Phobias: The Evolutionary Trend

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Abstract

Evolutionary development has provided many adaptive mechanisms for organisms survival. Many modern theories of phobias focus on their development due to evolution. The quick acquisition of phobias towards phylogenic stimuli(e.g. spiders and snakes) as opposed to ontogenic stimuli(e.g. electrical outlets and open wires) further suggests a relationship to evolutionary development. Mammal research has shown an evolutionary development of snake fears in Rhesus Monkeys, with a strong extinction difficulty with such fears. Phobic extinction in humans has proven to be just as difficult. However, new innovations in *in vivo* exposure, such as Virtual Reality have provided successful ways for extinguishing phobias in human subjects.

Phobias: The Evolutionary Trend

Introduction.

The habitats that mammals inhabit contain entities, both threatening and non-threatening. In order to survive mammals need to quickly know the difference between these types of entities (Ohman & Mineka, 2001; Ohman, Flykt, & Esteves, 2001). Without the ability to learn quickly, many mammals would not survive to reproduce.

Innate fears are the key to mammalian survival within their habitats (Ohman & Mineka, 2001). Many researchers believe that these innate fears have developed as phobias in human beings (Ohman, et. al., 2001; Muhlberger, Wiedemann, Herrmann, & Pauli, 2006; Andrews, 1966). There are many different types of phobias known, but the phobias that appear to be the most difficult to extinguish resemble the same fears seen in more primative mammals (e.g. snake and spider fears) (Ohman & Mineka, 2001; Ainslie & Engel, 1974; Mineka, Davidson, Cook, & Keir, 1984).

Mammalian fears have developed for protection of the species. The two strongest fears seen in primates are snakes and spiders (Mineka, Davidson, Cook, & Keir, 1984; Ohman & Mineka, 2001). Primates have an intense reaction when in the presence of either of these creatures, and research has shown that primates can learn to fear these creatures in a matter of minutes. This learning occurs even if they were not taught to fear these creatures by their family (Mineka, Davidson, Cook, & Keir, 1984; Ohman & Mineka, 2001).

Ohman and Mineka (2001) theorize that mammals have passed through three stages of development. The earliest stage has produced the most intense phobias in humans. The last stage of their theory which involves ontological fears, are apparently less developed in human beings, and are seemingly non-existent in other mammals (Ohman & Mineka, 2001).

Hypothesis and Outline.

Evolution has created a fear module within the mammalian response system designed to quickly associate certain entities and certain situations as harmful to survival and therefore these associations are extremely difficult to extinguish (Ohman & Mineka, 2001; Ainslie & Engel, 1974; Mineka, Davidson, Cook, & Keir, 1984). It is this fear module that evolves in mammals and allows them to survive and reproduce (Ohman & Mineka, 2001).

This paper is going to look at the stage theory proposed by Ohman and Mineka (2001) in explaining the development of phobias in human beings. The first stage involves phylogenic fears which began in early mammals and included entities like snakes and spiders. The second stage involves the ability of hominids to pick out angry, or evil faces in a crowd. The final stage is a very modern development that includes fears of ontological entities. The development of phobias at each stage has led to survival of the different species (Ohman & Mineka, 2001; Mineka, Davidson, Cook, & Keir, 1984; Andrews, 1966).

The present paper will review research relevant to fears in each category and use that research to argue that there has been an evolution of phobias, and that mammals have been primed to fear certain entities for survival (Ohman & Mineka, 2001; Mineka, Davidson, Cook, & Keir, 1984; Botella, Banos, Perpina, Villa, Alcaniz, & Rey, 1998; Teachman & Woody, 2003). It will briefly review the types of desensitization treatments used on phobic patients (Maltby, Kirsch, Mayers, & Allen, 2002). The paper will finish with an evaluation of virtual reality exposure. This new technology provides a cheaper, quicker, and safer way of extinguishing phobias than other desensitization techniques (Maltby, Kirsh, Mayers, & Allen, 2002; Botella, Banos, Perpina, Villa, Alcaniz, & Rey, 1998; Carlin, Hoffman, & Weghorst, 1997; Riva, 2003; Difede, Hoffman, & Jaysinghe, 2002).

