Exploring Drones as Pets

Challenging the idea of what a pet can be

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MIX301 - Media Technology: Theory and Development

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Table of contents

1 Introduction

Technology is constantly changing, evolving and affecting us more and more. At the same time are robots and drones getting increasingly intelligent and advanced. Unmanned Aerial Vehicles, famously known as drones, can be defined as flying robots absent of a human pilot. As robots are advancing and becoming increasingly autonomous, drones are following in the same steps. Research on cybernetics and autonomy has never been more relevant, and research on drones has recently witnessed rapid growth. “Flying user interfaces” may soon be a common research agenda as drones become more and more popular entering our everyday environments. Drones have the potential of becoming ubiquitous and autonomous, to the degree where ensuring their usability through natural Human-Drone Interaction (HDI) becomes critical.

As society is now, one may say that drones are inherently provocative. The increased use of and attention to drones have led to a widespread debate about their application, especially regarding drones for surveillance and warfare (Choi-Fitzpatrick, 2014, p. 9). These governmental usages obscure the opportunity for civil society actors to make use of drones. I want to explore the idea of drones as pets for these actors, challenging the idea of what a drone can be while pushing the concept of what a pet is.

This essay explores autonomous drones as provocative design cases, focusing on autonomy, emotions and social interactions. I will provide some background information on provocative prototyping, cybernetic machines and human-drone interaction before focusing on the autonomy of social drones and the emotions of sociable robots. I will further discuss how the concept of pets can be challenged and how drones are perceived in society. This essay proposes that drones as pets may in the future be superior to the pets we know and love today.

2 Prototype and methods

The MIX301 course has focused on robots and drones as interaction design cases, to design “provocative prototypes” for the future. The comPANions were created as a group project throughout the semester, aiming to challenge the idea of what a pet can be.

The comPANions is a collective name for a trio of autonomous drones. Each drone serves one user that it will engage with, follow and protect. The drones interact with their user through bodily movements, by which they convey their emotional state. Each state is associated with different behaviours or actions the drone carries out. The comPANions can either be happy, sad or confused, based on how they track their user. The drones use object detection through colour to track their user wearing a particular colour. If the drone is unable to detect its user, it will search the room and look around to locate him or her. It is in its confused state. When the drone detects its user, it will either be happy or sad. When a comPANion is happy, it flies up and down and displays its excitement by doing occasional flips. If sad, the drone flies from side to side, tries to do a flip, but fails and falls to the ground. After a small break, it will take off again and start its tracking mission. I will come back to how the drones communicate their internal states in a later section.

In concept, a comPANion would protect its owner by physically putting itself in between you and what it deems dangerous. It watches over you and records potentially harmful events, monitoring both you and the surroundings. For now, as drones are not yet accepted as a commodity in our society, the drones’ presence would possibly be enough to scare anyone off.

The comPANions are inspired by and modelled as flying insects, namely a bee, a butterfly and a dragonfly, pushing the idea of drones and insects as actual pets. This essay further explores one of the drones, the bee called “Buzz”. The bee has the additional potential of being provocative, due to people's associations and fear of this flying insect. The word “drone” also has various meanings, including the original name for a male honeybee. In addition, as a verb, to buzz like a bee or to speak in a monotonous fashion reminiscent of a bee’s persistent hum (Zimmer, 2013).

2.1 Provocative prototyping

> *“Provocative design refers to design approaches that operate in a design space where asking questions is as important as solving a problem”* (Raptis et al., 2017, p. 29).

In Human-Computer Interaction (HCI), several new design approaches, that deviate from the traditional ones, have appeared in the last few years. A provocative design approach was introduced to challenge established perceptions and practices. This approach is often characterised as being speculative, reflective, value-sensitive, and most importantly critical. The critical design utilises provocation as it tries “to challenge the status quo”. The provocative and critical design shares this common goal. They aim to challenge existing norms and attitudes, provoke discussion, and constructively critique the design itself and the impact of the design (Raptis et al., 2017, p. 29).

