UNIVERZA NA PRIMORSKEM
FAKULTETA ZA MATEMATIKO, NARAVOSLOVJE IN
INFORMACIJSKE TEHNOLOGIJE

ZAKLJUČNA NALOGA
(FINAL PROJECT PAPER)

SAMOMORI ŽIVALI SKOZI OČI LJUDI
(ANIMAL SUICIDE THROUGH HUMAN EYES)

KATJA LETONJA

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Samomori živali skozi oči ljudi

(Animal suicide through human eyes)

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Ključne besede:
Altruistični samomor, egoistični samomor, antropomorfizem, patologija, samo-poškodovalno vedenje

Izvleček:
Glavni namen te diplomske naloge je raziskovanje fenomena samomora pri živalih. Uporabljen je kritični pristop skozi aplikacijo teorije atribucije in antropomorfizma suicidalnih primerov v obstoječi znanstveni literaturi, in med prispevki o samomoru v modernih popularnih medijih. Ker je antropomorfizacija najvišja pri živalih vizualno podobnih ljudem in pri hišnih ljubljenčkih, je pri teh živalih posebna pozornost namenjena pregledovanju dokazov o njihovem samomoru, kot tudi o vplivu kognicije, emocij in socialne inteligence, ki so predlagani kot vzročni faktorji.
Živalski samomor je predstavljen v svoji altruistični ter egoistični obliki. Namen altruistične perspektive je razširitev splošnega razumevanja samomora, z opisovanjem različnih oblik altruističnega vedenja, ki lahko služi kot primer samožrtvovanja med živalmi. Za namen raziskovanja egoističnega samomora in človeškega vpliva nanj, je tema preučena posebej v divjih, ujetih in domačih živalih.
Ugotovitve ne morejo izključiti možnosti, da samomor ne obstaja pri živalih, katerih življenja niso povžena človeškemu vplivu (čeprav je egoistični samomor zelo redek pojav). Podobno, za živali, katerih življenja narekuje človek (domače živali in živali v ujetništvu), ni mogoče trditi, da storijo egoistični samomor. Vendar pa lahko zaključimo da pomemben vpliv človeka na življenja živali obstaja, in hkrati visoko korelira z egoističnimi suicidalnimi nagnjenji pri živalih.

Key words documentation

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Abstract:
The main intention of this thesis was to explore the phenomenon of suicide among non-human animals. The topic was critically approached through the application of the theories of attribution and anthropomorphism of suicidal cases in the existing scientific literature, as well as the suicide reports in the modern popular media. Since anthropomorphisation is the highest in animals visually similar to us and in pets, special care was given when reviewing the evidence for suicide in those animals in particular, as well as on the influence of their cognition, emotions and social intelligence that are proposed as the causal factors.
Animal suicide was considered in its altruistic as well as egoistic form. The purpose of the altruistic perspective was to widen the general understanding of suicide by describing the different forms of altruistic behaviour that can serve as examples of self-sacrifice across the animal kingdom. For the purpose of exploring egoistic suicide and the human influence on it, the topic was considered separately in wild, captive and domesticated animals.
The findings cannot exclude that suicide does not exist among animals whose lives have not been altered by humans (although egoistic suicide is extremely rare). Similarly, for animals whose lives have been dictated by humans (both captive and domesticated), it cannot be stated that they do commit egoistic suicide. However, it is concluded that a significant human influence on the lives of animals in general exists, that highly correlates with an egoistic suicide intention in animals.

CONTENTS

1 INTRODUCTION

What's the cause of human suicide is the most difficult philosophical question that cannot be provided with an answer that would entirely explain its origin or function. The topic of suicide in non-human species, like animals is a poorly researched one, because of the obvious reasons of not being able to communicate with animals in such a way as to research and conclude that they can truly be suicidal. To address the question whether humans really are the only being able of committing suicide, the topic will be approached through systematic investigation of evidence in order to provide a satisfactory answer.

Durkheim (1951) distinguished four types of suicide, depending on the relation of a person towards the living community. The four types are: egoistic, altruistic, anomic and fatalistic. For the study of suicide in animals, only the egoistic and altruistic seem to be important, but let us look closer at all four types.

Egoistic suicide in humans is a result of poor social integration. It may occur when a person does not have a sense of belonging, is not sufficiently bound to any social group, or has been detached from other members of the community. Such individuation can lead to apathy, melancholy, meaninglessness and/or depression.

Altruistic suicide, on the other hand, is a phenomenon which occurs in groups that are very social. In such groups, the individual can be overwhelmed by the group's goals and beliefs. The needs of the group become more important than the needs of an individual person. In this case a suicide doesn't seem to make sense, unless it is for the benefit of the altruistic society, which rarely happens among humans. Examples of this kind of suicide are Japanese military aviators, the kamikaze pilots, who committed suicide attacks mostly during World War II.

The other two types of suicide, anomic and fatalistic, are hardly observed among animals. The anomic one reflects the individual's moral confusion and lack of social norms, whereas the fatalistic one happens in an environment that's too controlled, for example: while being imprisoned.

Following Durkheim's (1951) typology, altruistic and egoistic suicide in animals should be considered separately because of the different function they serve. Altruistic suicide is an evolutionary adaptation with the purpose of helping others at one's own expense. The first research question related to this type of animal suicide is: In what forms does altruistic suicide exist among non-human animal species?

The first goal of this thesis is to widen the general understanding of suicide by describing different forms of altruistic self-sacrifice in animals and to explain those with the use of deCatanzaro's (1986) evolutionary model of self-preservation and self-sacrifice, which predicts that an individual's survival instinct is weighted against a summation of its future likelihood of reproduction, and the individual's impact on its relative's reproduction, while considering their genetic relatedness. The model was previously applied to humans, but not yet to animals.

The remaining part of the thesis deals with egoistic suicide in animals.

Most people see suicide as an egoistic act, which is performed by humans who are not satisfied with their life and wish to end it. This is why the phenomenon of suicide in animals seems to be a paradox at first display. Humans are convinced that the ability to end one's life can only be attributed to humans themselves, because animals have an instinct for survival and a universal need for self-preservation, which can be out-rationalized only in organisms capable of emotions, self-reflection, high intelligence and intention: thus animals with highly developed cognitive skills, such as great apes, dolphins and dogs. We propose that social intelligence be added to this list as well. When discussing these traits in animals, it is important to consider the influence of human subjectivity in the observations of animal behaviour because of our tendency to attribute human traits to animal, which may lead to false conclusions. Therefore, it is important to apply the theories of attribution and anthropomorphism while reviewing the data on emotions and cognitive abilities of animals. It is furthermore imperative to keep the human subjectivity in mind when reviewing any reports of egoistic suicide in other animals.

In animals egoistic suicide is a biologically and behaviourally complex phenomenon to discuss. For the purpose of answering our second research question, concerning the human influence on animals who have committed suicide, the topic will be addressed separately in wild animals, captive animals and domesticated animals. Collected data will guide the debate on the two compatible questions: Does animal suicide happen among animals whose lives have not been altered by humans, and do animal whose lives have been altered by humans commit suicide? We hope to show, that animals in the wild are not exposed to such artificial environmental situation, which could diminish their basic instinct of survival. The same cannot be said for captive and domesticated animals, with which we hope to conclude that their altered habitat and social environment is the main reason for the existence of egoistic suicide.

Furthermore, we wish to consider general reports of suicide in wild animals to conclude with finding objective explanations to disprove the categorisation as suicide. By considering the human factor in the suicidal range of behaviours of captive animals and pets (self-mutilation,

inactivity, depression), we hope to show that such behaviours do not come naturally to animals and that it is merely the consequence of human doing.

Research questions:

(1) In what forms does altruistic suicide exist among non-human animals?
(2) Does animal suicide happen among animals whose lives have not been altered by humans?
(3) Do animals whose lives have been altered by humans commit suicide?

2 ALTRUISTIC SUICIDE

When we hear the word “suicide”, we usually imagine a person, who is likely depressed, has given up on life and wishes to end it. We see such an act as a burden for grieving about relatives and friends (Marušič and Roškar, 2003). Apart from being a selfish act, suicide can also be considered honourable, particularly in the western cultures (like the previously mentioned kamikaze pilots). Such cultural tolerance has likely been fortified by the established historical function of suicide in the military, where ‘‘seppuku’’ was considered a justified response to inevitable defeat in battle. Traditionally, seppuku involved the self-inflicted slashing open of Samurai’s stomach with a sword, with the purpose of releasing the warrior’s spirit upon the enemy. Today seppuku isn’t practiced anymore, however honour suicides occur and are referred to as ‘‘hara-kiri’’. To the Japanese, this kind of suicide embodies the best qualities of courage, honour, and discipline and is an established facet, though limited, of their culture (Seward, 2012).

Another type of suicide occurring in human Asian societies that is still present and has a long history is called ‘‘shinju’’. It is a suicide committed by a group of persons which are bound by love, typically lovers, but as well as parents and children, and even whole families (Seward, 2012). It is similar to the Indian ‘‘sati’’, where the wife, after the death of her husband, lets herself be burned during the funeral of his remains, to show her loyalty (Hawley, 1994). Although the old tradition has been abandoned, occasional instances of sati are still reported by major newspapers (e.g.,‘‘India wife dies on husband's pyre’’, 2006).

The purpose of these old traditions listed above, that require self-sacrifice, are not necessarily for anyone’s benefit, but mostly only to defend and express one’s honour. However, suicide can serve a greater purpose. In line with this, Joiner (2010) has suggested that sometimes the death of an animal is worth more than its life. This can be noticed from typical writings of the last transcribed reasoning of suicidal individuals who wrote: “The world will be better off without me,” or “I am only a burden to my family”. Among elderly such writings are partly explained by Marušič and Roškar (2003) in being so called balanced suicides, or “rationally motivated” suicides. As opposed to wishing to punish themselves or others, on the other hand several suicides can be explained as a consequence of wanting to avoid severe suffering and illness. Authors add that the act is justified with the belief that by doing so, they will protect their relatives from distress and the financial burden of caring for them.

A third view on suicide explains it as an evolutionary mechanism (Mascaro, Korb and Nicholson, 2001), which causes animals to end their own lives under certain circumstances, mainly in order to benefit other members of their species. The circumstances, under which

these altruistic suicides occur, were previously studied by deCatanzaro (1981; 1986; 1991) whose theory will be discussed later on. This idea, that suicide is an evolutionary adaptation, is easier to comprehend if the phenomenon is addressed in non-human animals, which will be done in the next sections. We will explain that such behaviour in animals is usually referred to as self-sacrifice, and we will see that it can be considered as an altruistic suicide as well.

