

The Philosophy of Computer Games Conference, Istanbul 2014

Felino: The Philosophical Practice of Making an Interspecies Videogame

Michelle Westerlaken and Stefano Gualeni, PhD.

Abstract

This paper describes the design process of an interspecies video game that has its foundations in the field of Animal-Computer Interaction (ACI), but is inspired by philosophical notions and approaches including Jos De Mul's work on biohermeneutics (De Mul 2013), Pierce's theory of semiotics (Pierce 1931-35), and the work of Helmuth Plessner in the field of philosophical anthropology (Plessner 2006). Our approach serves to better design playful artefacts (video games among them) that take the animal's reactions and preferences into account in the research phase, the conceptualization phase, and the iteration phase of the design process. Our tablet game, called *Felino*, is merely a digital toy that aims at facilitating the emergence of 'play' between humans and domestic cats, and allows humans and animals to play together simultaneously. The design and development of *Felino* is not only informed by advancements in the field of ACI, but is first and foremost a critical artefact that materializes our philosophical approach, making it an object for critical evaluation.

1. Introduction

The current, general understanding of video games (as well as any forms of computing entertainment for that matter), tends to limit itself both in terms of game design and in terms of gameplay to being an intra-species affair. Humans, in fact, mostly design entertainment technologies for humans. After all, as argued by Gualeni, computers are "ultimately machines characterized by logics which are simplifications, extensions, distortions and repetitions of certain aspects of a human kind of sensibility and cognition" (Gualeni 2014). We argue, however, that there is no reason why the influences and the benefits of such technologies should be contained solely within the limits of our species. We share our anthropic world with animals and we are already arguably affecting their lives with technology in many ways. This is particularly evident in fields such as agricultural engineering, animal tracking, animal breeding, veterinary, or in the case of the domestic animal industry.

In the last few years, a considerable amount of commercial products and research projects explicitly addressed the field of playful interspecies interaction design. These are not only toys that facilitate 'play' between humans and domestic animals such as dogs and cats, but also, for example, video games that involve living crickets as game elements (Lamers & Van Eck 2012) or touch-screen interfaces for orang-utans that encourage 'play' (Wirman 2013). The game

discussed in this paper is precisely one of those interspecies interactive experiences that we developed as part of a larger research project aimed at discovering how technical artefacts mediate the relationships between humans and animals.

This paper describes an interdisciplinary design approach for Animal-Computer Interaction (ACI) design that is inspired by philosophical notions and approaches including Jos De Mul's work on biohermeneutics (De Mul 2013), Pierce's theory on semiotics (Pierce 1931-35), and the work of Helmuth Plessner in the field of philosophical anthropology and in particular his theory of positionality (Plessner 2006). Our approach aspires to guide the design of playful artefacts (among which video games) in ways that take the animal's reactions and preferences into account in the research, the conceptualization, and the iteration phases of our design process.

2. Background

In 2011, Mancini introduced the term ACI as a sub-field of HCI and proposed to develop a user-centred approach, informed by the best available knowledge of animals' needs and preferences. ACI aims to influence the design of technology for animals to improve their life expectancy and quality, support the animals in the functions they are involved in, and foster the relationships between animals and humans through promoting communication and understanding (Mancini 2011).

From this context, we initiated a systematic methodology for the design and research of technical artefacts that mediate the relationships between humans and animals. Our approach involves the animal in the design process and regards physical 'play' as a free and voluntary activity that is pre-cultural and shared by both animals and humans (Westerlaken & Gualeni 2013). Our existing work in this area has its foundations in the field of classic HCI. However, in this paper in particular, we would like to describe how a few key philosophical topics were central to our work by explaining how a philosophical angle was foundational for both our theoretical approach (ACI framework) and our practical one (the design of an interspecies game). Our aim here is to explain how a philosophical reflection on our relationships with animals and our ethos as human designers and researchers can be both desirable and fruitful and shall perhaps become a common practice in any forms of interspecies design. An approach combining philosophical anthropology and biohermeneutics helped us adopt more aware perspectives on how to understand and evaluate the animal's presence, its interactive capabilities in relation with the digital medium, and its response to aesthetical stimuli. It also made us more aware of our biases, our design process and several aspects of our own (to an extent inevitable) human perspective.

