THE IMAGE OF SNAKES – LITERATURE REVIEW ABOUT ATTITUDES TOWARDS SNAKES

DIPLOMARBEIT

zur Erlangung der Würde einer

MAGISTRA MEDICINAE VETERINARIAE

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Abstract

The Pannonian basin is home to Europe’s smallest snake species, the Hungarian meadow viper (*Vipera ursinii rakosiensis*). Once very common throughout the Pannonic basin today the species is extinct in Austria and only survives in a few highly fragmented populations near lake Fertő, in the Hanság and the Kiskunság in Hungary. Since 2004, two EU funded projects have been focusing on the conservation and restoration of the Hungarian meadow viper in Hungary and possibly Austria. Restocking or re-introduction programs generally trigger public interest.

In the case of controversial species, like large carnivores or poisonous snakes, opposition has to be expected. Preliminary studies and the negative attitude towards snakes in general show that successful snake conservation has to go hand in hand with education programs to gain public support. But do people really primarily hold negative attitudes towards snakes? What are the most likely explanations for people’s attitudes towards snakes? What lessons can be learnt from the literature for designing snake education or snake conservation programs? With these questions in mind I reviewed the literature on human-snake relationships.

In summary I found 66 publications of which the majority dealt with snake phobias, their origin and treatment. My expectation that snakes largely trigger negative feelings in humans was supported by the literature and can be traced back to the fact that: 1) snake differ extremely from humans in their anatomy, b) in European culture and religion negative associations of snakes prevail, and c) animals phobias and particularly snake phobias have a high prevalence in humans.

Ingrained negative attitudes towards snakes and fear of snake are unlikely to be changed simply by providing factual information. Reptile facilities which provide shows during which keepers handle snakes or even allow for a direct interaction with snakes while providing information on snake ecology and conservation are likely to have a longer lasting and more positive effect on people’s attitude than just providing written information. In this respect the meadow viper breeding facility in Hungary is ideal as an educational center for school children.
I. Introduction

Snake populations decrease worldwide (READING et al., 2010). But this is not a “tropical” issue which occurs only in distant countries. Like other animals, snakes are endangered by destruction and fragmentation of their habitat. Furthermore snakes seem among those animals that rank lowest in people’s attitude (COBORN, 1995). Although the chances to come to harm by a snake are minimal in Europe (KASTURIRATNE et al., 2008), snakes are among the most prevalent object of intense fear by people suffering from animal phobias (ÖHMAN & MINEKA, 2003). Fear and dislike of snakes often results in indiscriminate or organized killings (O’SHEA, 2005) and can be expected to greatly hinder snake conservation or restoration especially of poisonous species.

The Pannonian basin is home to Europe’s smallest snake species, the Hungarian meadow viper (Vipera ursinii rakosiensis). Once very common even in the Vienna basin (MÉHELY in 1912), today the species only survives in a few highly fragmented populations near lake Fertő, in the Hanság, and the Kiskunság in Hungary, totaling less than 500 individuals (UJVARI et al., 2002). In Austria the species is considered extinct (KAMMEL, 1992). Habitat destruction and fragmentation have been identified as the key threats for meadow viper conservation. However illegal collections and direct persecution by people are also important threats (EDGAR & BIRD, 2006).

In 2004 the Hungarian Meadow viper Conservation centre was founded in Kiskunság with the main goal to breed vipers collected from threatened populations. The breeding success with Hungarian meadow vipers in the semi natural outside enclosures is excellent and it is planned to use the captive bred snakes to supplement existing occurrences and re-establish the snake in suitable habitats within its former distribution range in Hungary and possibly Austria. Restocking or re-introduction programs generally trigger public interest. In the case of controversial species, like large carnivores or poisonous snakes, opposition has to be expected (e.g. WILIAMS et al., 2002). Preliminary studies and the negative attitude towards snakes in general show that successful snake conservation has to go hand in hand with education programs to gain public support. Successful examples exist for non-poisonous (e.g. Antiguan racer Alsophis antiguae on Great Bird Island, DALTRY et al., 2001) as well as poisonous (e.g. Prairie rattlesnake Crotalus viridis in Alberta, ERNST, 2003) snakes.
In this study I reviewed the literature on human-snake relationships with the main aim to provide an overview of its various facets as well as the underlying reasons. I focused on the following questions:

- Do people really primarily hold negative attitudes towards snakes?
- What are the most likely explanations for people’s attitudes towards snakes?
- What lessons can be learnt from the literature for designing snake education or snake conservation programs?

II. Material and Methods

1. The Hungarian meadow viper

_Vipera ursinii_ is the smallest European viper with a total length of 40 – 45 cm and has the typically appearance of a viper with dorsal zigzag and dark markings on a grey or brownish ground. Due to the high ambient temperatures in their lowland habitats the meadow viper can warm up quickly. This and the fact that these snakes are very alert and well camouflaged make them hard to detect. The main diets of the meadow viper are insects, spiders, small lizards and occasional small mammals. Consequently the venom of the meadow viper is weak and only constitutes a minor health risk for humans (MALINA et al., 2008).