2.1 Autothysis

The most common form of self-sacrifice in insects is the explosion of internal organs, called autothysis (literally meaning self-sacrifice). The phenomenon was first described by Maschwitz and Maschwitz (1974), who have studied this behaviour in the ant species *Camponotus saundersi*. The rupturing is caused by a contraction of the muscles around a large gland, leading to the breaking of the gland wall. If, for example, a bear is trying to attack the ant hill, ants will rush out and collectively spray the bear with acid from their abdomen. If they are successful, the acid will irritate the intruder's eyes and mouth to the point of giving up and backing away.

A similar behaviour was observed in termites, who by rupturing of a gland in their necks release a sticky substance that can be used for immobilizing attacking ants, or even strategically sealing off tunnels that lead to the colony (Bordereau, Robert, Van Tuyen, and Peppuy, 1997). This process isn't necessarily fatal in ants and termites, but in principle it can be considered as self-sacrifice.

Pea aphids use a similar mechanism in their defence against ladybugs. By their ability to transform food into mustard oil, which subsequently can be used as a chemical bomb, aphids become nature's very own suicide bombers when a ladybug is approaching them. By exploding, they kill, injure or at least scare away the ladybug and at the same time cause other aphids to scatter, making them harder to prey upon (Joiner, 2010). If they are mature enough to have developed wings, they can fly away, thus ensuring their own survival (for the moment), but before reaching maturity, this procedure of sacrificing themselves protects other aphids, and contributes to their survival as well.

2.2 Other heroes

Autothysis is only one of many evolutionary adaptations, resulting in self-sacrifice. If we continue the case of pea aphids, another mechanism of defence can be mentioned. The wasp uses pea aphids as a kind of incubator for their own eggs. The hatched young wasps eat its

host's insides and eventually chews its way out, leaving the aphid dead. If aphids didn't develop a breaking mechanism, this cycle could continue to destroy the rest of the population until all aphids are wiped out. Instead, when an aphid is injected with a wasp egg, it drops off the leaves and onto the ground, where it is soon preyed upon by other natural predators. By doing so, pea aphids kill the predator growing inside of them and remove the danger from their colony (Joiner, 2010).

The evolutionary drive in all of us is to pass our genes on (Grafen, 1984). We do that by ensuring that our children have a long and prosperous life and consequently many children of their own. In addition, we also help each other in doing so; especially someone we are related to, because those genes are related. This calculation is considered to be the basis for altruism among kin. Wilson (2015) has reviewed altruistic behaviour in humans and animals and has suggested that humans consider altruism separately, as a way of acting as opposed to a way of feeling or thinking. He has concluded that we (and most likely other altruistic species), base our/their preference for altruistic thoughts and feelings primarily on the actions they produce, which leaves no doubt, that altruistic acts are persistent across and within species, and do not need a rational decision making process.

Altruism is favourable in humans because, like many others, we are a social species, where mutual aid is required to accomplish greater tasks. Throughout our history, mutual help was needed for childcare, hunting, gathering, and defence. Ever since the ascension of agriculture and production of resources, a strong division of labour has led to modern megasocieties in which humans are very much dependent upon each other. They could no more survive on their own, than an ant separated from its colony (Wilson, 2015). The division of labour enables other animals to form strong colonies in which (often sterile) workers always act altruistically. The ultimate goal is to ensure the survival of their related genes (i.e. the whole colony), which is achieved though helping other members of the group.

This reasoning is true in all social animals and it seems to be the cause of all animal cases of self-sacrifice. Saving your family by removing yourself from it, is a simple calculation that comes naturally to some animals. Aforementioned pea aphids of course aren't the only ones removing themselves from the colony for the greater good. The same behaviour can be found in wasps (Hughes et al., 2004), honeybees (Wilson, 2015), ants (Heinze and Walter, 2010) and other insects with similar social structures. Not only is it observed in insects, but also in bacteria like Escherichia coli, which explode when exposed to a virus, in order to prevent the virus from spreading (Nedelcu, Driscoll, Durand, Herron and Rashidi, 2011).

One could even argue that in the case of mammals, the animal guarding the nest or pack is making a sacrifice by acting altruistically. Dealing with the case of rhesus monkeys (Caro, 2005), it has been noticed that while under attack, one animal will alert the others with alarm

calls. By doing so, it lets everyone know an intruder is near, but at the same time it attracts attention to itself. The alarming monkey will most likely be the first victim, which gives others more time to escape. A similar situation happens with the very social meerkats (Kalat, 2015), which intentionally place a guard outside of the nest. The meerkat standing outside of the nest is going to be the bait if an intruder comes, but not before it alerts everyone else and gives them a chance to hide. In this case, the self-sacrifice is 'passive' but just as valid. One individual willingly surrenders itself to give others a greater chance of survival. It must be instinct, but in a way, in our humane perception, it is a courageous and admirable act. These animal sacrificial acts may be considered as altruistic suicide, and are seen in many different forms, like the autothysis mentioned previously, but also in another: terminal mating.

2.3 Terminal mating

Terminal mating or sexual cannibalism (Polis and Farley, 1979) is the practice where the female eats the male after copulation. Even though males are usually a lot smaller than females, their body still holds some nutritional value. The female consumes the male to give herself a calorie boost. Because of the small spider's courageous sacrifice, her (and his) offspring have a greater chance of survival. The same can be said for praying mantises (Preti, 2005) and scorpions (Polis, Farley, 1979). We can even make the argument that the male spider knows he is going to get eaten, because some males put in an effort to prevent the cannibalistic ending: they try to inseminate the female as quickly as possible and then flee; they assume the safest copulating position in which the female head cannot reach them; they might distract her with bringing food to her immediately before the copulation, or ever chose the female that is well fed and less cannibalistic (Maxwell, 1998).

Death after copulation is a destiny set for male fire ants and honey bees as well (Joiner, 2010). Fire ants mate in the air, where the male inserts his reproductive organs into the female, after which his organs literally explode inside of her, releasing a dose of sperm that will be sufficient for the rest of her life. Similarly, honey bees also mate while in the air, when the queen leaves the hive to find mating partners. During their sexual contact, the male inserts his reproductive organ into the female and ejaculates with such a force, that his penis explodes and stays inside of her. The male honey bee then falls to the ground and dies soon after, and the queen continues the process with about a dozen males, to collect enough sperm for her entire lifetime.

In insects, altruistic suicide is a clear and understandable evolutionary adaptation. However, the only example of truly altruistic suicide is when a member of the colony presents a direct danger to others, for example when it is carrying a parasite or an infectious disease. Autothysis, nest guarding and terminal mating cannot be considered as suicide in our common

understanding of the word, because in these cases, the instinct of self-preservation never ceases. This theory is supported by the model of self-preservation and self-sacrifice.

2.4 Altruistic suicide explained by a mathematical equation

From an evolutionary perspective, reproduction seems to be the main goal. Natural selection leads us to expect animals to behave in ways that increase their own chances of survival and reproduction, not those of others (Grafen, 1984). But as explained above, altruism becomes favourable in species with complex social structures. In social insect colonies (ants, wasps, bees and termites), where sterile workers devote their whole lives to caring for the queen, constructing and protecting the nest, foraging for food, and tending the larvae. Those workers will not reproduce, but by cooperating with others, they greatly contribute to the colony. In some cases, they can contribute the most by sacrificing themselves. Similar reasoning was used by deCatanzaro (1986), who developed a simple mathematical equation, basically describing under which circumstances self-sacrifice of the animal is favourable, which he named the evolutionary model of self-preservation and self-sacrifice and it is summarized in the following equation:

$$\Psi_i = \rho_i + \Sigma b_k \rho_k r_k$$

Where Ψ_i = the optimal degree of self-preservation expressed by individual *i* (the residual capacity to promote inclusive fitness);
ρ_i = the remaining reproductive potential of *i;*
ρ_k = the remaining reproductive potential of each kinship member *k*;
b_k = a coefficient of benefit (positive values of b_k) or cost (negative values of b_k) to the reproduction of each *k* provided by the continued existence of *i* ($-1 \leq b \leq 1$);
r_k = the coefficient of genetic relatedness of each *k* to *i* (sibling, parent, child = .5; grandparent, grandchild, nephew or niece, aunt or uncle = .25; first cousin = .125; etc.).

With this model, the author has explained, how the degree of self-preservation changes with the individual's personal circumstances over time, as a function of reproductive prospects and interactions with potentially reproducing kin. Although the model is supposed to be applicable in all social species, it has been further debated and empirically studied only to explain the forever paradoxical suicide in humans (Brown, Dahlen, Mills, Rick and Biblarz, 1999). However, the logic behind it becomes more obvious when applied to other species.

Firstly, let us, take the previously mentioned case of ants leaving their nest when infected by a parasite or an infectious disease (Heinze and Walter, 2010). Since the worker ants are sterile, their remaining productive potential (ρ) equals zero. In this case, the remaining reproductive

potential of all other ants (ρ_k) is zero too (apart from the queen). Most ants in the nest come from the same male and female, thus making most of them sisters or otherwise closely related, contributing to a high value of r_k. From here on, the only variable that changes is the individual's impact on their kin (b_k). If that particular ant is carrying a possibly infectious disease, its impact on other ants would be negative, resulting in the value (of *b*) being close to -1. Combining the non-existent reproductive potential of this and most other ants, with the negative impact on others (weighted against their close relatedness), it becomes very obvious that the optimal degree of self-preservation (Ψ) will be a negative value, thus favouring self-destruction.

The same calculation using this model can be successfully applied to others insects with similar social structures: parasited pea aphids dropping off leaves (Joiner, 2010) and infected bacteria exploding (Nedelcu et al., 2011). But let us focus on ants as a particular example of animals living in highly developed social structures (Heinze, and Walter, 2010). Here, we can note that the *b* value changes depending on how beneficial that one animal is to the entire nest. All workers contribute to the colony in their own way, some by foraging for food, others by searching for new territory and some by tending the larvae. Male ants however only have one role – to reproduce. This process (described previously) happens only once during the queen's lifetime, and after the insemination, male ants would not contribute to the colony anymore, but only consume resources, resulting in a negative *b* value of deCatanzaro's equation. The final outcome of the calculation is pointing towards self-destruction, even though the instinct of self-preservation remains present. The negative outcome of the male ant's optimal degree of self-preservation is naturally solved by an explosion of its reproductive organs and death shortly after copulation.

The next calculation is applied to the case of the spider's cannibalistic mating process. Here, the animal's remaining reproductive potential (ρ) shows a positive value, as does ρ_k or the reproductive potential of kin. Since the male spider will not have any direct influence on his offspring, and provided that he and the female are not genetically related, his r_k value would be close to zero. The *b* value (individual's impact on kin) depends on the behaviour of the female. If the male spider leaves after copulation, the *b* value stays zero, but if he is eaten by the female, that contributes in a positive way to his offspring and consequently his genes. The optimal degree of self-preservation (Ψ) stays positive throughout the calculation, explaining the survival instinct of mating spiders, as well as praying mantises (Maxwell, 1998). However it is also true, that spiders who endure the cannibalisation longer, produce more offspring (Polis and Farley, 1979), making this one a close call for the male spider.