Our initial work was focused on setting up a theoretical framework for the research and design of playful technological artefacts that can be used by humans and animals. These initial efforts of ours are registered and discussed in two other papers (Westerlaken & Gualeni 2013; Westerlaken & Gualeni 2014, forthcoming). Naturally, the next challenge for us was that of designing and developing an actual game (or digitally-mediated playful activity) that would put our theoretical work into practice, materializing our philosophical approach and theoretical framework into a

critical object: something that would become the focus of critical investigation (as well as experimental research) both for ourselves as well as for other researchers.

We decided to develop a tablet game that would afford both the cat and human with a relevant, simultaneous role during the interaction with the game. Rather than a game with structured rules and objectives, it aligns more to the tradition of digital toys, allowing both the human and the cat to experiment with the mechanics of the game and adapt the interaction to the on-going, shared and mutually constitutive activity of ‘play’ (Gualeni 2014).

This paper will first describe how the philosophical notions that we mentioned above were relevant in the theoretical framework that we initiated. Secondly, we will explain how these philosophical theories informed the conceptualization phase and the iterative design process during the development of our game, *Felino* (see Figure 1).

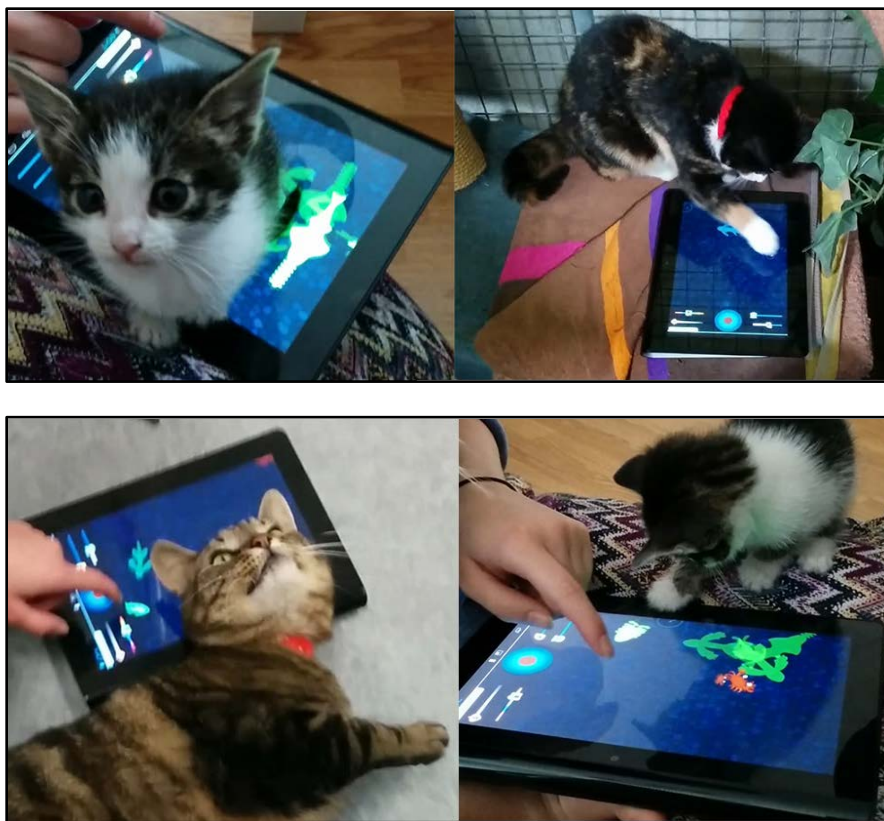


Figure 1: The tablet game *Felino*

3. Philosophy and the Design for Animals

We initiated a theoretical framework for the design of technologically mediated human-animal interaction with the overt objective of achieving a more balanced stance as designers. Our framework encourages, in fact, a shift in the design perspective from the human towards the animal in order to include animals not only more thoroughly in ‘play’, but also in the processes of prototyping and iterating while developing the design of a game, a toy, or a digitally-mediated playful experience. To enlarge our understanding of the animal as a relevant stakeholder in the

interactions that we design, Helmuth Plessner's theory of positionality was helpful to gain insights in the differences between humans and animals in terms of their operational autonomy and their possibilities to establish relationships with themselves and with the world.