The First Attack.

Before discussing the stage theory proposed by Ohman and Mineka (2001), the etiology of the first phobic reaction needs to be understood. The first phobic reaction and the first panic attack have almost the same etiology in a human being (Jacobs & Nadel, 1999). The Ohman and Mineka (2001) theory, combined with the etiological knowledge of panic attacks and phobic reactions provides a strong basis for understanding the evolutionary primed mammalian defense system.

There are several important differences between panic attacks and phobic reactions. The first difference is that unlike panic attacks which have no object of focus, there is some entity that elicits fear in phobic reactions. The second difference is that people with phobic reactions can often control their fear by avoiding situations that could involve the entity eliciting fear, whereas panic attacks are unavoidable. One must be cautious not to interchange the phrases phobia and panic attacks, because aside from the similar onset, both panic attacks and phobias take distinctively different paths (Jacobs & Nadel, 1999).

Most people know that they are not in any real danger when encountering a phobic situation, but they can not control their fear reactions (Jacobs & Nadel, 1999).

Phobic reactions are more likely to develop if four factors are encountered in combination: (1) the first phobic reaction originates in a time of life stress; (2) the feared object must be in contact with the individual during the life stress; (3) secondary phobias can develop in the individual when knowing that the initial panic attack is unwarranted; (4) phobic initiations often occur without any knowledge of a prior encounter with the feared stimuli. (Jacobs & Nadel, 1999).

The first three factors are either self explanatory or beyond the scope of this paper. The key to understanding the theory proposed by Ohman and Mineka (2001) is to grasp the fact that individuals experiencing the fear usually have no memory association with the objects of phobic reaction (Jacobs & Nadel, 1999). There must have been some harmful encounter with the object at some point in a person's life, otherwise there should be no fear (Jacobs & Nadel, 1999). As people develop, the earliest part of their lives become clouded and a form of amnesia occurs that does not allow them to remember memories before the approximate age of 2 (Jacobs & Nadel, 1999; Ohman & Mineka, 2001). We see this amnesia in ourselves when we try and remember our early childhood. We can not remember things that happened and Jacobs & Nadel (1999) theorize that it is during this time of our life that phobic fears originate.

As an adaptive function, many fears are hidden and locked in the primitive fear module, which is located in the subconscious. During times of stress, mammals revert to the primitive fear module in order to protect themselves (Jacobs & Nadel, 1999; Ohman & Mineka, 2001; Mineka, Davidson, Cook, & Keir, 1984). Phobic reactions occur because primitive structures override all other neurological associations in our brain and our body engages in a purely reactive way (Jacobs & Nadel, 1999; Ohman & Mineka, 2001; Mineka, Davidson, Cook, & Keir, 1984). This type of reaction is seen in more primitive mammals and in humans encountering phobias in the phylogenic stage of the Ohman and Mineka (2001) theory.

Since phobias can be seen as elicitations of fears created during early childhood, by conditions that are unknown to the person with the fear, there must be some module in place that automatically associates harmful situations with fear in order for survival (Jacobs & Nadel, 1999; Ohman & Mineka, 2001; Mineka, Davidson, Cook, & Keir, 1984; Andrews, 1966). When a mammal is stressed and encounters a harmful entity it quickly develops an intense fear of that entity that is difficult to overcome (Jacobs & Nadel, 1999; Ohman & Mineka, 2001).

The Stages.

The first stage proposed by Ohman and Mineka (2001) is the phylogenic stage. During this stage of development, early primates developed a fear of the dangerous entities in their habitats. These entities include snakes, spiders, alligators, and others that could hinder reproduction. Research supporting this stage consists primarily of primate research (Ohman & Mineka, 2001; Ainslie & Engel, 1974; Mineka, Davidson, Cook, & Keir, 1984). Primate research is the easiest way to actually create a phobia within a mammal, since ethical concerns allow us to only observe already developed phobias and fears in humans.