In the case of altruistic self-sacrifice in mammalian nest guarding and alarm calling (Caro, 2005), we cannot talk about instinct of self-preservation or self-destruction of the animal guarding the nest, but merely altruism for the sake of protecting the pack against intruders.

From the case of autothysis, particularly the exploding pea aphids described by Joiner (2010), it can also be concluded that there is no self-destructive instinct to be discussed. The optimal degree of self-preservation of every aphid is high and all values of deCatanzaro's equation are positive, up to the point of the attack, where the optimal outcome is to protect the rest of the colony.

In conclusion, deCatanzaro's model of self-preservation and self-destruction can indeed explain the self-destructive tendency of insects or bacteria, which desert the colony to perish on their own, if they are carrying a disease or parasite that might harm other members of the colony. The author has posited that human brains are designed by natural selection in such a way as to encourage us to end our own lives when facing certain conditions (deCatanzaro, 1991). He later supported his own theory by showing that suicidal ideations correlate positively with poor reproductive prospects of the individual and diminished sense of worth to family (deCatanzaro, 1995).

However the model cannot be applied to the examples of autothysis, nest guarding and terminal mating (especially for those males who might otherwise have a chance of mating several times). In these cases, the instinct of self-preservation stays in the forefront, up until the point of the attack (or mating), after which the best outcome is to ensure the survival of others. The self-sacrifice here is merely the result of defence against predators or other evolutionary pressures.

3 EGOISTIC SUICIDE

As opposed to altruistic suicide, which has an evolutionary function of benefiting others, egoistic suicide does not have a simple universal function, other than ending one's own suffering. The idea that animals are capable of consciously ending their own life started forming in the 19th century, when Lindsay (1880) suggested that we can mainly distinguish between intentional and accidental incidents, based on a collection of anecdotes dealing with suicide of lower developed animals. According to the author, the leading cause for "intentional" suicide seems to be the animal's old age, accompanied with physical and/or mental agony, such as pain, blindness, paralysis, etc. Among reasons leading to suicide in captive and domesticated animals, he notes desperation, depression, despair, man's cruelty and the captivity itself, as well as melancholia deriving from grief.

In these writings, we can note the strong tendency to attribute human-like traits to animals. It has been noticed that humans tend to pay particular attention to intentional behaviour of others, as opposed to accidental or spontaneous instinctive behaviour (Jones and Davis, 1965), which sometimes leads to false correlations between motive and behaviour. To help us recognize such false correlations, we will later closely consider the theory of attribution and anthropomorphism, and apply that to especially older writings, as well as modern popular media.

Any time an incident resembling animal suicide appears in the popular media, it sparks the debate on whether animals other than humans possess the kind of cognitive, emotional and self-reflective capacity that seems to be needed for egoistic suicide. So far we have concluded that suicide is present throughout the animal kingdom, though mostly in the form of altruistic self-sacrifice. To continue the complicated debate on whether the egoistic form of suicide exists among other animals, it is necessary to review the evidence for it separately in wild animals and those whose lives are influenced by humans (animals in captivity and pets), to conclude whether egoistic suicide is a distinctly human trait, or a behavioural pattern that appears among wild animals as well.

In order to address the topic of egoistic suicide in a holistic manner, we will first approach it though the discussion of underlying biological mechanisms of suicide and its related traits, which will be followed by the problematic of anthropomorphism and attribution of human traits to behaviour observed in animals. Before reviewing examples of egoistic suicide in wild, captive and domesticated animals, we will additionally discuss some of the latest research regarding the animal's emotional and cognitive capacity which is thought to be needed for egoistic suicide.

3.1 Pathology of suicide

Reasons for egoistic suicide in humans are as diverse as the people committing them, but in general, it appears to stem from depression, anxiety, irritability, hopelessness and increased impulsivity. It is often related to a history of early physical abuse and past suicidal behaviour, as well as situational factors, such as a major loss. The behavioural trait that is most often identified as a risk factor is angry impulsivity, which is in high correlation with child abuse. Almost all review cases also show that anxiety plays a big role in increasing the suicide risk (Fawcett, 2012). When exposed to novel or overtly open environments, animals often display behavioural symptoms that remind one of those observed in anxious humans (Preti, 2011; Overall, 2000).

The studies researching biological abnormalities of suicidal brains, which were conducted by Pandey (2013), have discovered that the serotonergic system plays a major role. The author has observed strikingly increased serotonin receptor subtypes and decreased serotonin metabolites, as well as abnormalities of receptor-linked intracellular signalling mechanisms (such as phosphoinositide and adenylyl cyclase), dysregulations in the hypothalamic–pituitary–adrenal axis and of the neurotrophins and neurotrophin receptors, and abnormal neuroimmune functions. In conclusion, this extensive list of abnormalities at the level of the central nervous system makes suicide a complex biological phenomenon, which consists out of a syndrome that seems to link various biological mechanisms and behavioural abnormalities.

It is believed, that animal models of suicidal behaviour may contribute to understanding the phenomenon. Several attempts have been made to replicate suicide trait related behaviour in animals, but because of its complexity, replicating suicide in animals is not possible and was never successful. However, we can study behaviour associated with suicidal ideation, suicide attempts and suicide completion, such as: aggression, impulsivity, irritability and hopelessness/helplessness (Malkesman, Pine, Tragon, Austin, Henter and others, 2009).

The model of required or learned helplessness in animals, is considered a good model of depression in humans (Malkesman, et.al, 2009), and it might be considered as a model of depression in animals as well. It is often used in drug trials where its responsiveness to antidepressants and psychoactive drugs is measured (Sherman, Sacquitne, and Petty, 1982). Learned helplessness can be easily elicited in laboratory animals with the combination of stressors and entrapment for an extended period of time. Eventually, the animal stops trying to escape the stressor. This points towards some awareness of futility in animals, during which behavioural symptoms of depression can be noticed (Malkesman, et al., 2009).

In most humans, defeat, no escape, and no rescue, are often critical factors leading to suicide (O'Conno, 2003). However, in the large majority of cases such severe stress does not lead to suicide (on neither humans nor animals). Believing that life is unliveable and that conditions will not improve, requires a certain level of cognitive ability. The individual must be able to assess current conditions, project future circumstances, understand death and plan a way of self-destruction (Hooper, 2010 in Preti, 2011). It remains unclear whether an animal can possess such a degree of cognitive ability.

Most of the animal research available on this topic is done on rats in a controlled laboratory environment (Pandey, 2013; Malkesman, et.al., 2009), which enables us to monitor the underlying biological processes and variations in their environment, but it prevents us from drawing direct conclusions or predictions on suicidal behaviour in other animals. Wild and captive animals are studied with observations, where their behaviour is interpreted by the observer, the human. Data collected though this type of studies needs to be reviewed cautiously to minimize the effect of anthropomorphism.

3.2 Anthropomorphism and attribution

When observing animals, we notice their behaviour, posture, changes in muscle tone, vocalisations etc., but it does not give us insight into what they think or how they feel. We don’t know what makes them act in the way they do, and because we cannot be certain, we try to fill this gap with speculations, based on our previous experience with our own thoughts.

We tend to search for cause and effect relationships, where none might be. The process of explaining behaviour and events is referred to as attribution. Attribution theory is the study of how we use external cues to arrive at a causal explanation for events (Malle, 2004). We pay particular attention to intentional behaviour in addition to trying to find a motive for it. It is easy to justify this tendency, as it helps us understand the world around us in our everyday life. The problem with attributing causal explanations to the behaviour of other animals is that they cannot confirm our assumptions, which leaves us with just that – assumptions. Heider (1958) believed that we are all naive psychologists, trying to make sense of the social world. He furthermore described how we are constantly explaining other people’s actions based on what we believe their thoughts and intentions might be. He noted that when we are attempting to explain our own behaviour, we tend to make external attributions (situational or environmental), but when explaining the behaviour of others we search for internal attributions, such as personality. In the particular case of observing animal behaviour, we often attempt to explain it with attributing human personality traits.

Attribution theory is the basis for anthropomorphism, which is defined as the attribution of human characteristics to animals (and other non-human objects). Among lay people, anthropomorphism is not only prevalent, it is the nearly exclusive method for describing, explaining, and predicting animal behaviour – whether the animals are kept as pets, visited in the zoo, or observed in nature (Horowitz and Bekoff, 2007). People are more likely to attribute similar experiences and cognitive abilities to animals that are visually similar to them (primates) and also to animals with which they have formed an attachment bond, like pets (Eddy, Gallup and Povinelli, 1993), and therefore anthropomorphism is most prevalent in explaining the behaviour of dogs (Rasmussen and Rajecki, 1995).

The general consensus among scientists is that anthropomorphism is not scientific and should thus be avoided (Schilhab, 2002, Horowitz and Bekoff, 2007). It decreases the objectivity and validity of the observations and may lead to false conclusions. It is of great importance to keep this in mind while reviewing reports about animal behaviour, particularly in older writings and modern popular media. However, there are some scientists who believe that resisting the critics' claim to avoid anthropomorphism is sometimes necessary in order to study animals, particularly their emotions (Bekoff, 2000).

3.3 Emotions

Little systematic empirical research has been devoted to the study of emotions in animals, especially among wild animals. Bekoff (2000) suggests that the lack of advances in this field is due to the fear of being non-scientific. The necessary tool to make the world of animals more accessible to humans might be exactly anthropomorphism, which enables us to explain animal feelings with the use of human words. Even if joy and grief in dogs are not the same as joy and grief in chimpanzees, elephants, or humans, this does not mean that there is no such thing as dog joy, dog grief, chimpanzee joy, or elephant grief (Bekoff, 2000).

Before searching for scientific arguments supporting the idea that animals feel, we must first differentiate between primary and secondary emotions. Primary emotions are wired into the evolutionary old limbic system (especially the amygdala) and they include: fear, anger, surprise, disgust, sadness and joy. Secondary emotions are those that are experienced or felt, evaluated and reflected on, like compassion and empathy, and involve higher brain centres in the cerebral cortex (Bekoff, 2000). We can agree that primary emotions exist among animals and have an undeniable evolutionary role in helping them manage and regulate relationships, and adapt to specific circumstances. Secondary emotions however were long considered to be uniquely human. Observable emotions from this category can be noticed in other animals (Bekoff and Goodall, 2008). For example empathy in animals is reflected through the

countless reports of animals helping humans or other animals, making adorable cross-species friends or fostering young animals of a different species.