Plessner's positionality theory

Positionality theory was originally presented by German philosopher Helmuth Plessner in his 1928 book *The Levels of the Organic and Man*. In introducing his philosophical anthropology, Plessner started *The Levels of the Organic and Man* by framing the elementary dissimilarities between plants, animals, and human beings on the basis of their spatial organization and relative autonomy in relation to their environment (Plessner 2006). His original standpoint can be adopted to become the theoretical foundation to understand the differences in perception, cognition, operation and communication that separate humans and animals, differences that, we believe, must be taken into account when designing interactions that are intended for animals or shared with animals.

According to Plessner's theory of positionality, a plant has no awareness or consciousness of itself or its environment. A plant does not have a centre of experience and therefore cannot control its external boundaries, that is to say it cannot decide autonomously how to relate to its environment and regulate exchanges with it (Plessner 2006).

Animals, on the other hand, are endowed with an experiential centre and a degree of self-awareness and autonomy in relation to their surroundings. Plessner called this way of relating to one's world a 'centric positionality', where one's experiences and exchanges are controlled and mediated by a central controlling system that the German philosopher identified in the nervous system. It is thanks to their experiential centres that animals can make independent decisions in relation to their surroundings, such as moving to a different location, whether to feed or not, to fight or flee, et cetera. The centric positionality makes the animal aware of its own body and experiences (Plessner 2006). Figure 2 graphically encapsulates the fundamental perspectives of theory.

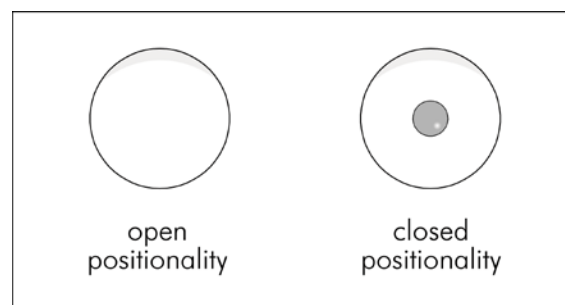


Figure 2: The first two positionalities of organic life according to Plessner in the visual interpretation of philosopher Jos De Mul (De Mul 2010). The diagram on the left characterizes an 'open form': a form that has no autonomy in relation to its environment, as in the case of plants. The one on the right exemplifies a 'closed form': a type of positionality whose centre of experience allows an organism to develop awareness of its world as well as a degree of independence from it. The latter is the case of animals: animals that can take several decisions with regards to their behaviour in the world, for example in relation to moving, feeding, mating, playing, et cetera.

The last positionality envisaged by Plessner is the one characterizing human beings, who represent – in his anthropological perspective – the pinnacle of organic evolution. Similar to animals, human beings have a ‘centric positionality’ but can, on top of that, establish a cognitive relationship with their very experiential centre. In other words, humans can take a stance which is external to themselves and is capable of looking on themselves as objects of perceptions. Plessner described this as an ‘eccentric positionality’. As such, a human being is capable of self-reflection and of making decisions which are independent from their environment and one’s own immediate interest (Plessner 2006). Figure 3 graphically summarizes the complete set of possible positionalities as presented by Plessner.

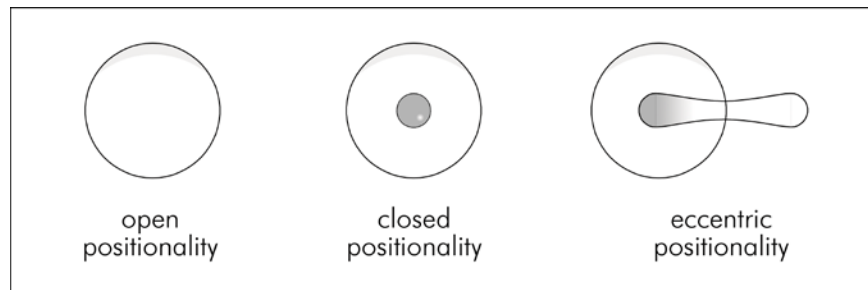


Figure 3: The three possible ‘stages of the organic’ according to the theory of positionality proposed by Plessner in 1928 in the visual interpretation of De Mul (De Mul 2010). The ‘eccentric positionality’, characteristic of human beings, shows two coexisting and connected nuclei: one within the body (the bodily experiential centre accountable for inner experiences) and the other outside of it (allowing for the possibility of self-reflection and for interpreting one’s own body as an object).