By using provocation as a means to conduct research through design, The comPANions were brought to life as a way to explore the relationship humans can form with autonomous drones. "Research through design [implies that] the design itself is the means to explore and understand an area of interest" (Raptis et al., 2017, p. 29). The drone design is an interactive system that lets us explore the possibilities of human-drone interaction and provocation in the real world. How the provocation is experienced can be understood at three levels: aesthetic, functional and conceptual provocation.

Aesthetic provocation is related to the design's visual look, dealing with how far from the mainstream is a design’s visual look and the materials used for crafting it (Raptis et al., 2017, p. 32). Buzz is modelled after a bee, with sheer plastic wings and a yellow body with black stripes (see figure 1 and 2). The size of the drone is with no doubt larger than a bee, but for a drone to be, it is quite small.

Figure 1 and 2: To visualise the idea of Buzz as a real bee, the drone is painted yellow with black stripes. Wings, feelers, eyes and stinger are attached to make it look even more like a bee.

Functional provocation is related to the way the design works. It deals with how far from the norm is the way a design works or operates (Raptis et al., 2017, p. 32). The comPANions operate autonomously without human intervention, forcing users to accept their existence in their everyday lives. If the drone behaves differently then what the owner wants it to, provocation is easily triggered. This provocation could resemble a disobedient pet.

Lastly, conceptual provocation is about an idea, a belief or a concept that is challenged or critiqued through a design (Raptis et al., 2017, p. 31). In this use case, this is the most appropriate provocation level, as the idea of what a pet can be is what I aim to challenge. Concerning the conceptual provocation, I chose to focus on two issues, the global idea that pets are limited to domestic or tamed animals walking on four legs, and the misbelief in the possibility of humans to create emotional bonds with machines.

First of all, drones are neither living creatures nor walking on four legs. Even though the concept of pets have developed into a bigger space of living creatures, including some reptiles and insects, flying insects or drones are still not included in the concept. First of all, the drone’s robotic body is not as welcoming or friendly as fluffy animals, and flying insects are annoying, ‘wild’ creatures. Additionally, as many people have safety and security issues with drones, making a drone to keep you safe is a paradox people will struggle to accept.

The goal for the comPANions is to create emotional bonds with their users, serving as both a companion and a protector. Creating emotional bonds with pets versus machines is linked to the question of whether machines can be emotional. I will further elaborate on the emotional machines later in the essay.

There are no methods or guidelines on how to be provocative. With Buzz, the goal is to challenge the understanding of how relationships are formed, by provoking the existing practice of owning and interacting with a pet. Intending to understand the experience over the three levels mentioned, this contributes to understanding provocation under the frame of research through design (Raptis et al, 2017, p. 29).

3 Background

3.1 (Cybernetic) machines

> “A machine can be defined as a device or an artefact that receives an input, processes it and presents an output” (Brooks, 2002).

The first machines translated mechanical energy into more efficient mechanical energy. Since then, a typology of machines according to their autonomy has been made by Brooks (2002), consisting of five types of machines. From simple machines without any autonomy, like the wheelbarrow, to cybernetic (robotic) machines, which autonomously run themselves. Cybernetics as a scientific field studies control and communication in animals and machines, and aims to understand and define the functions and processes of cybernetic machines (Wiener, 1950). Cybernetic machines have the highest level of autonomy, in which they achieve their goals independently of humans. Humans need not engage in moment-to-moment control of their actions (Brooks, 2002, p. 10).

Cybernetic machines can further be divided into three types; mechanical robots, electronic robots and digital robots. Autonomous drones belong to the last type, as they are controlled by a computer brain with artificial intelligence, computer vision and other sensors (Brooks, 2002, p. 33-34).

Humans make machines to do energy-demanding things for us in the physical world (Brooks, 2002, p. 6). Today, machines are taking over roles and jobs previously occupied by humans or other living creatures. Robotic machines are, among other things, driving cars, expediting customers and assisting humans in everyday life. Machines also have the potential to replace animals as pets, which is the focus of this essay.

3.2 HCI → HRI → HDI

Human-computer interaction (HCI) is the study and development of interactive technology and has witnessed significant changes in brief history (Turner, 2017). Robots and drones have recently been added to the various types of interfaces listed by Sharp et al. (2019, p.247-248), along with more common interfaces like web and mobile.