Research articles collected by Bekoff (2000) provide compelling evidence that at least some animals likely feel a full range of emotions, including fear, joy, happiness, shame, embarrassment, resentment, jealousy, rage, anger, love, pleasure, compassion, respect, relief, disgust, sadness, despair, and grief. Many of these are secondary emotions who can reside in the less sophisticated brains of animals like, for example rats, which have been found to experience the feeling of regret. This secondary emotion was previously believed to be a trait that was uniquely human (Steiner and Redish, 2014).

Further evidence for the existence of such complex emotions are Bekoff's (2000) observations on the uniquely recognizable expression of them. He postulates that even people with little experience who observe animals, usually agree with one another on what an animal is most likely feeling. Their intuitive characterization of animal emotional states predicts future behaviour quite accurately. The emotional states of many animals are easily recognizable though their faces, their eyes, the ways in which they carry themselves, changes in their posture, gait, facial expression, eye size and gaze, vocalizations, and odours (pheromones).

We can observe more nuanced emotions in social species like wolves where every individual of the pack needs to know, not only what others are doing or planning to do, but also what they are feeling. When comparing highly social wolves to less social coyotes and dogs, it has been noted that wolves have more varied facial expressions and that they use these expressions to communicate their emotional state to others. Wolf's tails are also more expressive and take more positions than the tales of dogs or coyotes, pointing towards their better ability to communicate through the expression of emotions (Bekoff and Goodall, 2008).

Being capable of expressing a bigger variety of emotions is a necessary skill for all highly social mammals. The evolutionary value of the ability to communicate through emotions is reflected through a distinct biological structure of the brain. Brain cells involved in processing emotions and encouraging the development of social interaction are called spindle cells or von Economo neurons. Their proposed role is involvement in social awareness and fast intuitive decision making in rapidly changing social situations (Allman, Watson, Tetreault and Hakeem, 2005), as well as processing complex social emotions (Brüne, Schöbel, Karau, Faustmann et al., 2011).

Hof and Van der Gucht (2007) have made a scientific breakthrough when they established the presence of spindle cells in the brains of humpback whales, fin whales, killer whales and sperm whales - all the whales that have large brains as well as large bodies. Other researchers have additionally found these cells in dolphins and elephants (Hakeem, Sherwood, Bonar,

Butti, Hof and Allman, 2009). This discovery not only means that humans and great apes aren't the only ones who have these particular cells, but that primates were not the first to have them.

Newer research on spindle cell is suggesting that these cells might serve as a common neuronal surrogate of empathy and suicide, because of their particular location in the brain (Brüne, et al., 2011). Although this connection has not yet been proven, it might have a significant impact on our understanding of egoistic suicide among species which are known to have von Economo neurons.

In conclusion, the most sophisticated emotional lives appear to be the ones of highly social mammals, such as primates, elephants, whales and dolphins, which even possess specialized neuronal cells to help them master complex social situations. Perhaps the most difficult remaining question about animal emotions is how emotions and cognition are linked; how emotions are felt and reflected on.

3.4 Cognition

According to several authors, who have elaborated on the possibility of suicide in animals, emotions, cognition and self-reflection are needed in order for an organism to consciously decide to end its own life (Ramsden and Wilson, 2010; Preti, 2011; Bekoff, 2000). After looking into the existence of emotions among animals and concluding that at least some animals experience a full range of emotions, let us additionally discuss some observations regarding cognition among these animals.

Thorndike (1998) was the first one to systematically study intelligence in animals, and he has posited that the animal's reactions can all be explained by the ordinary associative processes without the need for abstract, conceptual and inferential thinking. He claims that we may oversee their marvellous capacity of forming associations, and mistake it for intelligence, because of the tendency to anthropomorphise animal behaviour, particularly in pets and in animals that are visually similar to humans (Eddy, Gallup and Povinelli, 1993). However, most scientists that are studying the cognitive abilities of animals would not agree with Thorndike's claim.

Cognitive abilities or higher cognitive functions of the brain include: comprehension and use of language, visual perception and construction, attention (processing of information), memory, problem solving and self-awareness (Marušič and Roškar, 2003). All of the listed traits can be found and observed in primates (Whiten and Byrne, 1997; Griffin, 1981), and dolphins (Herman, 2006), both of which also serve as an example of animals that reportedly

have committed suicide. According to deCatanzaro's (1981) evolutionary theory of human suicide, threshold intelligence is necessary for suicidality. From this statement, it may be assumed that intelligence and suicide mortality have a positive correlation. This prediction was tested and confirmed in humans in a study that involved 85 countries and showed that the national IQ rate was significantly correlated with the incidence of suicide (Voracek, 2004). This suggest that intelligence does indeed play a role in suicidality.

Further, it has been suggested that the use of language is a good indicator of high cognitive functioning in animals and it might be a contributing factor in cognitive development among early humans as well (Griffin, 1981). Communication between members of the same species is a particularly important skill for those living in large social groups where more coordination and understanding between the group's members is needed. Since the expression and understanding of emotions is more evolved in highly social species (Bekoff and Goodall, 2008), it is safe to assume that their cognitive abilities have evolved to a higher lever for this reason as well. We may see this in the example of insects, particularly bees, which live in big colonies, where good coordination and communication enables a big group to function as one big organism, but where every individual has its own role. Still, in such a complex structure, even suicide has its function (as explained in chapter 2, which deals with altruistic suicide).

The need for better communication, group coordination, higher evolved emotions and subsequently higher cognitive function in social species of animals is leading to the suggestion, that social intelligence must be included in the list of required traits needed for egoistic suicide. Next to emotions, cognition and self-reflection, the absence of a healthy social environment seems to have a great effect on the animal's mental well-being. If such a big part of the evolutionary development of a species evolves around the complexity of their social environment, it is understandable that the absence of social support and grief, following the loss of one person representing such support, may lead to suicide, among humans as well as non-human animals.

The self-mutilation behaviour elicited in monkeys, as discussed later on, may be a good example, which shows the importance of proper social structure in the mental well-being of animals. Social isolation is the most important cause of self-biting, head banging and other self-destructive behaviour (Jones and Barraclough, 1987). Their isolations results in an absence of learned social skills though social interaction. The behaviour of socially deprived young rhesus monkeys was previously compared to the behaviour of autistic children (Braitman, 2014), who as well suffer from the absence of the ability to decode social cues. Early and complete social isolation is clearly the biggest stressor for animals that would otherwise be members of large social groups in the wild.

Primates are the most often mentioned animals in reports concerning suicide in captivity. Their captive environment differs from the natural one mainly in: (1) the size of their enclosure and (2) the size and adequacy of their social groups. In the wild, primates live among their relatives, who they are brought up by, and who teach them all of the necessary skills for coping with their social group (Whiten and Byrne, 1997). Once that is established, the social support becomes vital for their mental health (which can be said for other social animals too). The absence of such a support system, elicited by living in captivity, has a significant impact on the animals.

Not only primates, but also dolphins are known to form complex social networks. Bottlenose dolphins form 'communities' in discrete areas. Not only that, but they choose to hang out with the dolphins they like and avoid the ones they don't, and even have names for each other. The most compact social networks are found among dolphins that live in narrow areas, similar to humans who live in small towns and have fewer people with whom they interact (Titcomb, O'Corry, Hartel and Mazzoil, 2015). These observations on wild dolphins help us understand the stress they experience in captivity, where they are living alone or with other dolphins that are selected for them, not unlike forcing two random humans to live together in a confined space, such as in prison, where suicide occurs up to 8 times more frequent compared to the general population (Fruehwald, Frottier, Matschnig, and Eher, 2003).

The need to understand, respond to, and manipulate each other's behaviour is the origin of social intelligence, as well as self-awareness (Focquaert and Platek, 2007). The latter is particularly hard to discuss in animals since there is no conclusive way to test if an animal is aware of itself. The test most widely used is called the mirror test in which the animal is put in front of a mirror in order to observe its reaction. It was first described and used by Gallup who found that apes (except for gorillas) use the mirror to observe themselves, whereas other monkeys don't recognize the reflection, and react to it as if it were another monkey (Gallup, 1970; 1982). According to Gallup's theory, animals that fail to show mirror self-recognition should also fail to show any signs of sympathy, empathy, intentional deception, sorrow, and other similar complex emotions. Exceptions to this conclusion are dogs, which show empathy, but do not recognize themselves in a mirror (Bekoff and Goodall, 2008). They do however recognize their own scent (Coren, 2005), which is their prioritized sense. This shows that the mirror test is not the most accurate way to observe animal's self-awareness.

Even though attribution of possibly false human traits to animal behaviour and our inability to talk to animals is limiting the research success, the issue can partly be removed at least with primates with the use of sign language. An interesting thing was noticed during this kind of communication in that chimpanzees never have asked questions. Jordania (2006) suggested that this might be the breaking point between human and animal cognition. He is of the opinion that this might be the proof that chimpanzee's level of self-reflection isn't as high as

other scientists have previously mentioned (Focquaert and Platek, 2007). Although chimpanzees are still assumed to have the highest level of social intelligence and cognitive abilities (Gallup, 1970).

From the evidence presented, it is possible to conclude, that the biologically complex pathology of human suicide mainly stems from poor social integration, which has previously been suggested as the leading cause for egoistic suicide (Durkheim, 1951). The examples of egoistic suicide in wild, captive and domesticated animals, that may confirm this persistent reasoning, are presented in the following chapters.

4 MYTHS ABOUT EGOISTIC SUICIDE IN WILD ANIMALS

When reviewing evidence on egoistic suicide among wild animals, it is important to consider that seemingly unexplainable events are usually explained by some kind of anthropomorphism. Preti (2005) has collected over 2000 year old reports of animal suicide, most of which even he has called anthropomorphic fables. Among others, his findings include: a dolphin that has let himself be caught with the purpose of following his captured son; a purple coot that strangled itself following the adultery of its partner; and separate cases of a camel and a mare that have thrown themselves down a chasm after realizing that they have committed incest. What appears as suicide among wild animals can often be explained. In continuation, let us look at some reported cases of animal suicide and their explanation.

In Iberian folklore, there has been a persistent myth about suicidal scorpions. It is said that sometimes, when a scorpion is surrounded with fire, it will kill itself with its poisonous sting. Since this myth has been mentioned so many times, Morgan (1883) conducted a series of experiments to find out if this behaviour can be replicated. In his experiments, he subjected different species of scorpions to various methods of torture. Following extensive research he has concluded that neither of the tested species of scorpions have any suicidal instinct. This reflex appears to be a muscle spasm, caused by the heat or an attempt to relieve pain. Later it has been also found that the scorpions' venom is not even poisonous to them (Legros, Martin-Eauclaire and Cattaert, 1998).

