is to offer remote interaction with the small animals and another way of interacting with the small animals through advanced digital technology, along with providing frameworks for future human-animal media designs for the benefit of animal and human relations.

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