Even though humans and animals perceive their environment in a different manner, one among the activities in which humans and animals share a degree of mutual understanding and analogue responses to signs, cues, and behaviours is physical ‘play’. Physical ‘play’ is a voluntary activity that is observed in many mammals and is recognizable by some revelatory behavioural patterns and indexical signs (Burghardt 2006). Its recognisability, on top of its being already pursued as an interspecies activity, made physical ‘play’ a suitable context for interspecies research in the field of ACI with the purpose of finding a more compromising and animal-inclusive approach for the design of technological artefacts aimed at mediating human-animal interaction.

De Mul’s Biohermeneutics

Our research proposes the activity of ‘play’ as the context where humans and animals can ‘go-along’ and understand each other through the interpretation of bodily movements and playful signals. This concept of ‘going-along’, originally presented by philosopher Jos De Mul, does not only unfold itself in the course of the interaction, but is first and foremost a design attitude that we embraced in our work. ‘Play’ facilitates a mutual understanding due to the shared interaction and response to bodily cues. According to philosopher De Mul, common traits in the way bodily signs are produced and interpreted allow specific species to understand other species to a certain degree. In particular, De Mul argues that the dimensions that constitute the human world enable us not only to meaningfully relate to other human beings, but up to a certain extent, to understand animal life as well (De Mul 2013). In other words, a closer insight into the intentions

of an animal could be achieved by ‘going-along’ in a common, embodied praxis such as ‘play’. An example includes the elementary understanding of the intentions of a dog while playing with a human being.

De Mul describes how his own dog excitedly dared him to play by putting a rope toy in front of his feet. As soon as he tried to grab the toy, the dog wanted to snatch it away and if he would manage to grab the toy and throw it away, the dog retrieved it and the game would start again. In this activity, there seems to be an elementary understanding of what each of the participants want from each other in that specific moment. This conception is different from a psychological understanding of an intention or an understanding of the meaning of a signal or gesture, but it is rather an understanding in the immediate bodily interaction (De Mul 2013). Even though there is no ability to interact with the animal on a linguistic level, or to imagine what is going on in the animal’s mind, the signs, cues, and behaviour both before and during the interaction, make clear what the meaning and purpose of the dog’s behaviour are (De Mul 2013).

Peirce’s Indexical Semiotics

In the work of Donna Haraway it is emphasized how we can better understand other animals and the relationships we have with them by engaging with their material semiotics, even if they are not fully accessible (Haraway 2008). On this basis, Mancini et al. explored how the exchange of indexical semiotics allows humans and dogs to ‘coevolve’ and understand each other’s intentions (Mancini et al. 2012). In that paper, Mancini et al. describe how one of the three kinds of communication signs as identified in the theoretical work of Charles Sanders Peirce (who divided them into ‘symbols’, ‘icons’, and ‘indices’ depending on their semiotic functions) is specifically suitable for trans-species interaction. Where ‘symbols’ and ‘icons’ are merely abstract signs and require linguistic abilities in order to be decoded, ‘indices’ are directly and physically grounded in a bodily relationship with the world and other beings and thus neither preclude nor require shared mental or linguistic abilities (Peirce 1931-35; Mancini et al. 2012). In other words, if we are able to interpret an animal’s semiotic processes on the level of understanding their indexical signs, we can connect meaning to them in the context of human-animal interaction.

Digitally Complemented Zoomorphism

By observing our interactions with animals through the lens of the philosophical work of Helmuth Plessner (positionality theory) (Plessner 2006) and Jos De Mul (biohermeneutics and interspecies understanding through ‘going-along’) (De Mul 2013), we noticed that technical artefacts aimed at interspecies interaction often adopted design principles that were invariably focused on the human perception and rationalization of the interaction. Furthermore, even though these artefacts are deliberately created with the purpose of engaging animals and providing more enriching bodily and mental stimulations, their design decisions are often based on anthropomorphic interpretations of their preferences and behaviour. In other words, such products did not programmatically work towards the structuring of a design methodology that involved the animals’ perceptions and responses (Mancini 2011; Westerlaken & Gualeni 2013).