Preti (2005), other authors and the general public have made the mistake of categorizing lemmings (small rodents living in the arctic) as a species that is known to commit mass suicide. This myth likely came to life because of the occasional accidental death of few individual lemmings that happen to fall off cliffs during their mass migrations. The Walt Disney documentary ''White wilderness'' (1985) features a segment in which we can observe a group of lemmings, compulsively jumping and rolling down the bottom of a cliff, where they proceed to enter the large Atlantic ocean, being convinced that it's just a small lake. In the documentary, it is said that lemmings do this as a consequence of migration that ends in mass suicide. However, the epic "lemming migration" was staged using careful editing, tight camera angles and a few dozen lemmings running on snow covered turntable (Woodford, 2003). Consequently, the lemmings supposedly committing mass suicide by leaping into the ocean, were actually thrown off a cliff by the Disney filmmakers.

The most frequent articles disguised as animal suicide, are the ones about stranded whales and dolphins. Contrary to popular belief, stranded whales should not be returned to the water,

because when they get stranded, they are lost, dehydrated and starved. Mass strandings have been happening for millions of years (Williams, 2013) and are not suicide attempts at all.

Most whales live in deep waters far away from the beaches where they have been stranded on. Underwater earthquakes and volcanic eruptions are 10 times more likely in their usual deep water habitat, and can cause sudden changes in the water pressure, inflicting irreversible damage in whale's heads, 30% of which are air pockets. The damage in their inner ears and sinuses causes deafness, loss of navigation and agonising pain. The groups of affected whales stay close to the surface to avoid shark attacks where they slowly starve without the ability to navigate through deep waters and hunt for food. They are brought close to shore by the downstream current (Williams, 2013). Ear damage that is sometimes noticed in stranded whales can very likely be caused by military sonars and underwater explosions (England, 2001). Active sonar exercises by the U.S. Navy are said to cause nearly 2,000 deaths, 16,000 instances of permanent hearing loss, and over 5 million instances of temporary hearing loss among whales (Mulvaney, 2012).

Next to military sonars and underwater explosions, other mass or individual strandings can be caused by the ocean noise, oil explorations, heavy ship traffic, pollutants that affect the animals' health and behaviour, climate change, currents and ocean temperature, illness and disease or even topography. The ultimate cause for most individual strandings is that the whale is simply too weak from whatever reason. Because they then follow the path of least resistance, the downstream current brings them into shallower waters. Having ground support helps them to breathe easier, since whales and dolphins don't naturally float (Braitman, 2014), leaving them stranded once the tide moves. The death of the stranded animal is the result of starvation, weakness and dehydration and in no way a suicidal act.

Perhaps the most curious case of unexplained egoistic suicides is the one of Overtoun Bridge in Scotland. Since the 1960s more than fifty dogs have jumped off the bridge for no obvious reason. While the exact number of dogs isn't known, the phenomenon has been known for many years. According to a recent article by Smallwood (2014), an animal behavioral specialist, David Sands, discovered that the end of the bridge was located above a known nesting ground for mink. Sands also discovered that the majority of known dogs making the jump were long snouted breeds known for their extraordinary sense of smell. They were able to conclude that the dogs weren't committing suicide. In contrary, dogs were excited by the smell of the small furry mink and, while chasing it, tragically leapt over the safety wall (which is above the sight-line of most dogs).

Despite so many tales that have been disproved, in the general popular media there are still other speculations on whether animals commit suicide. One example is a recent article by Rahman (2015) describing a ''suicidal'' swan caught on camera by a Chinese woman. The

young swan was said to be traumatized by the death of another swan (presumably its mother) that was seen floating lifeless in the water. After calling out in distress and flapping its wings, the bird stuck its head in the water and held it there even after it appeared to have calmed down. After a few minutes, the animal had successfully drowned itself.

Unfortunately, we cannot further investigate such singular instances, leaving us unable to conclude with certainty that these particular described cases are falsely classified as suicide.

5 SELF-DESTRUCTIVENESS OF CAPTIVE ANIMALS

The lack of evidence for the presence of egoistic suicide among animals in the wild prevents us from entirely denying the possibility of suicide among animals in general, but we can say with certainty that it is present among captive animals.

It is common for animals to refuse food after they have been captured and caged. One of such cases was reported by Braitman (2014), who has mentioned an African elephant named Jingo that was being shipped from England to New York, but refused to eat and died during the transport. Additionally, the author elaborates on the use of sedatives on animals, in order to make their transport easier and prevent such accidents, which in this case could be a plausible explanation for the faith of the deceased elephant. In addition, and more importantly, Braitman's research on the topic revealed that the use of sedatives and antipsychotics on animals in captivity is more common than anyone would like to admit.

The refusal to eat can become a life-threatening problem, particularly for animals confined in zoos (Crawley, Sutton, and Pickar, 1985). Apart from refusing to eat, animals might actively try to hurt themselves in the form of self-mutilation, particularly by self-biting or by banging their head against the walls of their enclosure.

From the Chinese media, comes the tale of a moon bear mother that killed herself and her cub to escape a life of torture (Hoffman, 2013). Bear bile, collected from their gall bladders, is prized and widespread in Chinese medicine. Bears are confined in small cages, with shunts inserted into their gall bladders, or are in some other way continuously ''milked'' for bile. They only survive for around 10 years, until their bile production declines, after which they are killed and sold. In the article, Hoffman describes an incidence, in which the mother bear broke out of her own cage and into the cage of her cub, where the farmers were piercing its abdomen for the first time. She supposedly intentionally suffocated her cub by hugging it tightly, and then killed herself too by driving her own head into a wall. Furthermore, the author claims that the bear was intelligent enough to recognize the torture she experienced before, and to conclude that death would be the solution for it. Although these bears are kept under extremely inhumane conditions, there are no other similar reports that could support the idea of suicidal intentions among captive moon bears. The bears that may be fortunate enough to be rescued from such torture can reach a full physical and mental recovery and continue to enjoy life (Bekoff and Goodall, 2008).

The story of the suicidal moon bear is unreliable as it cannot be verified or supported by other similar cases. There are several other cases of what seems like suicide, but can be attributed to other factors, like stress in most cases.

Preti (2005) speaks of tales reporting the death of octopuses by self-cannibalism which usually happens after severe unnatural stressful stimulation (i.e. experiments with shock treatments), but is explained as an attempt to relieve the pain derived from unnaturally caused injuries. In his subsequent work, Preti (2007) describes another octopus ‘‘suicide’’. In this case, two young octopuses escaped from their tanks and died from desiccation. There were no problems with the water quality and the behaviour ceased when their habitat was enriched with pieces of green plastic resembling grass, pointing towards the obvious environmental impact on captive animals, and the reduction of stress by adding artificial habitat enrichment.

Although some zoos and animal sanctuaries really make an effort to provide adequate living conditions for their animals, many other wild animals owners do not have the capacity or do not want to care for them properly. Animal enclosures that are too small and in no way resemble a natural habitat are undeniably a source of stress and anxiety for their inhabitants. Some species (lemurs, antelopes and zebras for example (Tyrwhitt-Drake, 1951)) may thrive in captivity under the right conditions, whereas some others, particularly naturally wide-ranging carnivores, develop several health problems and repetitive stereotypic behaviour (Mason and Clubb, 2003), comparable to the obsessive compulsive disorder in humans. Stress producing situations depend on the animal species involved, and can include crowding, isolation, separation and confinement. When these are perceived as uncontrollable, they can result in self-endangering behaviours (Crawley, Sutton, and Pickar, 1985) that may escalate to self-mutilation and eventually suicide particularly in primates and dolphins, which we will review separately later in this chapter.

5.1 Self-mutilation in captivity

Self-injurious behaviour has been observed in leopards, lions, opossums, jackals, hyenas, marmosets, squirrel monkeys, long-tail monkeys (Jones and Barraclough, 1987), birds (Bordnick, Thyer and Ritchie, 1994), horses (McClure, Chaffin and Beaver, 1993), primates (Braitman, 2014) and dolphins (O’Barry and Coulborne, 2000). The reported behaviour typically includes biting of limbs and tail, hair/feather pulling, stereotypical movements, head banging and other aggressive moves that are mostly directed towards others and then oneself. Additional forms of self-destructive behaviour, namely intense and stereotyped head-banging, head-hitting, scratching, and self-biting have been reported in mentally deficient and psychotic people as well (deCatanzaro, 1991).

A whole range of self-injurious behaviours can be observed among jailed humans (Fruehwald et al., 2003) as well as animals in captivity. The human condition of compulsive hair pulling (trichotillomania) is similar to the phenomenon of feather picking in birds. Similarities have been found in analogous behaviour, proposed etiologies, evoking cues, response to behaviour therapy, and response to pharmacological treatments based on serotonin re-uptake inhibitors (Bordnick, Thyer and Ritchie, 1994).

On the other hand, compulsive self-mutilation may occur due to a genetic predisposition linked to an increased dopaminergic activity, particularly in captive psittacine birds (Jenkins, 2001) and can just as easily be elicited in rats by administering dopamine-increasing agents, such as amphetamine which induces stereotypical behaviour (Sharma, Manchanda and Nayar, 1991).

In cases where self-destructive behaviour is not induced through increased dopaminergic activity, it is induced or worsened by social deprivation (Kraemer and Clarke, 1990), sudden or longer confinement (Crawley, Sutton and Pickar, 1985; McClure, Chaffin and Beaver, 1993), stressful stimulation (Jones and Barraclough, 1987), or though separation anxiety in pets (Crawley, Sutton and Pickar, 1985). The search for reports on self-destructive behaviour among animals in the wild and those living in proper conditions with adequate social environments has yield no results, suggesting that self-mutilating behaviour happens only among animals subjected to unnaturally stressful conditions to which they are unable to respond with the appropriate natural behaviours.

5.2 Primates

Self-mutilation and other behavioral abnormalities are by far most commonly reported among primates, being mostly experimentally induced. Laboratory rearing and isolation have shown to be important predisposing factors in primates exhibiting self-inflicted injuries. In macaque monkeys, the more serious self-injuries are always initiated by some immediate stimulating event. Self-damaging behaviour in general occurs more commonly under stimulating conditions, particularly with early and complete isolation. After the age of three, when the animals have reached puberty, self-biting, teeth grinding, scratching and head slapping is known to greatly increase (Jones and Barraclough, 1987). The typical self-biting among rhesus monkeys that have been reared in isolation emerges at 3-4 months, increases during adolescence (3-4 years) and does not cease if they are returned to a social environment (Kraemer and Clarke, 1990). Other reports show that self-mutilation among rhesus monkeys occurs in 10-15% of animals if they are just housed alone with no additional intentional sensory deprivation (Braitman, 2014). Development of neurobiological (malfunctions in the norepinephrine and serotonin neurotransmitter system) and behavioural aspects of self-

aggressive behaviour is brought forward only in the absence of social factors that would normally bring the behaviour under environmental control (Kraemer and Clarke, 1990). All of the reports suggest that social isolation is the strongest precursor for self-mutilation, particularly in animals who live in large social groups in the wild.