The meadow viper is one of the most threatened snakes in Europe with 5 subspecies known: The Balkan meadow viper (_Vipera ursinii macrops_), the Greek meadow viper (_Vipera ursinii graeca_), the Moldavian meadow viper (_Vipera usrinii moldavica_), the Orsini’s meadow viper (_Vipera ursinii ursinii_) of southeastern France and central Italy and the Hungarian meadow viper (_Vipera ursinii rakosiensis_; EDGAR & BIRD, 2006).

The Hungarian meadow viper occurs in dry lowland meadow-steppe grasslands, up to a maximum of 800 m but usually below 300 m (EDGAR & BIRD, 2006). The only remaining known occurrences of the Hungarian meadow viper are near Lake Fertő (Neusiedler See), Hanság and Kiskunság with an estimated total number of 450-500 individuals (B. HALPERN pers. comm.). These remaining sites with Hungarian meadow viper occurrences are isolated due to agricultural reclamation, increased human activities, artificially high level of predators like wild boar and pheasants as well as illegal collection and outright persecution (SANTOS et al., 2009). In Austria where the Hungarian meadow viper was once common throughout the Vienna basin it is now considered extinct (KAMMEL, 1992; EDGAR & BIRD, 2006).
The Hungarian meadow viper is protected in Hungary since 1974, strictly protected since 1988, and was raised to the highest conservation category in 1992. Internationally the meadow viper is included in Bern Convention Appendix II., categorized as ‘endangered’ by IUCN, listed in CITES Annex I and listed in the EU Habitats Directive in Annexes II and IV. The action plan for the conservation of the meadow viper in Europe foresees, among other things, to re-establish, enlarge or re-connect the meadow viper populations in Hungry and possibly re-establish the species in Austria (EDGAR & BIRD, 2006). Further activities include habitat restoration and management, population monitoring as well as public awareness and education campaigns. Since 2004, two EU funded projects have been focusing on the conservation and restoration of the Hungarian meadow viper in Hungary (http://www.rakosivipera.hu/en/).

2. Literature review

I searched the literature for publications and reports on snake-human relationships using the search engines ISI and Scopus by entering the following key words: snake(s), serpent(s) in combination with fear, anxiety, phobia, human, people, history, relationship, attitudes, environmental education, educational programs, therapy, religion, snakebite, reptiles, re-introduction, re-establish, conservation, conservation programs. Moreover, I searched the references of the obtained publications for additional references likely dealing with human-snake relationships.

If I could only find the abstract of an article, I tried to reach the author to ask for a reprint. About 35 authors were contacted by email. Only 8 authors answered my inquiry. In case, nobody answered I excluded the abstract. I additionally searched the library of the University of Veterinary Medicine in Vienna for books concerning snakes, their biology, history or husbandry guidelines. For additional material on snake-human relationship, I browsed the world wide web entering “snakes” combined with “educational programs”, “school” and “Chinese calendar” in the search engine google (www.google.at). I saved all references as numbered pdf files and organized them accordingly in program ProCite 5 (Adept Scientific GmbH, Frankfurt, Germany) and Reference Manager 11 (Adept Scientific GmbH, Frankfurt, Germany).

For this review I located and summarized 66 references of which 51 were articles from scientific journals, 5 from books and 10 from internet pages (Table 1). I organized the
references into 6 main groups: attitudes and perception of snakes including dangerous snakes, historic background, prevalence of fear, phobias and their origin, therapy of phobias and education. The majority of publications (24; 22 journal articles and 2 homepages) dealt with the phobias and their origin and 10 journal articles and 1 homepage with the therapy of phobias. Environmental education, focusing on snakes was the topic of 2 book, 7 journal articles and 3 homepages. Three journal articles, 3 books and 2 homepages reviewed the historic background of our image of snakes. The prevalence of fear was the topic of 4 journal articles. The risk of snakebites and the attitudes towards and perception of snakes were in the topic of 6 journal articles and 1 homepage. The majority of the reviewed references were published after 2000 (Fig. 1).

Fig. 1: number of used literature in ascending date sorted in books (pink), internet references (yellow) and papers (blue)
Table 1: Number of articles by source used for this review.