In 2013, we argued for a more informed and compromising form of anthropomorphism that relocates the focus from the human perspective to the animals'. From this framework, the following three guidelines emerged and form the basis of our further work:

1. It recommends the use of external stimuli in the form of technological artefacts: the natural curiosity of animals and their explorative behaviour can be used to stimulate their engagement with interactive technological artefacts in a research setting. This means that the animal is motivated by the artefact to engage in natural and voluntary 'play';
2. It analyses animal behaviour through 'going along' in a common praxis: the understanding of indexical semiotics and common traits in the way bodily signals are produced and interpreted allows specific species to understand others to a certain degree. This 'going along' could be achieved in a common and free praxis such as 'play'. This objective unfolds itself intuitively in the course of the interaction;
3. It advises to digitally track metric and/or biometric data concerning the animal experience: in order to complement the subjective human approach that results from the first two guidelines, metric and/or biometric research can offer additional insights in the experiences of the animals that are studied. This includes methods that can provide a quantifiable analysis of the interaction with the artefact (Westerlaken & Gualeni 2013).

In sum, the initial phases of our research were largely informed by philosophical notions and theories that helped us to reflect upon the differences between humans and animals and proposed new ways in which a mutual understanding can be facilitated in the activity of 'play'. Such differences could be surpassed in practices where it is possible to achieve a degree of participation and mutual understanding (or 'going-along', as De Mul puts it). Both De Mul and Mancini insist that the participation and the mutual understanding mentioned above largely emerge from our capability to produce and interpret bodily indexical signs. In our framework we propose to measure those bodily signs and relative changes in bodily dimensions such as changes in cortisol levels and/or quantitative behavioural analysis of the animal's interaction with the artefact. The derived data about biological and behavioural changes in the animal can be the foundation of an objective assessment of the internal states of our playmates. In this way, the shared practice is no longer solely interpreted and filtered through human subjectivity, but assessed ethnographically (through 'play') and with a higher degree of objectivity through data gathering.

Another important philosophically-entrenched aspect of how we tied in theoretical work and practical design is the decision to approach the iterative part of the design of digitally-mediated playful experiences with the additional tool of Grounded Theory (GT). GT was adopted with the objective to re-balance the design process of digital toys towards the inclusion of the animals that are supposed to be the final users (with or without the co-action of humans). In GT, rather than performing data analysis starting from hypotheses and preconceptions, the data itself guides the analysis and steers the research in directions that were not planned out from its onset (Furniss et al. 2011). We consider such an approach to be particularly desirable for the tentative steps that we are taking in an experimental field that still lacks a systematic organization of methodologies and foundations. The results of our user tests indicated design iterations that are described in

another paper of ours dedicated to this topic (Westerlaken & Gualeni 2014, forthcoming). As already mentioned, the practical employment of a GT approach in the design iterations for our game, together with the progress and development of specific design choices ran in order to meet our ‘zoomorphic’ objectives are the focus of the next section of this paper.

4. Philosophy and the specific design of *Felino*

The game that we designed to evaluate our theoretical work allows humans and cats to ‘play’ together (see Figure 4). Even though both the human and the cat have a fundamentally different perception of their environment, we wanted to create a playful artefact that facilitates mutual understanding and meaningful interaction between the human and the animal.

After we decided to develop a digital game for cats it was clear that tablet devices would offer us with the widest range of possibilities compared to fixed monitor systems (computers or consoles), or mobile devices with smaller screens (smartphones or portable game consoles). When looking at the few existing tablet games for cats, we notice that they are all built in a similar way: a moving object on the screen that (in some cases) reacts to the input when the cat taps the screen, either with visual or auditory feedback. After trying out some of these games with cats and looking at gameplay videos, we noticed that there was a clear interest from the cat in this type of interaction. However, the existing games have an overly human focus and are not aligned to the cat’s perceptions and understandings. For example, they often include scoring mechanics, game objectives that involve time pressure, and they sometimes lack visual or auditory feedback. Next to this, these games often offer no progression and their mechanics are highly repetitive.

As a finished product, *Felino* serves as a digital toy that has some crucial differences compared to existing digital artefacts that include playful interaction with animals. Not only does the game aim at the entertainment of domestic animals or at the enrichment of their living environment, but it serves as an artefact that plays a central role in mediating the interaction between the human and the cat by putting both the human and the animal in control of how ‘play’ unfolds. This allows the human to interact with the cat according to the theory of ‘going-along’ as we described in the previous chapter.