Human-robot interaction (HRI) is the design of interactions between humans and robots, while human-drone interaction (HDI) is naturally the design of interactions between humans and drones. Drones, especially, remain a marginal design field but could be seen as a significant HCI paradigm in the future. Autonomous flying drones have the potential of becoming ubiquitous in the future (Baytas et al., 2019, p. 2) and might become a commodity present in our everyday lives. Exploration of human-drone interaction therefore requires small, human-friendly drones that can fly in confined spaces and in close proximity to people (Floreano and Wood, 2015, p. 460).

Essentially, a drone is a flying robot or a flying camera that can be remotely controlled or fly autonomously. Like other aircraft in flight, a drone is free to rotate in three dimensions and with 360 manoeuvrability a drone can have control over everything at the same time. A drone camera can pick up, record and/or transmit movements, distances, directions and colours, to mention some (Wikipedia, 2020).

Our prototype drone is the Tello Edu Drones developed by Ryze in partnership with technology from DJI. These drones are small quadcopters, controlled by four rotors, each consisting of a motor and a propellor. The four-rotor design allows for simplicity, reliability and manoeuvrability, which is essential for drones flying close to people, like Buzz. Quadcopters resemble helicopters, but instead of balancing themselves by the use of a tail rotor, they use the movement and angle of the four blades (Hoffman et al., 2007). The quadcopters are cheaper and more durable than the small helicopters because of their mechanical simplicity. Their relatively simple configuration makes programming for autonomous flight possible.

Reducing the size of the drone results in both pros and cons. Small drones have less endurance and shorter flight time. However, the drone's agility is higher and it is more manoeuvrable (Floreano and Wood, 2015, p. 461). Because of their short battery life and quick overheating, frequent breaks are required. Luckily, changing and charging batteries is an easy process. On the positive side, due to the size and low operating speed, the small drones are likely to cause proportionally less harm compared to other drones (Floreano and Wood, 2015, p. 465). With smaller blades, the quadcopters possess less kinetic energy, reducing their ability to cause harm. This is crucial for making close and safe interactions with humans. Additionally, with their small size and manoeuvrability, these drones can be flown safely indoors and outdoors.

3.3 Technological innovations

Choi-Fitzpatrick (2014) talks about three innovative shifts that have made up for peoples sceptical attitude towards drones. These shifts have made drones more promising, but at the same time, more threatening. The shift from analogue to digital devices makes up for the first one, which allows for more powerful and affordable devices. This shift allows for longer battery life and streaming of audio and video to digital devices. Combined with more stable drone designs, the drones have gone from the hobbyist market to the general public. Now everyone can own a drone.

The possibility of efficiently storing, sharing, copying and distributing images through digital image devices represent the second technological shift. Combined with online storing and sharing, images are now more accessible, but also more vulnerable to leaking to the public (Choi-Fitzpatrick, 2014, p. 20). As drone footage is a huge privacy concern, not knowing who has their hands on the footage recorded can be frightening.

The third shift is the break between the camera and the street level. Drones relocate the boundary between what is public and private since the line of sight is moved from the street to a bird view from the air. What once were private places may now be subject to surveillance. Technology has redrawn the lines between private and public spaces. One may suggest that the number and type of public locations should be increased or suggest that much of what happens in private spaces is not actually private (Choi-Fitzpatrick, 2014, p. 20-21). Because of this, people tend to get worried around drones and find an issue with drones' impact on privacy. Worries include the feeling of being watched or surveilled without consent.

4 Social drones and sociable robots

As previously mentioned is Buzz a small autonomous drone that operates in close proximity to people. Baytas et al. (2019) propose the term *social drones* for this type of drones since an autonomous embodied agent in an inhabited space can be described as social, similar to how some form of social interaction is unavoidable in an environment occupied by two or more living agents. In other words, the term social drones are used "to describe applications where an autonomous drone operates in an environment inhabited by human users or bystanders". The new term was required due to the shift from drones motivated by manoeuvrability with a remote human pilot inspecting an environment not easily accessible to humans, to fully autonomous drones that operate in spaces populated by human users or bystanders (see figure 3). So, for a drone to become social and open for interaction with humans, it must be small and human-friendly (Baytas et al., 2019, p. 2). Also, a certain level of autonomy is required.