<table>
<thead>
<tr>
<th>Journal</th>
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<tr>
<td>American Journal of Medical Genetics</td>
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<tr>
<td>American Psychiatric Association</td>
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<td>Archives of General Psychiatry</td>
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<tr>
<td>Behavioral and Brain Sciences</td>
<td>1</td>
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<tr>
<td>Behaviour Research and Therapy</td>
<td>4</td>
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<tr>
<td>Biodivers Conserv</td>
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<td>Biological Psychiatry</td>
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<tr>
<td>Biological Psychology</td>
<td>1</td>
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<tr>
<td>Biotechnology &amp; Biotechnological Equipment</td>
<td>1</td>
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<tr>
<td>BMC Psychiatry (biomedcentral)</td>
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<tr>
<td>Cognitive Affective and Behavioral Neuroscience</td>
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<td>Cognitive Therapy and Research</td>
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<tr>
<td>Current Directions in Psychological Science</td>
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<tr>
<td>Current Issues in Tourism</td>
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<tr>
<td>Developmental Science has been published in psychology</td>
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<td>Emotion has been published in psychology</td>
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<td>Ethology</td>
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<td>European Journal of Neuroscience</td>
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<td>European Journal of Oral Science</td>
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<td>Herpetologica</td>
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<td>Herpetological Review</td>
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<td>International Journal of Global Environmental Issues</td>
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<td>International Journal of Psychophysiology</td>
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<td>Isis</td>
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<td>Japanese Psychological Research</td>
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<td>Journal for Nature Conservation</td>
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<td>Journal of Anxiety Disorders</td>
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<td>Journal of Ayub Medical College Abbottabad</td>
<td>1</td>
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<tr>
<td>Journal of Behavior Therapy and Experimental Psychiatry</td>
<td>5</td>
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<tr>
<td>Lecture Notes in Artificial Intelligence (LNAI)</td>
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<tr>
<td>Neuroimage</td>
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<td>NeuroReport</td>
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<td>Oryx</td>
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<td>Physiology and Behavior</td>
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<tr>
<td>Proceedings of the National Academy of Sciences (PNAS)</td>
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<td>Psychiatry Research: Neuroimaging</td>
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<td>Psychophysiology</td>
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<td>Public Library of Science Medicine (PLoS)</td>
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<td>The Quarterly Journal of Experimental Psychology</td>
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<td>Science</td>
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<td>Society and Animals</td>
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<tr>
<td>Wildlife Society Bulletin</td>
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Thirty-eight references were published in psychological journals (e.g. Journal of Behavior Therapy, Experimental Psychiatry or Behaviour Research and Therapy) and only 28 references were published in ecological or life science journals (e.g. Biological Conservation, Science or Nature).
III. Results

1. Attitudes towards and perception of snakes

1.1. Aesthetic perception of snakes

There are very few studies looking at people’s attitude towards snakes other than in the context of fear, which tends to be high (e.g. BREWER, 2001). The few studies that looked at attitudes toward snakes found them to be largely negative and likely influenced by the fear of snakes (PROKOP et al., 2009; YOREK, 2009).

Snakes move fast without feet, use their tongue for sensory information, have unblinking eyes and swallow their prey in one piece (MARKWELL & CUSHING, 2009). The Similarity Principle predicts that animals which are similar to humans or which are physically attractive to them are more likeable to people. Consequently these animals receive more attention and their conservation will be of higher priority (TISDELL et al., 2006a; TISDELL et al., 2006b). Public interest and the willingness to pay for their conservation is biased towards attractive animals, large animals, animals having childlike characteristics (e.g. large head and large eyes), animals that are consider to be a higher form of life and anthropomorphic (human-like) animals.

Aesthetic preferences for animals may be rather similar across humankind. In a study comparing students from Czech Republic and local villagers from Papua New Guinea the authors expected that the aesthetic perception of snakes would differ between Europeans and Papuans due to the large number of venomous snakes in Papua New Guinea. The authors were surprised to learn that people from two very different cultures and life realities showed a very similarity ranking of different snake species. It may be possible that this result is a consequence of more general perceptual processes that are not animal specific, e.g. colors and patterns. However, the ranking of colors is known to differ significantly between European and Papuan inhabitants (MARESOVA et al., 2009).

1.2. The danger of snake bites

KASTURIRATNE et al. (2008) analyzed global snakebites, envenoming and death due to snakebites. It was shown that globally between 1.2 million and 5.5 million snakebites lead at least to 421,000 envenomings and 20,000 deaths each year. The majority of snakebite victims are rural men of developing countries due to a lack of knowledge about first aid and deficient
medical care (HAYAT et al., 2008; WHO, 2010). Consequently, the highest number of envenomings and deaths occur in South Asia, Southeast Asia, and sub-Saharan Africa, the lowest in Central Europe and Central Asia. In Western- and Central Europe, where few poisonous snake species occur and medical facilities are well equipped, the estimated death toll due to snake bites is 5-6 human fatalities per year (KASTURIRATNE et al., 2008).

1.3. The portrait of snakes in human culture

1.3.1. Legends
The image of snakes portrayed in religious texts or folk tales is highly polarized: either extremely negative or extremely positive. In the majority of legends, snakes are either equated with a godlike creature or with a demoniac ghosts. In the Greek mythology the foundation of many cities go back to snake-like kings or a fight between a king and a snake (BAUCHOT, 1994). Chimeric creatures including snakes and sea snakes are often described in the mythology of Greece, e.g. in Homer’s Iliad (BAZOPOULOU-KYRKANIDOU, 2001). Similar stories, dealing with the fight between a hero, king or a god and a snake or a snake-like creature, are a part of the mythology of many nations like India and Japan (BAUCHOT, 1994).

In the Middle Ages humans believed in dragons in the shape of giant snakes, snakes with wings or creatures consisting of a snake-body, claws and the head of a beast (BAUCHOT, 1994). Because of findings of fossil bones of whales and other huge animals this idea has been intensified. The myths of dragons are supposed to have their origin in primitive myths mainly about pythons long before the Middle Ages (STOTHERS, 2004). Today European people still belief in snake-like creature like the Loch Ness in Scotland (NIETZKE, 1989).