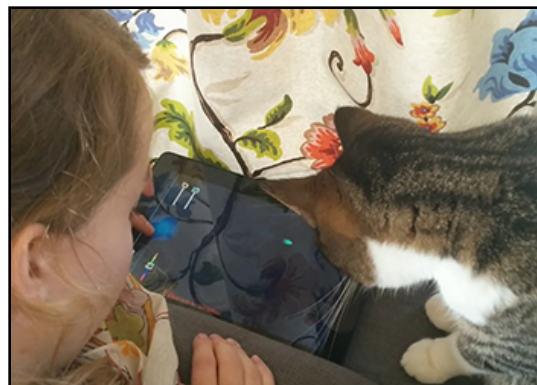


Figure 4: Human and cat playing *Felino*

The game metaphor represents a top-down aquarium in which fish and other colourful sea creatures swim and can be caught by the cat. Each fish has a specific look and behaviour that allows the cat to experience a degree of unpredictability and variation while playing. By using virtual controls placed at the bottom of the screen, the human player can alter game attributes, such as the size and speed of the fish, and regulate the movements of in-game objects in order to align the game to the specific preferences of the cat in real time, interpreted as the activity of ‘play’ develops. One specific virtual control that the human can use consists of a small joystick that regulates the movement of a crab that is always present in the aquarium. With this crab, the human player can collect spheres that are released whenever the cat catches a fish. By collecting these spheres, other small crabs are created behind the main one, generating a trail that the cat will be able to interact with (see Figure 5). In other words, the interactions of the cat with the game generate resources for the human to collect, which creates a gameplay loop in which both the cat and the human can simultaneously participate.

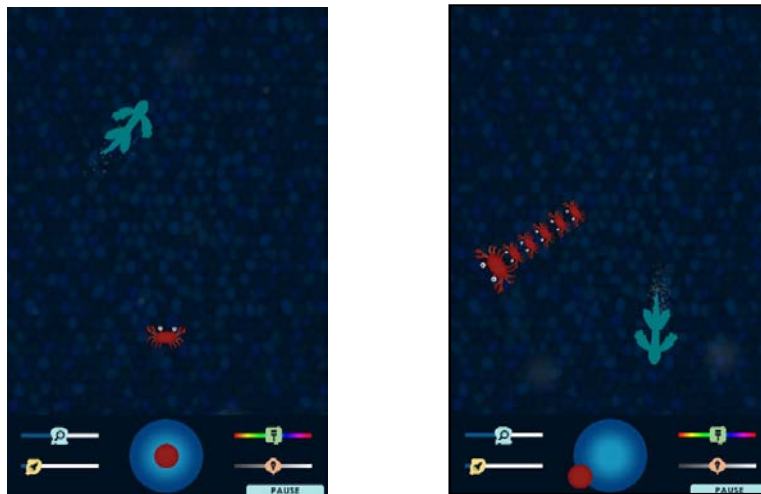


Figure 5: Screenshots of *Felino*

As human developers, we tried to design a game that adheres to the sensory perceptions and playful behaviour of the cat. This means that rather than including conventional mechanics such as time pressure, high scores, or game-over states, we based our design decisions on our interpretation of available animal research regarding for example the eyesight, colour perception, and playful behaviour, of cats. We also decided to avoid human interface elements that could interfere with the cat’s gameplay, such as introduction menus, textual explanations, or buttons that could unintentionally be operated by the cat.

Additionally, we performed a behavioural analysis of video observations that were recorded during user testing. As outlined in the previous section of this paper, a Grounded Theory (GT) approach seemed to us to be particularly desirable with the shifting of design control and research direction away from the human pole of the human-animal interaction towards more inclusion of the animal’s experience with the artefact. In total we recorded audio and video of the interactions of 19 cats (10 female, average 4,5 years old) with *Felino*. The length of each recording varied depending on the interest of the cat and existing ethical guidelines specifically developed for HCI studies with animals were taken into account (Vääätäjä & Pesonen 2013). On

average the individual interactions lasted 5 minutes and 51 seconds. The data was then analysed using the *Elan* software for video coding (see Figure 6) (Max Planck Institute for Psycholinguistics 2014). With a systematic analysis including 1666 video annotations we uncovered the interactions of both the cat and the human with the artefact as well as with each other (Westerlaken & Gualeni 2014, forthcoming). We coded the behaviour of the cat to analyse movement patterns and playful signals. Human behaviour was coded to analyse their interaction with both the cat and the game. Additionally, we coded game content to analyse what happens in the game at certain points of interest. This user testing phase contributed to design iterations that were not only based on the experience of the human, but also programmatically included the animal in the evaluation process (Westerlaken & Gualeni 2014, forthcoming).