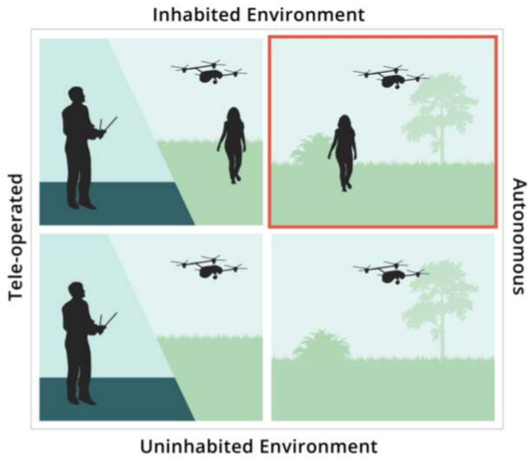

Figure 3: displaying the environment where social drones operate (Baytas et al., 2019, p. 2)

4.1 Autonomy

According to Baytas et al. (2019), drones can become social if they become sufficiently autonomous. Robot autonomy is defined as “the ability to perform intended tasks based on current state and sensing, without human intervention” (Floreano and Wood, 2015, p. 462). Social drones like Buzz require this autonomous ability. Based on what the drone sees and tracks, it must make its own decisions for further actions.

The definition encompasses a wide range of situations, which demand different levels of autonomy depending on the type of robot and the intended use (Floreano and Wood, 2015, p. 462). In the case of small drones, a three-level definition of autonomy is presented by Floreano and Wood (2015); sensory-motor autonomy, reactive autonomy, and cognitive autonomy. Below, I will describe the three levels and discuss how they relate to the prototype’s intended use.

Sensory-motor autonomy translates high-level human commands into combinations of platform-dependent control signals. Such commands can be to reach a given altitude or move to GPS coordinates, translated into signals such as pitch, roll and yaw angles or speed (Floreano and Wood, 2015, p. 462). With this level of autonomy, drones can follow pre-programmed trajectories using GPS waypoints. Because of this, the level is not sufficient enough for the intended use of Buzz. Obstacle-free trajectories must be identified with a precise map of the surroundings, limiting the space where the drone can fly safely. Making predefined routes for the drone to follow is not adequate or suitable for its use case, which depends on the drone autonomously following its user. Additionally, GPS information is not always reliable or even available in confined places. This level of autonomy is not complex enough for Buzz.

Reactive autonomy requires sensory-motor autonomy and with this level, drones can take off and land, avoid obstacles, coordinate with other drones and maintain a safe distance from the ground. Most efforts in small autonomous drones have focused on achieving this autonomy. To achieve this level, decades worth of research on vision-based insect flight has been translated into simple control algorithms and lightweight sensors (Floreano and Wood, 2015, p. 462). As the drone is modelled after a bee, this vision-based insect flight is a good match. The currently working prototype has this reactive autonomy but is dependent on the user wearing a bright coloured hat or some kind of accessory for him and her to get detected by the drone. Admittedly, this autonomy is not advanced enough to recognise faces. Human supervision is also necessary to avoid crashes. When the code is running, the drone takes off and starts its mission of detecting and following its user. Reactive autonomy is complex enough for a lot of the tasks the drone is intended to do, especially for take-off and landing, avoiding obstacles and maintaining a safe distance from the ground. To make Buzz fully autonomous in the future this is not enough - the next level is necessary. First then, conceptual provocation can be aimed for.