1.3.2. Religion
Not only in mythology, also in religions snakes are seen either extremely negative or extremely positive (godlike). In the Christian tradition the snake is the epitome of the evil (BAUCHOT, 1994). In the book of genesis the snake persuaded Eve to eat the fruit of knowledge resulting in the exclusion from Eden (ÖHMAN & MINEKA, 2003). In Egypt it was believed that the world was created by the giant-snake Apep or Apophis and Egyptian pharaohs wore a snake on their crown as a symbol of protection (NIETZKE, 1989; BAUCHOT, 1994). In south America the Quetzalcoatl was the snake-like god of the Toltec
people and a symbol of death and rebirth (BAUCHOT, 1994). In Africa snakes represent a connection between god and human being (BAUCHOT, 1994). This admiration has been transported with the slave trade to Haiti and America (COBORN, 1995). Also in Central America and Egypt people believed in the divine quality of snakes (COBORN, 1995). In India Nagas, snake-like gods or reincarnations of important people, can pass medical knowledge to humans (BAUCHOT, 1994; COBORN, 1995).

The aboriginal inhabitants of Africa and Australia believe that snakes played an important role in the creation of the world (BAUCHOT, 1994). Snakes are often combined with the element water which is essential for living (BAUCHOT, 1994). In Australia the Rainbow-snake is combined with the origin of life and protects waterholes from drying-up (COBORN, 1995). In North America the Hopi Indians have a ritual called the dance of snakes for which they collect up to 60 snakes, wash them and dance with them (BAUCHOT, 1994).

1.3.3. Snake symbols

The Aesulapian Staff is a symbol of medicine. The Greek god Asklepios is often seen in the form of a snake or he is carrying a staff with a snake on it (BAUCHOT, 1994). Another possible origin of the Aesculapian Staff is the history of Hermes or Merkur (the god of the travelers) who separated 2 fighting snakes with a staff. Consequently the Aesculapian Staff is also a symbol of peace (BAUCHOT, 1994). Another symbol of medicine and commerce is the caduceus. The caduceus is a staff entwined by 2 snakes often included by wings originally representing the planet Mercury. This symbol can be found e.g. on the uniform of some American Medical Associations who use the caduceus as a medical sign by mistake (http://en.wikipedia.org/wiki/Rod_of_Asclepius).

In Brazilian religions and traditional Chinese medicine snakes are often seen as mystic animals and humans buy their organs in order to get health, love or financial success (ALVERS & FILHO, 2007). In the Chinese calendar the snake is one of the 12 zodiacs. People born in the year of the snake are believed to be quiet and helpful humans. Furthermore they do not have to worry about money and are usually good-looking persons (CHINESE CULTURE CENTER OF SAN FRANCISCO, 2008)

2. Snake phobias

2.1. Definitions
Anxiety disorders are pathological forms of anxiety which include pathological fear and phobias. Anxiety is a normal reaction to stress in order to prepare us for an unexpected negative event. Fear is a mechanism to survive. It is an emotional reaction to a threatening stimulus. There is a wide range of fear-variations, from mild-fear (caution) to a pathological form of fear (e.g. phobias and paranoia). Phobia is an intensive and persistent fear of an external stimulus. They are a form of learned, irrational anxiety disorder due to a negative event in the past. Phobias are divided into 3 groups (AMERICAN PSYCHIATRIC ASSOCIATION, 1994): the social phobias (e.g. public speaking), the agoraphobia (a phobia of leaving home) and specific phobias (e.g. snakes, spiders, height, water). Clinical signs of anxiety and anxiety disorders are related to the fight-or-flight system that is activated by the sympathetic nervous system. The amygdaloid region of the brain (the amygdala) activates hormones that enable the body into an alert state. This leads to an increased heart rate, an increased blood pressure and sweating. Phobic patients show the same symptoms but the intensity depends on the possibility to avoid confrontations with the threatening stimulus. The fear of phobic patients can range from a mild anxiety to panic attacks (http://en.wikipedia.org/wiki/Phobia).

2.2. Anatomic location of fear and phobia

The anatomic location of fear is believed to be in the amygdala, which is a collection of nuclei situated in the medial temporal lobe of the brain (KOPP & ALTMANN, 2005). The amygdale has a primary role in the processing and memory of emotional reactions. In phobic stimulations it could be shown that the numbers of substance P-Neurokinin-receptors of the right amygdala are responsible for the effect of fear (MICHELGARD et al., 2007). Another study showed that event-related brain potentials of fearful individuals reached the maximum at the centro-parietal and partly the parietal brain regions (MILTNER et al., 2005). Anticipation, an aspect of fear, is located in the anterior insula, dorsolateral prefrontal cortex, and parahippocampal gyrus including the amygdala (SIMMONS et al., 2004). Startle, a defense response, is activating the left amygdala and the anterior cingulate cortex (PISSIOTA et al., 2003).

Many scientists examined the regions of the brain where the detection of fear-relevant stimuli take place. Fox et al. (2007) demonstrated that these stimuli (e.g. snakes, spiders) are detected more efficiently than fear-irrelevant stimuli (e.g. flowers, mushrooms) by using a visual
search task. ÖHMAN et al. (2007) showed that the detection seems to be situated in the amygdala activated via a neural pathway including the thalamus. This pathway, also known as the subcortical route, is an important structure for the classical conditioning of fear. These findings can be interpreted that ancient fear-relevant stimuli (e.g. snakes) were conditioned during the evolution, which support the evolution theory of the origin of snake fear (ÖHMAN et al., 2007). BLANCHETT (2006) reported a difference in the detection of recent (e.g. guns) and ancient (e.g. snakes) evolutionary threats. She supposed this could be due to two different neural pathways in the brain distinguishing between evolutionary threats (the subcortical route) and modern threats.