The second stage is that of the pre-industrialized nation. As defined by Ohman & Minkea (2001) this stage extends from the time of the first hominids to the advent of modern technology about 300 years ago. During this stage of development, people began congregating away from the phylogenic dangers encountered in the first stage and began developing facial recognition skills as an adaptive trait in order to be able to point out those people who appeared dangerous, before they produced harm (Ohman & Mineka, 2001; Andrews, 1966; Jacobs & Nadel, 1999). Research has shown that people more quickly identify an angry face in a sea of happy faces, than the other way around (Ohman & Mineka, 2001).

The final stage includes ontological fears of industrialized society. These types of fears include open electrical sockets, hot stoves, and handguns. Unlike fears in the first two stages which are very resilient to extinction, the only ontological fear that is resilient to extinction are guns. Other ontological fears do not easily develop due to conditioning and are very easy to extinguish (Ohman & Mineka, 2001; Ohman, Eriksson, & Olofsson, 1975; Muhlberger, Wiedemann, Hermann, & Pauli, 2006). The research pertaining to handgun fear has had methodological problems and some have had problems with external validity (Ohman & Mineka, 2001).

The present article will now look at the research pertaining to the three stages proposed by Ohman & Mineka (2001). Each section will support the hypothesis that phobias have evolved and that phobias are a strategic advantage in mammalian response system.

The Phylogenic Stage.

The beginning stage proposed by Ohman & Mineka (2001) as described earlier includes fears involving snakes, spiders, and other dangerous entities. These fears have incorporated into a fear module that has primed mammals to associate certain dangerous entities with fear (Ohman & Mineka, 2001; Mineka, Davidson, Cook, & Keir, 1984; Ainslie & Engel, 1974). The development of fears in this category is limited to primate research.

Mineka, Davidson, Cook, & Keir (1984) conditioned fear in Rhesus Monkeys in order to find out if primates raised in captivity can develop a fear of snakes, or objects that resemble snakes. Four distinct confounds are inherent in previous research: (1) They have involved conditioning to components of fear that do not always correlate highly with other fear components. (2) Context specificity was never tested. The primates were only tested for fear in the same surroundings in which they acquired the fears. (3) Many of the tests took place in one session and did not include follow up testing. (4) Many of the studies used highly arbitrary neutral stimuli as their conditioned stimulus. Mineka, et. al. (1984) wanted to perform their research while keeping these confounds in mind. They also moved away from the use of skin conductance responses (SCRs), which do not accurately measure fear. General emotional arousal, interest, and attention can produce the same results as fear in the SCR (Ohman & Mineka, 2001).

In their first experiment to test fears and primates, Mineka, Davidson, Cook, & Keir (1984) adapted the Wisconsin General Test Apparatus (WGTA) to control for the mediating influence of parental abandonment in primates. The improved WGTA now contained clear walls and was placed near the wild-reared primate cage so the young lab-reared primate could see its natural surroundings. The WGTA is designed to test reaching latency with the knowledge that the longer the reaching latency, the more fear the subject is experiencing. The reason for the improved WGTA is that abandonment can sometimes create long times in reaching latency. The Sackett Self-Selection Circus was used without modification. This test is designed to test the amount of time a subject associates with a set number of objects. The less time spent with an object equates to higher levels of fear.

Mineka, et. al. (1984) tested 7 wild-reared and 9 lab-reared primates on both the WGTA and the Circus test. The Circus testing used a real, a toy, and a model snake, and neutral wood objects. During this test wild-reared primates only associated with the neutral object, completely avoiding all the others, whereas all the lab-reared primates did not show a preference towards any object. In the WGTA setting, lab-reared primates did not show significant reaching latency towards any object, whereas wild-reared primates showed a tremendous reaching latency when presented with the snake-like objects. The lab-reared monkeys were then exposed to their wild-reared counterparts acting violently by screeching, jumping, and waving their arms when encountering snake-like objects. In a timeframe as short as 8 minutes, the lab reared primates also began acting violently to the same objects. Both tests were applied again, and there was now no significant difference in either test between the lab-reared and wild-reared primates. The adapted WGTA results agreed with that of the Circus test and so Mineka, et. al. (1984) were confident that their improvements did not reduce the validity of the WGTA. The lab-reared primates had the same fear intensity levels on both the WGTA and the Circus tests at a 6 month follow up.