Reports of suicide however are rarer. Bekoff (2000) has written about a one-and-half year old chimpanzee named Flint, who has stopped eating, withdrew himself from the group and finally died, following the death of his mother. Braitman (2014) described a different case of a monkey mascot from an U.S. Navy ship that was acquired during the Spanish-American war. The monkey named Jocko was reportedly so homesick for his original Spanish crew that he tried to drink poison. His death was attributed to ‘‘fatal melancholia’’. Other cases are merely anecdotal, such as the ‘‘suicide’’ of a gorilla that died through starvation after its capture (Preti, 2005).

Although some of the reported suicide cases in primates may be a product of anthropomorphism, it is clearly present in all others examples of self-destructive behaviour and suicide, especially when an otherwise highly social primate is not sufficiently bound to any social group or has been detached from other members of the community, the sanity and mental well-being of the animal severely declines.

5.3 Dolphins

Apart from some old anecdotal cases of dolphins dying in a suicide-like manner (Amory, 1970; Preti, 2005) two other notorious cases of dolphin suicide can be found in the popular media. In the documentary *The Cove* (2009), activist Richard O’Barry described his experience with his dolphin Kathy, which he was training for the popular TV series called *Flipper*. In the end of the movie, O’Barry states, that Kathy has looked directly into his eyes while resting in his arms where she stopped breathing. She eventually sunk to the bottom of the aquarium and never returned to take another breath. In that segment of the documentary, O’Barry explains that dolphins and whales breathe consciously. This means that every trip to the surface to take a breath is their conscious decision that they may decide not to take.

A similar case was described in the documentary *The girl who talked to dolphins* (2014). The movie describes NASA’s experiments in which they have attempted to teach the human speech to dolphins. During these experiments, one dolphin (named Peter) has developed romantic feelings for his trainer, Margaret. They have spent a lot of time together, during which they have formed a deep relationship that has even become sexual on Peter’s side. After the project’s cancellation, Peter has been separated from his trainer and moved to a smaller

tank. Observers have reported that he has become depressed and eventually committed suicide in the same way as Kathy from the previously described case.

Dolphins are intelligent magnificent sea creatures that are mostly kept in captivity for rehabilitation purposes or in animal parks where they are trained to entertain and often mistreated. In either of these cases it is not a custom to perform observations in a scientific manner which results in lack of evidence that may help us understand the psychological impact of captivity on them. One example of animal ‘‘madness’’ is a dolphin called Big boy, who reportedly has spent much of his time ramming his head against the wooden entrance of his sea pen (O’Barry and Coulborne, 2000). He could not be released into the wild as he would not survive on his own and even though he was not mistreated by his handlers, the nature of captivity alone was causing enough stress to cause his bead banging.

According to O’Barry and Coulborne (2000) captivity strips the dolphin’s life of the natural rhythms of the sea, the tides, the currents and exposure to live fish, all of which is therapeutic and improves the animal’s quality of life. The authors furthermore add that some animals receive too many human imprints through their captivity, and thus lose the skills needed to survive in the wild. They describe how captivity can make some of them mad through human intervention and stress, which always plays a leading part in the death of captive dolphins. Stress is a result of small enclosures and the need to adapt to human training.

In the wild, dolphins are sometimes found stranded on beaches. In the previous chapter, several reasons for mass strandings of whales and dolphins were presented, in order to remove the anthropomorphic label of suicide from them. The same explanations can be applied to the individual cases of stranded dolphins, with some incidences remaining unexplained. Although it is technically possible for dolphins to consciously stop breathing, it is hard to imagine a situation in their natural habitat that would lead to egoistic suicide.

6 EGOISTIC SUICIDE IN DOMESTICATED ANIMALS

Domesticated animals are bred in captivity and thereby modified from their wild ancestors in ways to make them more useful to humans. Domestication is thus distinct from mere taming of wild-born animals (Diamond, 2002). Humans control the animal's reproduction and food supply, which leads to reduction of competition for important resources, and thus permits selection for the retention of juvenile characteristics (Price, 1984; Anderson, 2014). Most domestic animals have smaller brains and less acute sense organs than their wild ancestors (Diamond, 2002), and are also less responsive to changes in their environment (Price, 1984).

The seeming unresponsiveness of domesticated animals is useful to humans in the case of farming animals, which are sometimes mistreated and abused by their owners in addition to living in poor conditions. Anecdotal cases even show that their discontent with the conditions may escalate to suicide. Ramsden and Wilson (2010) have collected several old tales of donkeys and horses that have deliberately drowned in the river Nile, after they have been forced to work too much. The same behaviour was noticed in camels (Lindsay, 1880). However, these reports are old urban stories that cannot be verified and may not be true.

Besides farming animals, humans have been domesticating animals with the purpose of companionship as well (Diamond, 2002). The most popular human pets are of course dogs, which we will review separately. Next to cats, we also like to keep avian pets, such as parrots, which have recently been compared to mammals (especially primates) in terms of their cognitive abilities (Anderson, 2014).

When it comes to mental well-being of pets, birds seem to be particularly problematic, as discussed by Anderson (2014), who has conducted a study on birds and the owner's relationships with them. In her study, the author has found that 90% of bird owners strongly agreed that birds are sentient or aware beings with their own thoughts and feelings, supporting the suggestion that attribution and anthropomorphism is prevalent in pets (Eddy, Gallup and Povinelli, 1993). Additionally, Anderson elaborates on the dangers of infantilization and anthropomorphisation of birds, which present themselves as the deliberate failure to wean an adult parrot as substitute for human child, sharing inappropriate human foods with them, celebration of holidays and misinterpretation of bird behaviour. It is no surprise for parrots to be considered human-like, if we take their potential ability to speak into account. Most owners are very loving towards their pets, whereas some never sustain an affective bond and may treat their bird, not as a sensitive and highly intelligent sentient being, but as an object, dead or alive, to be manipulated for the pleasure of the person. Because of their high cognitive ability, longevity and the need to socialize, mistreated animals may develop severe behavioural

problems (Anderson, 2014, Braitman, 2014), such as feather-picking, which we discussed and compared to similar human conditions previously.

Some species of birds may live for up to 80 years, during which they may be rehomed three or more times due to the death of the owner or other human life changes (Anderson, 2014). Although bird suicides in captivity or in the wild were never reported by scientists, their self-mutilation points toward the negative effect of captivity and poor social integration on these animals. In otherwise healthy and happy birds, behavioural issues appear to arise if they are not provided with enough social interaction, usually after the loss of their master.

The death of an animal's owner, mate or relative has been the only suspected cause of reported animal suicides in general, if we exclude the cases of deliberate maltreatment by humans. Preti (2005) has collected several such reports in his review of reported animal suicides though history. He mentions two eagles, a purple coot, a dolphin, a horse and eleven dogs. All of these reports are again anecdotal and could just as well be the result of false attributions and anthropomorphism. These reports mostly describe singular events, except for the stories of dogs that have starved to death following the death of their owner. These stories have appeared through different sources so many times, that they should be taken into closer consideration.

6.1 Dogs

Lindsay (1880) was the first to collect anecdotes of suicide among dogs. Almost always were these dogs old, malnourished, ill, and/or rejected by their owner. The most notorious case however, is of a Newfoundland dog (unknown author, 1845, in Ramsden and Wilson, 2010), where, according to the author, the dog was not as lively as usual a few days before the incident. Many bystanders have seen the dog go into the water, assume complete stillness and sink slowly. Despite being rescued, he went back to the water and repeated the same behaviour. He was dragged out several times, until he eventually drowned. This reported case is the most often cited example of suicide in animals, and is more intriguing than other similar ones because in this case, the dog was said to be young and valued, and no reason for his death wish could be found. However, some cases do have an explanation other than insanity.

The stories about dogs that starve to death after the loss of their master are definitely the most common of all animal suicide stories and have been appearing in literature for over 2000 years (Preti, 2005). They might be interesting for the understanding of the mechanics leading to suicide among humans, reminiscent of the suicide by starvation sometimes observed among the widowed, males mostly, after the death of the spouse (Preti, 2007). The despair following the loss is thought to drive these people into a spiral of withdrawal which ends in neglecting

their basic needs, including nourishment (Harris and Prouvost, 2014). These cases should thus be taken as an example of grief over the pet's owner's death, causing the animals to commit suicide.

Dogs exhibit several other pathological behavioural conditions that may be equivalent to certain human psychiatric conditions as well, such as separation anxiety, obsessive-compulsive behaviour, cognitive dysfunction, dominance aggression, panic disorder (Overall, 2000), post-traumatic stress disorder and phobias (Braitman, 2014). These canine conditions appear spontaneously or endogenously without genetic or neurochemical manipulation. This suggest that they might be homologous to human anxiety disorder, obsessive-compulsive disorder, Alzheimer's disease, impulse control disorders, and panic disorder (Overall, 2000).

Since these conditions have not been reported in dog's closest relatives (wolves) it may be assumed that they have emerged as a consequence of domestication and worsened by their owner's modern lifestyle in which they are too busy to give them the proper attention and care, leading to behavioural issues (Braitman, 2014). During the process of domestication, dogs have been selected for a set of social-cognitive abilities that enable them to communicate with humans in unique ways. They are more skilful than primates in using human social cues to find hidden food (cues, such as gazing or pointing at the right food container). Wolves which are raised by humans do not show these skills, whereas domestic dog puppies only a few weeks old, even those that have had little human contact, do show the skills of recognizing such cues (Hare, Brown, Williamson and Tomasello, 2002), which makes us believe that our long co-evolution provided dogs with the necessary skills to communicate with humans and understand their intentions. The same experiment was recently repeated by Takaoka, Maeda, Hori and Fujita (2015), with one difference. In this study, humans first pointed out the right container like in the previous study, and to the wrong container in the second round. They have found, that the dogs no longer responded to the pointing gesture after being deceived in the second round. According to the researchers, these findings suggest that dogs are able to make inferences about a person's reliability based on experience, and can use this to change their behaviour and predict what someone will do in future situations.

The most recent studies by Müller, Schmitt, Barber and Huber (2015) shed even more light on the dog's big skillset needed for understanding humans. In the attempt to demonstrate that animals, other than humans, are able to discriminate between the emotional expressions of a different species, the researchers have found that dogs are able to distinguish between happy and angry faces, even when presented with only the top or bottom half of a picture. They learn to recognize happy faces faster than the angry face. The authors note that this would be expected if the dogs recognized these angry expressions as an unpleasant stimulus.

The dogs' domestication might have created their capacity to not only recognize simple emotions in others, but also express a wide range of primary and secondary emotions (Braitman, 2014). Jealousy is one of the complex emotions, which has been previously assumed to require the cognitive ability to reflect on the self and to understand conscious intentions. Reports of the occurrence of jealousy in dogs are at least as common, if not more so, than some other emotions that are often considered more primary (anxiety and anger). It is speculated that even if several social species have the capacity for jealousy, dogs may be the only species besides humans in which the emotion can be evoked in connection with a member of a different species (Harris and Prouvost, 2014).