2.3. Methods of evaluating anxiety, fear and phobia

An important issue of therapy of fearful or phobic patients is the degree of their anxiety disorder. A large number of literatures refer to the different methods of tests, scoring and treatment of phobias. To understand the origin and the different approach of treatments it is important to differentiate between anxiety, fear and phobia. To evaluate the kind and degree of anxiety disorder as well as the success of treatment, different methods are used. The self report of patients alone provides a rather low expressiveness and is therefore often combined with physiological parameters (e.g. heart rate, blood pressure or skin conductance before and during in vivo exposure). The skin conductance test is a measurement of the electrical resistance of the skin that varies when muscle tissue is strained (e.g. when the fight and flight system is activated) (TEARNAN et al., 1982; MCGLYNN et al., 1995; FLYKT et al., 2007)

2.4. Prevalence of snake fear and phobia

There is a wide variety of the prevalence of fears depending on the specific kind of fear (OOSTERINK, 2009). Fear of animals is the most frequently reported fear with a prevalence of 12.6 – 39.0%. Animal fear seems to depends on age, sex, geographic location and the cultural background of people (ARMFIELD, 2007). Women are affected two or three times more frequently than men. A study of New England showed that snakes are the most prevalent object of intense fear, with 38% of women and 12% of men showing this specific fear (ÖHMAN & MINEKA, 2003). OOSTERINK et al. (2009) also showed a prevalence of 34.8% for fear of snakes among Dutch adults, with females having significantly higher mean severity of fear rating than males.
Fearful individuals do not necessarily develop phobias. Rather, the development of phobias depends on a combination of factors like genetic predisposition, the developmental environment, and experiences with the frighten stimuli (FYER, 1998). The prevalence of specific phobias (the fear of a single specific stimulus) is estimated at about 10%, with animal phobias being the most frequently seen specific phobia (1.1 – 7.9%; OLSSON et al., 2005; OOSTERINK et al., 2009). In Dutch adults, the prevalence of snake phobia is 1.2%, and of spider phobia 2.7% (OOSTERINK et al., 2009).

2.5. Origin of snake fear

There are different hypotheses about the origin of snake fear. An evolutionary background, as well as genetic and cognition factors are discussed.

2.5.1. Genetic factors:
Genetic factors in the etiology of fears and phobias could be seen in familial aggregation by interviewing twin pairs. The best fit model showed that family aggregation was due to genetic factors with modest heritability between 25% and 37%. It is also reported that this genetic influence has probably the same effect for men and women (KENDLER et al., 2001).

2.5.2. Evolution hypothesis:
ÖHMAN et al. (2007) use the term “preparedness theory” to explain the evolutionary background of the readiness to learn fear. The preparedness theory deals with the fact that some fears are more common and easier to learn. This could be attributed to our evolution during which snakes played a role as predators on hominids and early humans (ÖHMAN et al., 2007; AHS et al., 2009). Therefore there was a selection on genes that are responsible for traits which help to avoid getting bitten (e.g. a highly developed visual system integrate with the fear system; ÖHMAN et al., 2007). The difference of snake fear in different primates which can be seen nowadays might be explained by the genetic variability and the division into old world monkeys (e.g. chimpanzee and humans) remaining in Africa with its venomous snakes, the monkey (later to become lemurs) dispersing to Madagascar which lacks venomous snakes and the new world monkeys which radiated throughout South America which was initially free of venomous snakes (ÖHMAN & MINEKA, 2003; OLSSON et al., 2005; ÖHMAN, 2007; OOSTERINK et al., 2009).
To proof the preparedness theory many different studies have been done. Experiments supporting this theory demonstrated that fear could be learned by watching other individuals. In general there is a higher readiness to acquire fear towards threat relevant animals than towards harmless animals (KENNEDY et al., 1997; ÖHMAN & MINEKA, 2003; ÖHMAN, 2007; DAVEY, 1995). In one experiment it was tested, if monkeys can learn to fear snakes and flowers by simply by watching a video. The results showed that primates easily learn to fear snakes by observing other individuals displaying a fear response, but that they do not learn to fear a flower in this way. This seems to proof a selective association developed for fear of snakes (FOX et al., 2007). High-fear individuals may enhance their fear by selectively processing information about their fear-relevant stimuli (KENNEDY et al., 1997). Beside the readiness to learn fear, another important evolutionary survival mechanism is the fast detection of dangerous stimuli (e.g. snakes) in order to prevent getting injured. This ability of detecting a potentially dangerous object is known as the attention capture (FOX et al., 2007). At the majority of these tests the visual search task was used. This tests shows pictures on a monitor with different animals and the participant has to decide as fast as possible if the determined animals is on this picture or not. WATERS et al. (2007) reported a high attention capture by fear-relevant animals (e.g. snakes, spiders) in fearful patients. It could be seen that on pictures with different animals, fear-relevant animals could be found easier than non fear-relevant animals (e.g. horses, fish, birds). Moreover this detection was enhanced in fearful people. Not fear-relevant stimuli like mushrooms and flowers on the pictures with snakes or spiders were detected slower in humans who are afraid of snakes or spiders. Most studies about attention capture have been done with fearful patients. But MIYAZAWA & IWASAKI (2009) showed that the modulation of attention capture by threats occurs irrespective of the fear of an individual. This supports the notion of an evolutionary background where the majority of a population should show avoidance of fear-relevant animals. Faster detection of threatening stimuli is also known as the threat-superiority effect. BLANCHETT (2006) tested the effect of high and low evolutionary significance of a fear-relevant stimulus. High evolutionary threats are stimuli that occurred in the early evolution like snakes and spiders. Low evolutionary threats are stimuli that were not present during early evolution but are nowadays threats like guns and knives. The results proof that the threat-superiority theory is not restricted to ancient threats. One problem in the threat-superiority theory is the fact that it was shown that nonthreatening animals (e.g. cats and
pigeons) resulted in the same effect as threatening animals do. Because phobic individuals show an increased threat-superiority effect only for their feared animal it seems that fear, not the animal per se, plays a role.