Cognitive autonomy requires reactive autonomy, and therefore also sensory-motor autonomy. With this autonomy, drones can perform simultaneous localisation and mapping, resolve conflicting information, recognise objects or persons, and plan future actions. All possible in both indoor and outdoor environments. In principle, a drone with this level of autonomy can recognise objects or persons and learns from its experiences (Floreano and Wood, 2015, p. 462). All made possible with artificial intelligence. This level of autonomy is reached through researching statistical methods for vision-based navigation of terrestrial vehicles and simultaneous localisation and mapping. Monocular vision has been used, but without completely successful outcomes, while stereo vision has provided better results when trying to avoid obstacles (Floreano and Wood, 2015, p. 464).

Cognitive autonomy is not explored enough yet for small autonomous drones like Buzz to achieve. None of today's commercial drones has sufficient control autonomy to complete missions without skilled human supervision. This is a real problem. Human supervision makes operation slow, dangerous and not scalable (Floreano and Wood, 2015, p. 460). Cognitive autonomy requires heavier sensory payloads and more powerful computational units. This may explain why progress has been slower for small drones (Floreano and Wood, 2015, p. 464).

As Buzz is to become completely autonomous in the future, cognitive autonomy is required. With this complex level of autonomy, the drone would be able to recognise its user and remember his or her face. Obstacle avoidance would be more accurate and secure, and supervision wouldn't be necessary, making operations faster and safer. Additionally, the drone will be able to make decisions on its own, and as a cybernetic machine, it will achieve its goals independently of humans. Cognitive autonomy will continue to be driven by the development of artificial intelligence for smartphones capable of identifying human users, learning their behaviours and creating representations of their environment (Floreano and Wood, 2015, p. 465).

4.2 Communication

Communication, as well as control and comfort, are among crucial drone issues and deals with interaction and user experience on a generic level. The focus is on intuitive input on output, issuing commands to control drone behaviour and drones communicating their intentions and internal state to humans (Baytas et al., 2019, p. 5). The autonomous drone receives input from its built-in camera and behaves accordingly. How the drone behaves based on this input is the intuitive output I will explore further.

In what way the drone can communicate its intentions or internal state to humans are of great interest as Buzz is aiming for cognitive autonomy in the future. Internal states, or the ‘moods’ of the drone, in this case, is showcased through different flight patterns. Mood states or future actions may be communicated intuitively through design features and behaviours. As a way of communication, ‘emotional states’ can be encoded in flight characteristics, such as height, speed, and special movements. Such characteristics correlate strongly with human comfort, meaning that abrupt motions correlate with discomfort (Baytas et al., 2019, p. 9)

Humans, as well as humanoid robots, can express their moods and emotions through facial expressions and body language. Flight characteristics can be thought of as the drones body language, and without the possibility of facial expressions, the characteristics need to be clear and easily understandable by humans. Robots equipped with human features, such as a face and a body can adapt human characteristics and emotions, while drones modelled after flying insects, need to adopt flight characteristics and movements from these insects. Therefore Buzz needs to move like the insect it is modelled after, the bee.

Drones are free to rotate in the same three dimensions as bees and other aircrafts in flight, which is a good base. Both drones and bees can adjust their movements by moving their nose left or right about an axis running up and down (yaw), nose up or down about an axis running from wing to wing (pitch), and rotate about an axis running from nose to tail (roll) (Wikipedia, 2020). With small movements about these axes, the drone can imitate or mimic the bee's wiggling flying pattern. Utilising the potential of adjusting the propellor speed can increase the effect of the mood conveyed even more. A high speed increases the noise from the propellers, which can convey intensity and anger, and result in the user feeling more stressed out. Slow speeds, on the other hand, can convey sadness, resulting in compassion from the user.

An analysis of studies done by Baytas et al (2019) on autonomous flyers in inhabited environments identified twelve design concerns about how drone aesthetics and behaviours relate to pertinent human responses. One of these concerns is sound, which can be associated with noise originating from the drone. However, the noise from the drones propellers and flight motions can be seen as a way of designing sound (Baytas et al., 2019, p. 7). Utilising contrasts through speed as mentioned in the previous section can help minimise the negative effects of propeller noise. Although research agrees that propeller noise very easily can become bothersome when it comes to drones meant for close encounters with humans (Baytas, 2019, p.