However, the most important emotion for our discussion about suicide in dogs seems to be grief. The inactivity, drooping posture and overall melancholy associated with the feeling of grief, can be observed universally among many different species of animals (McMillan, 2008), particularly those who are social and form strong bonds with other animals or humans. The loss of a mate, close relative or friend seems to greatly affect human as well as non-human animals that have a habit of developing strong social attachments.

Considering all of the recent findings on dogs' abilities to understand humans and our deep connection formed through co-evolution and domestication, it is undeniable, that the dogs' refusal to eat after the death of its master cannot be explained simply by their reluctance to accept food from unknown people. In these cases all evidence points towards the possibility that dog suicide may be considered as a conscious act of self-destruction.

7 DISCUSSION

The purpose of this thesis was to explore the topic of suicide among non-human animals, which was considered in its altruistic as well as egoistic form. When considering altruistic suicide, the focus was to describe the different forms of self-sacrifice across several species of animals. For the purpose of exploring egoistic suicide and the human influence on it, the topic was considered separately in wild, captive and domesticated animals. Here, the research was focused on discovering whether suicide occurs in animals whose lives have or have not been altered by humans.

7.1 Altruistic suicide

Suicide in lower animals, where the collective colony of animals functions as one big complex organism, does happen in the altruistic form of self-sacrifice. The only example of truly altruistic suicide is when a member of the colony presents a direct danger to others, for example when it is carrying a parasite or an infectious disease. The solution serving the purpose of protecting its kin is for the individual to desert the colony even though it cannot survive on its own. This behaviour can be observed in ants, pea aphids, wasps, honeybees, other insects and certain forms of bacteria. In insects, altruistic suicide is a clear and understandable evolutionary adaptation. It is believed that humans have a sense of need for self-sacrifice when they feel as a burden on their kin as well.

Other instances of self-sacrifice in animals may appear to be altruistic suicide but should not be considered as such. Referring to evolutionary adaptations resulting in a voluntary death of the animal, such as in the case of autothysis, nest guarding and terminal mating, we can notice that these deaths are the result of defence against predators or other evolutionary pressures. The instinct of self-preservation stays in the forefront up until the point of the attack (or mating), after which the best outcome is to ensure the survival of others, thus resulting in self-sacrifice, and proving that under the right circumstances, the death of an animal could be worth more than its life. Here the categorisation as suicide is anthropomorphic and should be avoided.

7.2 Egoistic suicide

Contrary to self-sacrifice for the benefit of others, egoistic suicide does not serve this purpose and because it has no clear evolutionary function, it has not been reported among lower animals. In humans egoistic suicide is a result of poor social integration, leading to a variety of

complex biological abnormalities and suicide related behaviours, such as depression, anxiety, irritability, hopelessness and increased impulsivity. The listed behaviours may be elicited and studied in animal models; however suicide as such in animals has never been successfully replicated.

It is believed that emotions, cognition and self-reflection are needed for an animal to commit suicide. Many higher evolved animals experience a full range of emotions and display complex cognitive abilities, such as the use of language. Among higher evolved mammals (mainly referring to primates and dolphins), the complexity of their social environment appears to be the most important precursor in the development of more nuanced emotions, sophisticated language and complex cognitive function. Animals of the same species require a big social group for their optimal mental well-being, much like humans, who live in complex social groups, similar to those of dolphins or chimpanzees. Since social isolation is the most significant cause of self-destructive behaviour and maybe even suicide, we suggest that social intelligence and the need for a healthy social environment must be added to the list of required traits needed for egoistic suicide.

False attributions of human traits to animal behaviour may leads to false categorizations of sudden animal deaths as suicide, which are the most problematic when considering suicide in wild animals. For this reason, a critical approach was applied when studying suicide in wild animals, which has led to the disproval of many popular suicide myths. In the thesis it has been discussed and concluded that animals in the wild, like lemmings, whales and dolphins do not commit mass suicide; scorpions do not sting themselves to death; and dogs do not jump off bridges because of suicidal tendencies or a higher power. Neither of these animals have any suicidal instinct.

However, there are still other singular anecdotal reports of what appears to be suicide, and the reason for those usually appears to be the loss of a mate or relative. Such singular cases cannot be analysed or disproven, thus preventing us from concluding that suicide does not happen among wild animals, whose lives have not been influenced by humans.

On the other hand, the human impact is evident in the emotional states of captive animals, particularly those that are reared in captivity for experimental purposes. Most reported self-mutilating behaviours are deliberately caused by humans through the use of social isolation and additional stimulation, but no matter how much stimulation is added, the behaviour cannot be forcefully escalated to suicide. In general, there is no singular animal case in which self-injuring would lead to suicide. Apart from the refusal to eat in newly captured animals, egoistic suicide among them is very rare. It can be found mainly among primates and dolphins, which were never proven to end their own life in the wild. It seems highly speculative, or at least impossible to determine whether egoistic suicide is the reason for

individual strandings in wild dolphins. In other words, this leaves their capacity for suicide unanswered.

The captive environment of animals differs from the natural habitat firstly in the size of their living space. A polar bear's typical enclosure size, for example, is about one-millionth of its minimum home-range size (Mason and Clubb, 2003). The limited and unstimulating living space is undeniably a big source of stress, especially for animals born in the wild. Secondly, the captive environment does not necessarily provide an adequate social group, which is very important for highly social animals. Dolphins and great apes for example, are paired with few other members of their species, which they do not necessarily get along with. The biggest challenge arises when an animal gets very attached to one companion without having any other social support. When this one individual is taken away, the animal may develop clear signs of depression or even commit suicide. Such a situation would not happen in a natural setting, where their social groups are large and diverse, providing them with adequate social support after the loss of one member of the group. Captive animals are put into unnatural situations with no proper tools to deal with such an amount of stress. This leads us to conclude that the human impact on the lives of captive animals is the cause for rare instances of suicide that would not happen with the same animal species in their natural habitat.

The best examples of animals whose lives have been altered by humans are domesticated animals, namely farming animals and pets. Egoistic suicide in those animals does occur and appears to be the result of maltreatment and/or major loss. The anecdotal cases of suicide in farming animals following maltreatment cannot be confirmed and taken as a fact, because of their unknown/unreliable origin. However, we certainly cannot deny the existence of egoistic suicide in dogs, which are known to grieve very deeply after the loss of their master, sometimes leading to the indefinite refusal to eat and consequential death, whether from a ''broken heart'', or the reluctance to accept food from strangers.

The long ongoing domestication and co-evolution of dogs appears to have given them a remarkable level of empathy and complex cognitive functions, resulting in their extraordinary learning abilities. Among other abilities that make them the best human companions, dogs can interpret their owner's mood, behaviour and intention, distinguish happy and angry human faces, remember their trustworthiness and express complex emotions such as jealousy, which was previously thought to be uniquely human. Their strong connection and the sharing of the modern human lifestyle has unfortunately led to a variety of behavioural issues, such as separation anxiety, obsessive-compulsive behaviour, cognitive dysfunction, dominance aggression, panic disorder, post-traumatic stress disorder and phobias. Thus it should come as no surprise that they are able to experience the profound sadness, which leads them to die by starvation, after the death of their master.

8 CONCLUSION

In order to provide a holistic answer to the question on whether humans really are the only being able of committing suicide, the topic was approached through an altruistic as well as egoistic point of view. The purpose of the altruistic perspective was to widen the general understanding of suicide by answering the first research question, which was concerned with describing the different forms of altruistic self-sacrifice in animals. The egoistic point of view on suicide among animals was guided through the research questions on whether animal suicide happens among animals whose lives have not been altered by humans, and whether animal whose lives have been altered by humans commit suicide.

To conclude, it can be said that suicide does happen among many different species of animals. Altruistic suicide serves a particular evolutionary function and can be found in several different forms, most often among insects. Egoistic suicide on the other hand, appears to be caused by the human influence on the lives of animals. Because of singular anecdotal cases of egoistic suicide in wild animals, which cannot be verified, it cannot be concluded that suicide does not exist among animals whose lives have not been altered by humans. We also cannot say that animals whose lives have been dictated by humans do commit suicide, but we can say that in the particular cases presented here, suicide would not have happened without the human influence.

9 POVZETEK V SLOVENŠČINI

Samomor pri ljudeh predstavlja težko filozofsko vprašanje, na katerega ne moremo podati odgovora, ki bi v celoti razložil njegov izvor in funkcijo (Brown idr., 1999). Samomor pri drugih živalskih vrstah je slabo raziskana tema, zaradi očitne nezmožnosti takšne komunikacije, ki bi nam omogočala, da fenomen raziskujemo na način, ki bi vodil do zaključka, da so živali res samomorilne.

Durkheim je leta 1951 opisal različne vzroke samomora pri ljudeh in ga razdelil v štiri vrste, in sicer: egoistični, altruistični, anomični in fatalistični, pri čemer sta za raziskovanje samomora pomembna le prva dva tipa. Pri ljudeh je po avtorjevem mnjenju pogostejši egoistični samomor, do katerega pride zaradi izločenosti posameznika iz skupine, čemur sledita depresija in osamljenost. Altruistični samomor je nasprotje egoističnega. Pojavlja se v zelo socialnih družbah, v katerih se posameznik identificira s skupino in njegovi osebni interesi niso pomembni.

Z namenom zagotovitve holističnega odgovora na vprašanje, ali so ljudje res edina bitja sposobna samomora, smo v tej nalogi temo raziskali skozi altrustični in egoistični vidik. Namen altruistične perspektive je razširiti splošno razumevanje samomora z odgovorom na prvo raziskovalno vprašanje, ki se nanaša na obstoj različnih vrst altruističnega samožrtvovanja pri nižjih živalskih vrstah. Razlaga egoističnega vidika samomora pri živalih je bolj zapletena, pri čemer želimo skozi njo podati odgovor na drugi dve raziskovalni vprašanji, in sicer, ali egoistični samomor obstaja pri živalih, katerih življenja niso pod človeškim vplivom; in obratno, ali živali katerih življenja so podvržena vplivu ljudi, lahko storijo samomor.

Ob besedi »samomor« večinoma pomislimo na depresivnega posameznika, ki je nad svojim življenjem obupal in ga zato končal. Takšno dejanje vidimo kot breme za žalujoče svojce in prijatelje. Vendar pa je samomor lahko tudi koristen. Joiner (2010) je predlagal zanimivo misel, in sicer, da je včasih smrt živali vredna več od njenega življenja. Tako razmišljanje lahko srečamo tudi pri samomorilnih posameznikih, ki pravijo: »Svetu bo lažje, če mene ne bo,« ali »Svoji družini sem le v breme.« Pri starejših ljudeh, se tako razmišljanje lahko pojavi kot prekurzor za "racionalno motiviran" samomor (Marušič in Roškar, 2003), kjer se njihovo dejanje opravičuje skozi prepričanje, da bodo s tem zavarovali svoje svojce pred stisko in finančnim bremenom.