SANDER et al. (2005) pointed out, that the attention capture (or threat-superiority effect) should be renamed into relevance detection model due to the fact, that the same system should be activated by any relevant stimuli. This hypothesis assumes that highly relevant stimuli lead to a faster detection than low relevant stimuli (FOX et al., 2007). However, the fact, that highly potent ontogenetic (learned) threat stimuli (guns) are similar with potent phylogenetic (inherited) threat stimuli (snakes) is not explained by the evolution theory. The results of an experiment demonstrate this, by measures of the mean reaction time, where snakes were not detected earlier than guns. The conclusion of this study was that attention capture is flexible and can be modulated (FOX et al., 2007).

2.5.3. Conditioning

Classical conditioning (also known as Pavlovian reinforcement) is a form of associated learning; people or animals connect a stimulus with a certain reaction or behavior. The aim of classical conditioning is to pair an unconditioned stimulus with a conditioned reaction. Pavlov tested the classical conditioning by using dogs and a neutral, “unconditioned” stimulus (e.g. metronome) which do not lead to a reaction and a “conditioned” stimulus (e.g. food) which leads to a “unconditioned reaction” (e.g. salivation). After pairing the “unconditioned” (metronome) and the “conditioned” (food) stimuli for a few times the “unconditioned” reaction of the food (salivation) could be caused by similar using the “unconditioned” stimulus. Therefore the “unconditioned” reaction became a “conditioned” reaction (http://en.wikipedia.org/wiki/Classical_conditioning). Cognitive theories postulate that the correlation of fear-relevant stimuli (e.g. snakes, high, water) and negative experiences in the past leads to the maintenance or development of fears (KOPP et al., 2005). But not only fear-relevant stimuli can lead to fear. DAWSON et al. (1986) demonstrated that conditioning is independent of the kind of stimulus. Potentially phobic (fear-relevant) stimuli could be learned the same way like neutral (fear-irrelevant) stimuli.

DELOACHE et al. (2009) tested two different notions, either there is an innate fear of snakes, where learning is not necessary, or an evolved tendency to associate snakes with fear. Fearful individuals often cannot identify the moment of the origin of their fear. By testing young children watching different films of snakes and other animals the hypothesis of an innate fear
of snakes could be eliminated because the children did not look differentially on snakes and other animals. On the other hand children quickly learn to associate a moving snake with the sound or voice of a fearful individual. In order to find out if the movement of the snake plays an important role in this reaction, an experiment was done where photographs instead of films were shown. But the children did not look differentially at the non-moving snake and other animals (DELOACHE & LOBUE, 2009). Because an innate fear of snakes could be neglected there has to be a predisposition to learn the association between snakes and fear. By hearing a frightened voice the children looked longer at the snake than on other animals. This demonstrates that there is a predisposition in children to associate snakes with fearful stimuli (DELOACHE & LOBUE, 2009).

The cognitive vulnerability model shows that animal fear is a result of how an animal is perceived. This explains the uneven distribution of animal fear in human populations in different countries. A questionnaire survey where students had to rank 4 high-fear (snake, spiders, cockroaches and rats) and 4 low-fear animals (ducks, rabbits, cats, guinea pigs) according to their subjective fear and perception of dangerousness, disgustingness, uncontrollability, unpredictability, loomingness, negative evaluation, familiarity and leaning history shown that vulnerability, uncontrollability, perceptions of loomingness and negative evaluation are highly correlated with fear. On the other hand, unpredictability had the lowest correlations with fear, and familiarity with the animal had a negative correlation with fear (ARMFIELD, 2007).

An interesting aspect in the examination of fear is the fact, that animal fearful patient have a tendency to exaggerate why animals might be harmful or might be safe. When comparing students with a high and a low level of fear towards spiders, the spider-fearful persons could name more reasons why fear-relevant (e.g. tiger, snakes) animals were harmful, but also why fear-irrelevant (e.g. rabbits, kitten) animals were safe (CAVANAGH & DAVEY, 2003)

2.6. Therapy

The major problem with the therapy of fears and phobias is the psychological stress for patients confronted with their fear stimuli, which may also compromise the successful outcome of therapy.