Mineka, et. al. (1984) supported the assumption present in research that many fears in humans and nonhuman primates are based on observational conditioning. The quick association of fear seen in lab-reared primates supports the assumption made by Ohman & Mineka (2001) that there is a fear module primed to certain fear conditions and that fear is not context specific (Mineka, Davidson, Cook, & Keir, 1984). In a time of stress, a small exposure to another of the species reacting fearfully to a phylogenic object can produce a phobia in the observer (Mineka, Davidson, Cook, & Keir, 1984; Ohman &

Mineka, 2001; Jacobs & Nadel, 1999). Mineka, Davidson, Cook, & Keir (1984) in a 6 month follow up test showed that snake fears in primates had not decreased which provides support for the difficulty in extinguishing phylogenic fears (Mineka, Davidson, Cook, & Keir, 1984; Ohman & Mineka, 2001; Jacobs & Nadel, 1999; Ainslie & Engel, 1974; Andrews, 1966; Ohman, Eriksson, & Olofsson, 1975).

The research by M. Cook and Mineka (cited in Ohman & Mineka, 2001) tested to see if primates generalized the adult's fearful reaction to any stimulus. In the research, M. Cook and Mineka (cited in Ohman & Mineka, 2001) videotaped adult primates acting fearfully towards snakes. These original videos were shown to a set of lab-reared primates. These primates develop a quick fear of snakes due to observational conditioning just like the primates in the Mineka, Davidson, Cook, & Keir (1984) research. M. Cook and Mineka (cited in Ohman & Mineka, 2001) took the original videos and dubbed in a neutral picture of a flower. The new video was then shown to another set of lab-reared primates. In this case there was no significant development of fear towards flowers. Young primates do not just fear objects that are feared by adults, but show selectivity in their fear module that is activated by objects that are life threatening (Ohman & Mineka, 2001; Mineka, Davidson, Cook, & Keir, 1984). Since fear is not generalized to neutral objects just by observation of an adult primate acting fearful, there needs to be some module developed in the primate system that can associate objects relevant to fearful situations (Mineka, Davidson, Cook, & Keir, 1984; Ohman & Mineka, 2001; Jacobs & Nadel, 1999; Ainslie & Engel, 1974; Andrews, 1966; Ohman, Eriksson, & Olofsson, 1975).

The fear module plays an important role in our peripheral attention as well

(Mineka, Davidson, Cook, & Keir, 1984; Ohman & Mineka, 2001; Ohman, Flykt, Esteves, 2001). In an article presented by Ohman, Flykt & Estevez (2001) there appears to be an ability in humans to detect dangerous and fearful stimuli that are not in direct sight. During the experiment subjects were exposed to a 3x3 grid which either contained a fearful stimuli against 8 neutral stimuli (FxS) or a neutral stimuli against 8 fearful stimuli (NxF). Each picture used was different from others in its category. The 9 pictures were then flashed on the screen as described above. The subjects focused on the middle cell but could still identify the cell that contained the harmful stimuli in the FxS situation more quickly than they identified the neutral stimuli in the NxF situation, even if the off-stimuli was presented in the outer rows.

The fear module evolved as an adaptation that enhanced primate survival, and the first beneficial examples are seen in different phylogenic fears (Ohman, Flykt, & Exteves, 2001; Ohman & Mineka, 2001; Mineka, Davidson, Cook, & Keir, 1984). This fear module is now located almost exclusively in the human subconscious and has evolved to include facial recognition skills (Ohman & Mineka, 2001). In times of stress humans revert to their fear module in order for survival (Ohman & Mineka, 2001; Jacobs & Nadel, 1999; Ainslie & Engel, 1974; Andrews, 1966). This module is evoked whether mammals are actually directly presented with the object, or just catch a glimpse of the object (Ohman, Flykt, & Esteves, 2001). This easy ability to notice harmful stimuli in both direct and peripheral sight and fear the stimuli is part of the evolved fear module.

The Pre-Industrialized Stage.