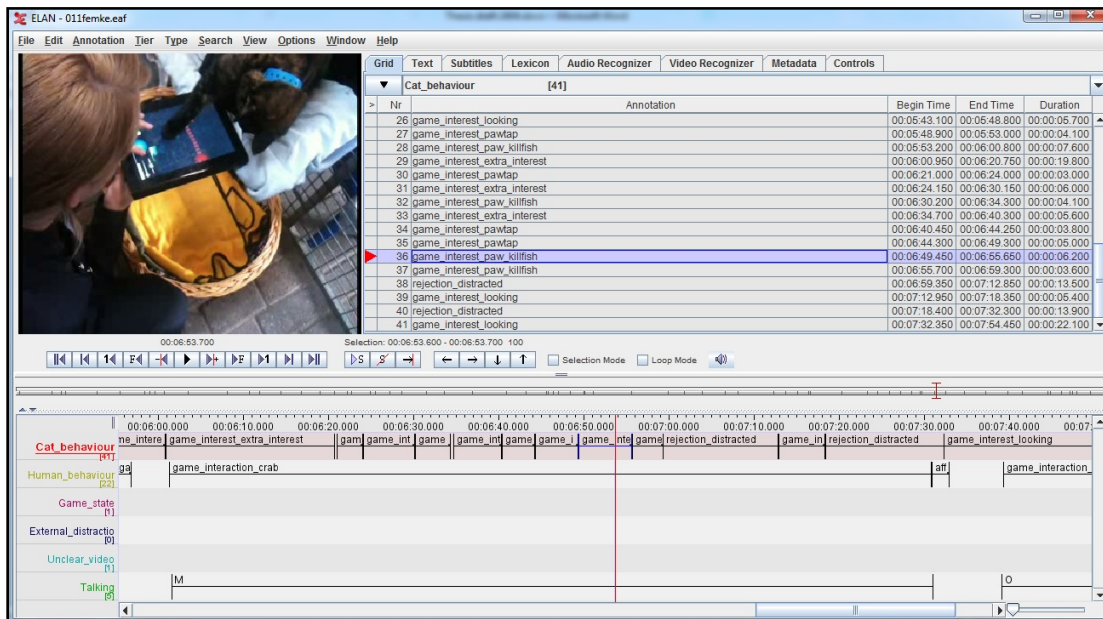


Figure 6: Example of video coding annotations in *Elan*. The recorded audio and video was analysed in different categories including human behaviour, cat behaviour, game state, and external distractions.

During the design process of *Felino* we aimed at continuously and critically reflecting upon our design perspectives and iteration processes in order to include the philosophical perspectives that we theoretically explored in our research phase and put them into practice. In this sense, materializing our biases and objectifying our theoretical framework, we embraced the development of *Felino* as an example of ‘critical making’.

6. Conclusion

In this paper, we first explained how the initial phases of our research were guided by philosophical theories that helped us to reflect upon the differences between humans and animals. These differences play a fundamental role in the design and evaluation of digitally mediated artefacts that have animals as users. Inspired by the work of Plessner and De Mul, we proposed a theoretical framework that outlines how a mutual understanding between humans and animals can be facilitated in the activity of digitally mediated interspecies ‘play’. This ‘going-

along' largely emerges from our capability to produce and interpret bodily indexical signs that are directly grounded in our interactions and do not require any shared mental or linguistic capabilities.

Additionally, we propose to measure those bodily signs and relative changes in bodily dimensions with metric and/or biometric analysis of the animal's interaction with the artefact. In that way, the shared practice is no longer solely interpreted and filtered through human subjectivity, but assessed ethnographically (through 'play') and with a larger degree of objectivity through data gathering.