2.6.1. Imaginal ability
One direction of therapy focuses on the imaginal ability of the patient. Imaginal ability means the ability to imagine pictures and actions in a moment when they are not perceived (http://en.wikipedia.org/wiki/Imagination). This direction of therapy includes the use of virtual reality as a therapeutic tool in order to create a “smooth” therapy for phobic patients. Imaginal exposure is a mild form of exposure therapy where people have to imagine handling a snake (TEARNAN et al., 1982; HUNT et al., 2006). A study tested the effectiveness of virtual reality for therapeutic use compared to using pictures or “real” fear-relevant stimuli. They split emotional responses on the stimuli in 2 dimensions, the valence (to categorize an emotion) and the arousal. They used the skin conductance responses as an index of arousal and the startle eyeblink responses as an index of valence. It could be shown that videos exhibited more negative valence as still images. Moreover films showed a strong effect on the physiological arousal. The author proposed to use virtual reality in the therapy of phobic patients (COURTNEY et al., 2009). It was argued that imaginal ability correlates with the number of aversions of people. But HUNT & FENTON (2007) could not confirm these findings. They showed that imaginal ability was not correlated with pre-treatment or avoidance.

HUNT et al. (2006) tested the efficacy of in vivo exposure compared to cognitive imagery modification and a minimal exposure. Cognitive restructuring is a modification of the relationship between the frightening images of the stimuli and the actual stimulus (e.g. the snake). This method includes finding the frightening beliefs and providing new information about snakes. Hunt pointed out that this modification differs significantly from imaginal exposure. The results of this study showed that cognitive restructuring is an effective therapy and is easier to tolerate for highly fearful patients. However, for less fearful individuals this therapy approach was more difficult because they had less pronounced frightening images to relate to.

2.6.2. Relaxation training

Another possible method of stress-reduction during in vivo therapy is giving a relaxation training before exposure therapy which seems to be an effective method to reduce heart-rate changes, skin-conductance changes and self-reports of fear during the therapy (MCGLYNN et al., 1995). TEARNAN et al. (1982) compared covert modeling alone where participants had to imagine handling a snake and covert modeling plus self-instructions. In covert modeling alone the participants imagined an anxious scene eventually overcame their fear. In the covert
modeling plus self-instructions the participants imagined the same scene but were able to self-verbalize their fear and self-instruct strategies for coping with their fear. It could be seen that covert modeling plus self-instructions led to an improvement in self-report of fear. However, the patients’ behavioral measure, which measures how close a patient can move to the fear-relevant stimulus, did not differ between the two groups.

2.6.3. Safety behavior
The third opportunity of gentle therapy is providing safety behavior to the patients. MILOSEVIC & RADOMSKY (2008) tested the effect of safety behavior, like gloves and goggles, in the treatment of specific phobias. During the in vivo exposure therapy the safety behavior group was able to reduce the distance between themselves and the snakes. But post-treatment, where both groups did not wear gloves or other safety gear, the safety behavior group and the control group showed comparable treatment gains.

2.6.4. Post-treatment return of fear
ROSE et al. (1997) pointed out the high number of post-treatment return of fear which can range between 25% and 30% in fearful patients. The responsible factors could not be identified. Some of these factors include the intensity of pre-treatment fear as well as the duration and method of exposure therapy.

3. Educational programs
TISDELL et al. (2006b) tested the notion that information about species could increase the likeability and could change the readiness to save endangered animals. Secondly it was discussed what factors influence the humans choice. For this survey 204 Australians had to vote whether or not they were in favor of the survival of a native species. The same individuals filled in two questionnaires, one prior to and one after having received information about each species including the species’ pictures, description, geographic distribution, life history and conservation status. Some species were ranked higher in the second questionnaire; that is after the respondents had received information on each species. However, TISDELL et al. (2006b) caution that this study only assessed whether or not people favored the survival of a species, but not their readiness to pay for conservation.
Although most people do not like snakes, reptile houses are frequently visited by humans. One reason for this is to satisfy their curiosity (MARKWELL & CUSHING, 2009). However, zoo visitors on average only spend a brief time (just 8 seconds per stop) at any given exhibition (MURPHY & XANTEN, 2007). Venomous and large snakes are watched a few seconds longer than non-venomous and small snakes and a large number of snakes is more compelling to watch and thus has a higher “staying power” (the time spend in front of an enclosure; MARKWELL & CUSHING, 2009). Unfortunately, there seems to be a trend in zoos in the United States to reduces money and space for reptiles or construct multi-species enclosures where small and inconspicuous species (e.g. snakes or amphibians) are often not detected by the visitors (MURPHY & CARD, 1998).