8), I suggest it could rather be seen as a way of communication. By taking advantage of one of the concerns regarding drone design, challenges are turned into opportunities. This is especially relevant as the propeller noise sounds like a buzzing bee.

As well as noise, the propellers also produce airflow. This is another factor famously known as bothersome. Looking into ways of turning it into a positive feature could result in new opportunities. One way is to think about a hot summer day when the airflow could be a way to cool the user down.

4.3 Emotions

Sociable robots, as the forerunner to social drones, must be believed as an illusion of life (Breazeal, 2002). Buzz can to a certain extent be believed as an illusion of life, both by how it looks and how it behaves. The drone has sheer wings and is painted in similar colours as bees. Buzz flies like real insects and does even sound like a buzzing bee. Breazeal (2002) goes further and says that sociable robots must convey personality to the human interacting with them. In addition, they must give attention, express emotions and engage in playful activities. This is at the core of the whole idea of the pet drone. The drone tracks its user, looks out for potential dangers, while at the same time expressing emotions through movements and behaviour. Buzz is both playful and protective, serious but at the same time not. A somewhat controversial idea is that sociable robots should be able to socialise with humans and collaborate with them as if they were our peers (Breazeal, 2002).

Norman (2004) argues that with time, robots will gain full-fledged emotions, like fear and anxiety when in dangerous situations, pride and pleasure when accomplishing desired goals, and subservience and obedience to their owners. Emotions need to be displayed when interacting with humans, and also with other robots (Norman, 2004, p. 163). Future machines will need emotions for the same reason people do: the human emotional system plays an essential role in social interaction, learning, cooperation and even survival. When machines face the same conditions, they will need a form of emotion, machine emotion. Machine emotions are not like human emotions, but rather emotions that fit the needs of the machines themselves

(Norman, 2004, p.162). The emotional system of Buzz will for example need to play a role in survival or at least in the goal to survive; to know why and when to avoid fatal crashes. Additionally, it needs to play a role in cooperation; when working together with bystanders or other drones, and lastly, when learning from experiences; to bond with its user and to develop both technically and emotionally.

These machine emotions are an example of how the conceptual level of provocation is challenging the idea of drones as actual pets. Norman (2004) argues that machine emotions are essential when machines must operate continuously without any assistance from people. Especially when new situations continually arise in the complex, ever-changing world we co-live in (Norman, 2004, p. 162).

To argue that Buzz is an emotional machine and should experience feelings in the same ways humans do is another controversial idea. Especially since the drone is a machine and modelled after a flying insect, one may argue that it should be reasoned with the fact that machines and insects do have emotions. Research done on insects can’t agree if they have emotions or not, but most of them claim they don’t. Still, Darwin once wrote in his book *The Expression of Emotions in Man and Animals* from 1872 that insects “express anger, terror, jealousy and love.” Today, some argue that he might have been on to something. Bees appear to have emotions, but it’s an open question of whether they subjectively experience feelings. Furthermore, bees may experience something akin to happiness, but this idea is still controversial (Goldman, 2016).

5 Pets challenging the norm

There are several reasons why the idea of what a pet can be should be challenged. There are lots of people who, for several reasons, can't own a dog or a cat. Either due to allergies in the family or because of the amount of care, attention and time they need. Regardless of the reason, an option for those who can’t own a “standard” pet themselves is called for. Below, I will suggest and discuss some examples of ‘pets’ currently challenging the norm or who has the potential to challenge the pet norm in the future, respectively robots, insects and drones.

5.1 Robots as pets

Pet robots, in the guise of human companions, are being commercialised. When designing robots, several research teams have taken the ‘cute and cuddly’ approach. For humans, this signals that robots are more pet-like than human-like. Sensors are often embedded in these pet robots, enabling them to detect certain human behaviours and respond or act accordingly (Sharp et al, 2019, p. 215). Typical responses given by pet robots are movements of eyes and ears. These responses are difficult to replicate on small drones, and also not necessary if modelled after small flying insects who lack facial expressions.