With the employment of design guidelines inspired by philosophy that are meant to facilitate interspecies 'going-along', we developed the tablet game *Felino*. With this game, we aim to provide both the cat and human with a relevant role simultaneously during the interaction. The design of *Felino* is unique in the sense that rather than a game with structured rules and objectives, it allows both the human and the cat to experiment with the mechanics of the game and adapt the interaction to the on-going experience of the players. Furthermore, the game is designed according to our existing understanding of the sensory perceptions and playful behaviour of domestic cats.

The user testing of *Felino*, using a GT approach systematically uncovered the interaction of both the animal and human with the artefact as well as with each other. The design iterations that we could derive from this analysis were not only based on the subjective experience of the human, but also included the animal in the evaluation process.

We believe that our philosophical approach to the organization of a theoretical framework, to our design process, and to the evaluation of digitally mediated artefacts that encourage the emergence of 'play' between humans and animals was useful to guide our research and keep us aware of our own processes and biases. This was, we feel, especially true because we worked in a highly experimental and pioneering field, where the absence of established methodologies and the need to remain aware and in control of our research efforts constituted additional challenges.

References

- Burghardt, G. M. (2006). *The genesis of animal play. Testing the limits*. London: MIT Press.
- De Mul, J. (2010). *Cyberspace Odyssey: Towards a Virtual Ontology and Anthropology*. Cambridge: Cambridge Scholars Publishing.
- De Mul, J. (2013). 'Understanding nature. Dilthey, Plessner and biohermeneutics'. In: G.D. Anna, H. Johach, and E.S. Nelson (eds.), *Dilthey, Anthropologie, und Geschichte*. Würzburg: Königshausen & Neumann, 459-478.
- Furniss, D., Blandford, A., & Curzon, P. (2011). 'Confessions from a grounded theory PhD experiences and lessons learnt'. *Proceedings SIGCHI'11*, ACM Press, 113-122.

- Gualeni, S. (2014). 'Augmented Ontologies; or, How to Philosophize with a Digital Hammer'. Journal article on Springer's *Philosophy of Technology*. Ed. Luciano Floridi, Vol. 26, N. 2, 177-199.
- Haraway, D. (2008). *When Species Meet*. University of Minnesota Press.
- Lamers, M. H., & Van Eck, W. (2012). 'Why simulate? Hybrid biological-digital games'. *Applications of Evolutionary Computation Lecture Notes in Computer Science*, Springer, 7248, 214-223.
- Mancini, C. (2011). 'Animal-computer interaction: A manifesto'. *Interactions*, ACM Press, 18, 69-73.
- Mancini, C., Van Der Linden, J., Bryan, J., & Stuart, A. (2012). 'Exploring interspecies sensemaking: Dog tracking semiotics and multispecies ethnography'. *Proceedings Ubicomp '12*, ACM Press, 143-152.
- Max Planck Institute for Psycholinguistics, The Language Archive, Nijmegen, The Netherlands. (2014). Elan – Linguistic Annotator (v4.7.0) [Software]. Available from <https://tla.mpi.nl/tools/tla-tools/elan/>
- Peirce, C. S. (1931-35). *Collected Papers of Charles Sanders Peirce*. Cambridge, MA: Harvard University Press.
- Plessner, H. (2006). *I gradi dell'organico e l'uomo. Introduzione all'antropologia filosofica*. Torino. Italy: Bollati Boringhieri. (The original text was published in German in 1928)
- Vääätäjä, H. K., & Pesonen, E. K. (2013). Ethical issues and guidelines when conducting HCI studies with animals. *CHI'13 Extended Abstracts*, ACM Press, 2159- 2168.
- Westerlaken, M., & Gualeni, S. (2013). 'Digitally Complemented Zoomorphism: a Theoretical Foundation for Human-Animal Interaction Design'. *Proceedings DPPI'13*, ACM Press, 193-200.
- Westerlaken, M., & Gualeni, S. (2014). 'Grounded zoomorphism: An evaluation methodology for ACI design'. *Proceedings ACE'14 Workshop on Animal Human Computer Interaction*, ACM Press, forthcoming.
- Wirman, H. (2013). 'Orangutan play on and beyond a touchscreen'. *Proceedings of the 19th International Symposium of Electronic Art, ISEA2013, Sydney*.