Pri nižjih živalskih vrstah je samožrtvovanje jasna evolucijska adaptacija, za katero ni potrebna racionalna podlaga. Pri žuželkah, ki živijo v velikih kolonijah, ki funkcionirajo kot

velik kompleksen organizem, je samožrtvovanje posamezne živali smiselno in potrebno v primeru infekcij, ki bi lahko bile škodljive za celotno kolonijo. V tem primeru je najboljša rešitev ta, da okužena žival zapusti kolonijo, čeprav ne more preživeti sama zunaj skupine. Tako vedenje je moč opaziti pri mravljah, listnih ušeh, osah, čebelah, drugih žuželkah in tudi pri določenih bakterijah (Joiner, 2010; Hudges idr., 2004; Wildon, 2015; Heinze in Walter, 2010; Nedelcu idr., 2011). Tako vedenje je podobno človeškemu nagonu samodestruktivnosti, ki naj bi ga čutili nekateri posamezniki, ki se počutijo v breme svoji družini (deCatanzaro, 1991).

Drugi primeri samožrtvovanja pri žuželkah na prvi pogled lahko delujejo kot altruističen samomor, vendar ni primerno, da jih vidimo kot take. V primeru samožrtvovanja skozi eksplozijo notranjih organov (Maschwitz in Maschwitz, 1974), varovanja legla (Caro, 2015; Kalat, 2015), spolnega kanibalizma (Plis in Farley, 1979; Preti, 2005) in drugih primerov, kjer samec umre takoj po parjenju (Joiner, 2010), ne moremo govoriti o samodestruktivnosti živali. V teh primerih nagon po preživetju ostane v ospredju do samega napada na žival, oziroma parjenja. Po napadu je najboljši izid situacije, da žival poveča možnost preživetja za druge pripadnike svoje vrste, kar rezultira v samožrtvovanju.

Dejanja, s katerimi organizmi povzročijo lastno smrt, srečamo pri zelo različnih živalskih vrstah, od visoko razvitih sesalcev pa vse do bakterij. Altruističen samomor je pomemben del preživetja in je značilen za celotno živalsko kraljestvo. Egoističen samomor pa srečamo le pri višje razvitih sesalcih, ki jim moramo, če dopuščamo možnost, da je njihova smrt bila namerno dejanje, pripisati inteligentnost, samozavedanje in čustva (Ramsden in Wilson, 2010).

Številne višje razvite živali lahko doživljanjo polni razpon čustev (Bekoff, 2000) in se hkrati ponašajo s kompleksnimi kognitivnimi sposobnostmi, kot je na primer uporaba jezika (Griffin, 1981). Najpomembnejši prekurzor za razvoj širše palete čustev, sofisticirane komunikacije in kompleksnih kognitivnih funkcij (predvsem pri primatih in delfinih) je kompleksnost njihovega socialnega okolja. Ker je pomanjkanje socialnega konteksta in podpore najboljši prediktor samopoškodovalnega vedenja in celo samomora, predvsem pri živalih v ujetništvu (Jones in Barraclough, 1987), predlagamo, da se socialna inteligenca in potreba po zdravem socialnem okolju doda na seznam potrebnih lastnosti za možnost egoističnega samomora.

Ob diskutiranju teh lastnosti pri živalih je potrebno upoštevati vpliv človeške subjektivnosti pri opazovanju živalskega vedenja. Nagnjeni smo k atribuciji človeških lastnosti na živalsko vedenje, kar lahko vodi do nepopolnih ali napačnih zaključkov (Heider, 1958). Iz tega razloga smo podrobneje preučili teoriji atribucije (ljudje vidijo vzročno–posledične povezave tudi, ko teh ni) in antropomorfizma (pripisovanje človeške podobe in/ali karakteristik vsemu, kar ni

človeško bitje), ki morajo biti uporabljene kot vodilo pri objektivnem obravnavanju karkšnih koli pripovedi o samomoru pri živalih.

Pri ljudeh je egoistični samomor posledica slabe socialne integracije, ki vodi do vrste kompleksnih bioloških abnormalnosti, kot so depresija, anksioznost, razdražljivost, brezup in impluzivnost. Te pojave je mogoče povzročiti in raziskovati skozi živalske modele (Malkesman idr., 2009). Vendarle pa samomora kot takega ni mogoče replicirati pri laboratorijskih živalih. Tematika egoističnega samomora pri živalih je zapletena, malo raziskana in polna špekulacij. Za oblikovanje čim bolj jasne predstave o tem, ali se egoistični samomor pojavlja v naravi ali le kot posledica človeškega vpliva, je potrebno ta pojav obravnavati ločeno pri domačih živalih, živalih v ujetništvu in živalih v divjini.

Pri obravnavi pojava egoističnega samomora pri živalih v divjini, je kritičen pristop privedel do ugotovitve, da je večino teh mitov mogoče ovreči skozi druge razlage. Pokazali smo, da živali v divjini, kot so postrušniki (majhni arktični glodalci), kiti in delfini, ne storijo masovnih samomorov (Woodford, 2003; Williams, 2003; Braitman, 2014). Prav tako škorpijoni ne storijo samomora preko pika z lastnim želom in psi ne skočijo iz mostov zaradi suicidalnih nagnjenj ali višje sile (Morgan, 1883; Smalwood, 2014). Nobena od teh živali v naravi nima samomorilnega nagona. Vendar pa v starejši literatuti in modernih popularnih medijih še vedno najdemo posamezne primere pojavov, ki na prvi pogled spominjajo na samomor (npr. Rahman, 2015). Takšni redki osamljeni primeri ne morejo biti nadaljnje analizirani in ovrženi skozi druge razlage, kar nam preprečuje, da bi lahko z gotovostjo trdili, da se samomor ne pojavlja med živalmi v divjini, na katere ljudje nimamo vpliva.

Po drugi strani je človeški vpliv razviden iz čustvenega stanja živali v ujetništvu, še posebej tistih, ki so vzrejene v ujetništvu z namenom eksperimetalnega raziskovanja. Večina poročil o samopoškodovalnem vedenju pri živalih izhaja iz poskusov, v katerih so živali izpostavljenje socialni izolaciji in dodatni stimulaciji (Kraemer in Clarke, 1990; Crawley idr., 1985; McClure idr., 1993; Jones in Barraclough, 1987). Vendar pa, ne glede na količino dodane stresne stimulacije, tako vedenje v nobenem od poročanih primerov ni vodilo v samomor. Razen zavračanja hrane pri živalih, ki jim je bila odvzeta prostost, je egoističen samomor v ujetništvu zelo redek pojav. Najdemo ga lahko v glavnem pri delfinih in primatih, ki pa v divjini ne kažejo takega vedenja.

Življenske razmere ujetniških živali se od naravnih razlikujejo v velikosti njihovega življenskega prostora in socialni skupini, ki jim je dodeljena. Omejen in nestimulativen prostor je nedvomno velik izvor stresa, še posebej za živali, ki niso bile rojene v ujetništvu. Socialno okolje je prav tako umetno in velikokrat živalim ne nudi primerne socializacije, ki je zelo pomembna za duševno zdravje živali, ki so v divjini močno povezane z drugimi člani svoje skupine. Delfini in primati, na primer, si v ujetništvu delijo svojo celico z enim ali večini

pripadniki svoje vrste, s katerimi se mogoče ne ujamejo, ali pa se nanje zelo navežejo. Največji izziv nastane, ko jim je mogoče edini prijatelj in vir socialne podpore odvzet. V takem primeru se lahko pojavijo jasni znaki depresije, ki v redkih primerih vodi v samomor. V naravnem okolju so socialne skupine velike in raznolike, in nudijo zadostno socialno podporo, ki preprečuje nastanek takih pojavov.

Največ primerov egoističnega samomora v znanstveni literaturi in drugih medijih se pojavlja med živalmi, katerih življenje je pod največjim vplivom ljudi. Pri tem mislimo predvsem na pse in druge hišne ljubljenčke ter domače živali. Anekdotski primeri samomorov trpinčenih konjev in drugih domačih živali, ki naj bi se namerno utopile, so nezanesljivi in jih ni mogoče potrditi (Preti, 2005). Vsekakor pa ne moremo zanikati obstoja samomora pri psih, ki globoko žalujejo za smrtjo svojega lastnika, kar v nekaterih primerih lahko vodi do popolnega zavračanja hrane in pomoči (Ramsden in Wilson, 2010; Lindsay, 1880; Preti, 2005).

Zbrane raziskave kažejo na to, da je dolgotrajna udomačenost in skupna evolucija psov privedla do njihove presenetljive sposobnosti empatije in kompleksnih kognitivnih funkcij. Med drugim so psi sposobni interpretirati lastnikovo razpoloženje, vedenje in namen, prepoznajo vesele in jezne človeške obraze, zapomnijo si, koliko lahko določeni osebi zaupajo in izražajo kompleksna čustva, kot je na primer ljubosumje (Hare idr., 2002; Takaoka idr., 2015; Müller idr., 2015; Harris in Prouvost, 2014). Njihova močna povezanost z današnjim modernim življenskim stilom ljudi je žal pripeljala tudi do vrste vedenjskih motenj, kot so separacijska anksioznost, obsesivno kompulzivno vedenje, kognitivna disfunkcija, panična motnja, post travmatska stresna motnja in fobije (Overall, 2000; Braitman, 2014). Iz navedenih raziskav je razvidno, da je povezava med psi in ljudmi kompleksna in globoka, iz česar je lahko razumljivo, da so psi sposobni občutiti žalost in brezup, ki jih lahko privede samomora ob izgubi svojega lastnika.

Zaključimo lahko, da se samomor pojavlja med mnogimi vrstami živali. Altruistični samomor služi določeni evolucijski funkciji in ga lahko najdemo v različnih oblikah, največkrat med žuželkami. Egoistični samomor se največkrat pojavlja pri živalih, na katere je človeški vpliv največji. Zaradi obstoja posameznih nezanesljivih primerov samomora živali v divjini ne moremo zaključiti, da samomor v egoistični obliki ne obstaja pri živalih, katerih življenja niso pod vplivom ljudi, čeprav si je težko predstavljati primer v naravi, ki bi živali privedel do izgube nagona po preživetju. Prav tako ne moremo z gotovostjo trditi, da živali, katerih življenja so pod vplivom ljudi, res lahko storijo samomor. Kljub vsemu lahko zaključimo, da pri živalih, predstavljenih v tej nalogi, do samomora ne bi prišlo, če človeški vpliv ne bi bil prisoten.

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