Possibilities to increase the attention of visitors are family learning centers and reptile discovery centers. It could be shown, that interactive stations, description of the reptilian biology and the answer of questions slow people down. Snake exhibits should not focus on facts about single species, but ideally raising awareness for biodiversity conservation (TISDELL et al., 2006b; MARKWELL & CUSHING, 2009) or the important ecological role snakes fulfill by feeding on pests who eat plants or transmit diseases (O'SHEA, 2005; O'SHEA, 2007). Another aim of reptile exhibitions, especially in countries with many different snakes, can be to teach visitors to differentiate between endemic venomous and non-venomous snakes (MARKWELL & CUSHING, 2009). An educational form of entertainment was done in the Reptile Park in Australia, where visitors were able to watch the milking of venomous snakes to produce antivenom while listening to a presentation about antidots, antibodies and other medical issues (MARKWELL & CUSHING, 2009). Centers like this improve the visitors’ feelings about reptiles and enhance the information about the keeping, feeding and conservation of these animals (MURPHY & XANTEN, 2007).

However, ingrained negative attitudes towards snakes are unlikely to be changed simply by watching a snake exhibit (MARKWELL & CUSHING, 2009). Furthermore, education programs on Great Bird Island of Antigua showed that information alone and direct contact to snakes had little effect on attitudes, except increasing knowledge (DALTRY et al., 2001). Children are easier to reach, especially when they are young and have not yet acquired a fear of snakes. Several snake owners offer “snake sessions” for schools during which they give information about snakes and spiders and also allow children to get in contact with these animals (e.g. www.fruehling-austria.at). The feedbacks from participating schools seem positive (www.fruehling-austria.at). A snake farm in Schladen (Germany), which besides...
providing information to children and adults about snakes, also provides the opportunity to caress snakes and spiders (www.kindererlebnis.de/schlange). Quiet frequently children are much braver than their parents when handling snakes (www.kindererlebnis.de/schlange).

IV. Discussion

My expectation that snakes largely trigger negative feelings in humans was largely supported by the literature (BREWER, 2001). However, only few studies actually measured attitude towards snakes (e.g. PROKOP et al., 2009), whereas the majority dealt with the perception of snakes or the fear of snakes. Snakes are often perceived to be creepy, ugly and dangerous, even in Europe (KOVAC, in prep.; ZIKA, in prep.) were the risk to come to harm by snakes is minimal (KASTURIRATNE et al., 2008). Snakes are animals that differ extremely from humans by their behaviour and anatomy and thus trigger little sympathy as predicted by the similarity principle (LEE, 2010; TISDELL et al., 2006b).

In European religion and culture the image of the snake is also largely negative. In the Christian tradition the snake is the epitome of the evil (BAUCHOT, 1994). In the Middle Ages humans believed in dragons in the shape of giant snakes, snakes with wings or creatures consisting of a snake-body, claws and the head of a beast (BAUCHOT, 1994) and many of these images are still present today in historic pictures and as statues. These negative images cannot be counteracted by the few positive associations with snakes, like the Aesculapian Staff (BAUCHOT, 1994).

Furthermore, animal phobias are among the most prevalent anxiety disorders with snake phobias being the most common (OLSSON et al., 2005; OOSTERINK et al., 2009). The high prevalence of snake fears and phobias as well as a predisposition to associate snakes with fearful stimuli (DELOACHE & LOBUE, 2009) points towards an evolutionary background of snake fear (ÖHMAN et al., 2007).

The majority of the papers reviewed could be sorted in the group of phobias, their origin and the specific treatment methods. Surprisingly I could only find a very small number of articles dealing with educational programs of snakes for children and even less for adults. Fearful behavior towards snakes is readily picked up by children (DELOACHE & LOBUE, 2009). Therefore educational programs should ideally target both children and adults. Although phobic patients are difficult to heal and there is a large number of post-treatment returns of
anxiety (ROSE et al., 1997), phobic people tend to be aware of the fact that their fear is irrational and may not necessarily oppose snake conservation (ZIKA, in prep.). Consequently, an education campaign focusing on snake conservation cannot aim for fearful people to suddenly start loving snakes like their dogs or their cats this would be totally irrational. Posters, stamps and brochures will eventually get the attention of people but as a stand-alone measure are unlikely to change people’s attitude toward snakes or snake conservation (DALTRY et al., 2001; TISDELL et al., 2006b).

Reptile houses, on the other hand, attract many visitors and are an ideal platform to raise awareness for snakes and snake conservation. Rather than just present the snakes in their environment, providing shows during which keepers handle snakes or even allow for a direct interaction with snakes while providing information on snake ecology is likely to have a longer lasting and more positive effect on people’s attitude than just providing written information (MORGAN and GRAMANN, 1989).

Children are easier to reach, especially when they are young and have not yet acquired a fear of snakes. Observing an adult fearlessly handling a snake may well dampen fear and raise curiosity in the same way as seeing an adult being afraid of snakes triggers fear in young children (DELOACHE & LOBUE, 2009). In this respect the meadow viper conservation center in Kiskunshak is a very important facility. The breeding facility is located in the original snake habitat and the motivated and experienced stuff make it possible for school classes to see snakes being handled and observe snakes on close range while being given information on the smallest and most threatened venomous snake of Europe (www.rakosivipera.hu/en/hungarian-meadow-viper-conservation-centre/). Although snakes trigger fear and negative reactions in many people, preliminary results of a questionnaire survey and short interviews in Austria and Hungary suggest that the majority of respondents were actually in favor of restocking the meadow viper in Hungary and re-introducing it to Austria (ZIKA, in prep.; KOVAC, in prep.).

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