Real pets can detect our moods through emotional patterns in our voices and body language, and also evoke strong emotions among us (Norman, 2004, p. 191). In the future, robot pets may take on all these attributes of real pets. Many people will also argue that they would be superior to real pets (Norman, 2004, p. 210). A robot that has had great success is Aibo. Aibo is a series of robotic pet dogs first introduced in 1999. The name means ‘companion’ or ‘friend’ in Japanese, and Aibo develops from puppy to an adult dog with a personality shaped by interactions with its owners and its surroundings. Made for entertainment, Aibo gains an understanding of the people it interacts with and takes part in a two-way communication of feelings with them (Sony Aibo, 2020).

5.2 Insects as pets

Many people have found, and are still finding, that insects make wonderful pets. Not only are they small, but generally they are cheaper to feed, quieter, and safer for young children than the average cuddly mammal (Ramel, 2020). Although non-flying insects, like tarantulas and stick insects, are easier to control and more popular than flying insects, the latter are also kept as pets.

The idea of keeping bees as pets are interesting. They like the humans who take good care of them. They can detect faces, which means they can recognise humans, and build trust with their caretakers. If it is true that bees do have feelings, implications for the way we think of them, including how we attempt to control them as pets would be tremendous (Goldman, 2016). Bees aren’t the usual favourite insect among humans. People tend to be afraid of the possibility of being stung and will do much to get rid of them. Much of this fear is irrational but for allergic people, a sting can have fatal consequences. Bees sting to defend their nest if they are provoked or feel threatened. They don't sting without a reason, though it’s not always easy to know what the reason is (Goldman, 2016). Even if they don’t sting, the buzzing sound and their close encounters can still be annoying.

5.3 Drones as pets

Robot pets have been a popular research field for a long time, while research on drone pets has been given little attention. One reason is that drones are a newer and less explored technology, and the typical pet-like actions and responses possible with robots are harder to achieve with drones. Other reasons include the associations people have with pets. The concept of pets is often limited to four-legged fluffy animals like dogs and cats, which can’t be replicated with drones.

So, why would anyone want a drone as a pet? Drones, in contrast to real pets, are low maintenance. The owner is in control of how much attention and care is given, and once the drone is bought there are no more high costs. The ‘food’ or ‘livelihood’ is charged batteries and replacements for broken parts are usually cheap. Autonomous drones will as well give the feeling of owning a real pet, as they can fly around independently. Additionally, in contrast to non-flying robots, drones can inspect and explore a much bigger space. They can fly high or low, and their small size lets them access remote spaces out of reach for other robots.

An example of a drone with pet-like attributes is “Fotokite”, introduced in 2014 as a ‘friendly’ aircraft on a leash. The idea was a simple quadcopter to take aerial photos without making people feel uneasy. The startup behind the design called it a pet drone as it was tethered to a leash. Besides the leash, the drone did not have other attributes or similarities to a pet. Because of the leash, the drone could be classified as a kite and therefore skirt laws governing the use of drones, the company claimed. Positioning the drone as a flying pet that could be taken for a walk on a leash, with a physical connection to the operator would possibly also make people less suspicious and concerned regarding privacy and safety (Griffiths, 2014).

6 Conclusion

As drones have the potential of becoming ubiquitous and fully autonomous in the future, new application areas for drones need to be explored. Designing and developing drones as pets can change the way people perceive and experience drones in their future everyday environments. Especially regarding privacy and safety. This requires that drones continue to get increasingly intelligent and autonomous, to the point where cognitive autonomy is reached, and at the same time assuring laws are followed and up to date. Further research on usability through natural Human-drone interaction is another factor of crucial importance.

In the future, Buzz can be thought of as a combination of a bee and Aibo, only in drone form. As a cybernetic machine with cognitive autonomy, Buzz can fly autonomously and make its own decisions, and simultaneously develop as it learns from past experiences. As a companion, Buzz can follow and look after its user. If threatened or provoked, it can fly by and bump into people to warn that stinging is imminent. If needed, Buzz will “sting” anyone who does not behave accordingly.

Through exploring and challenging the idea of what a drone can be, and at the same time pushing the idea of what pets, currently limited to cuddly animals, are, I hope my research can contribute to further research on drones as pets for the future.

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