During this period in history the first hominids began socializing more and congregating in larger colonies (Ohman & Mineka, 2001). Facial recognition skills began developing due to a need for interpersonal communication (Ohman, Lundquvist, & Esteves, 2001). Facial muscles are designed to move the skin tissues rather than moving the bones (Ohman, Lundquvist, & Esteves, 2001). It is this small anatomical fact that suggests that the face has evolved to become a specialized form of non-verbal communication (Ohman, Lundquvist, & Esteves, 2001, Ohman & Mineka, 2001). Key features that identify an angry face include pronounced frowning brow, intensely staring eyes, and a shut mouth with lowered corners. These same features can be seen in the facial displays of dominate primates in both the wild and captivity (Ohman, Lundquvist, & Esteves, 2001). Research cited by Ohman, et. al. (2001) led to an assertion that through facial recognition humans can decode, learn, and emotionally respond to threatening stimuli that is not consciously perceived by the human. Like the fears of the phylogenic stage and the ontological stage, fear responses in this category do not require conscious perception.

Ohman, et. al. (2001) investigated the speed at which people detect either a happy, neutral, or angry face in a sea of faces of a another type (e.g. one happy face against neutral or angry faces). The Ohman, et. al. (2001) research showed that angry faces are more quickly detected and more correctly identified in a sea of happy or neutral faces than the other way around. A major issue addressed in both the Ohman, et. al. (2001) research and the Herman & Herman (1988) research is the possibility that it is not actually the angry face that produces the quick and accurate response, but the fact that there might be less variation of happy faces than neutral or angry faces. This fact also leads to the possibility that, if more people are happy or neutral, and a person experiences this on a regular basis, the showing of a varying type of face will result in a quicker response (Ohman, et. al., 2001).

Ohman, et. al. (2001) compared the response times of facial recognition as described above to the response time of angry, sad, and scheming faces in a sea of happy faces in order to address this issue. The hypothesis was that if people responded to a different type of face than they are used to, then the response times should be similar for angry, sad, and scheming faces. This in fact was not the case, people detected angry faces against a sea of happy faces significantly quicker than the detection of sad or scheming faces against happy faces. This suggests that there must be some module in place to detect angry faces, not just abhorrent faces (Ohman, et. al., 2001).

Hansen & Hansen (1988) addressed the issue of there being less variance in happy faces than in angry faces by taking a snapshot of one person with a happy face, and the same person with an angry face. They then superimposed these images into a picture of a crowd. If detection of angry faces was due to the varying of the type of face, there should be no difference in detection rate between a happy face within angry faces, or the other way around in this setting. This was not the case as the angry face was found significantly quicker than the happy face in a crowd of opposing faces. This means that the structures mentioned earlier which signify an angry face have become incorporated into the evolved fear module suggested by Ohman & Mineak (2001).

The Ontological Stage.

In this stage mammals are faced with fears involving an industrialized society such as open electrical sockets, airplanes, stovetops, guns, etc (Ohman & Mineka, 2001; Andrews, 1966; Muhlberger, Wiedemann, Hermann, & Pauli, 2006; Maltby, Kirsch, Mayers, & Allen, 2002). These fears appear to be more easily extinguished than phylogenic fears (Mulberger, Wiedmann, Hermann, & Pauli). A possible reason for this is that the evolutionary primed fear module has not been influenced enough by the modern industrialized nation, and hence ontological fears have not been associated with a need for survival (Ohman & Mineka).

Many researchers have compared the fears developed in the phylogenic stage to ontological fears (Ohman & Mineka, 2001). The difficulty in this research has been that some ontological fears may actually be culture specific. In most experiments the researchers looked at both snakes and spiders and compared their fear elicitations to those of guns and broken electrical equipment (Ohman & Mineka, 2001; Jacobs & Nadel, 1999; Ohman, Eriksson, & Olofsson, 1975).

Research by Hugdahl and Karker (cited in Ohman & Mineka, 2001) showed that strong fears can be conditioned for electrical outlets, snakes, and spiders, however electrical outlets were the quickest and easiest to extinguish. In research performed by E. W. Cook (cited in Ohman & Mineka, 2001) paired a loud noise with a fearful picture. One type of picture was that of a snake, and the other was that of a gun barrel. Each type of object created a strong phobic reaction that was resistant to extinction. They also compared snakes to ontological entities other than guns and found that these other ontological entities were more easily extinguished than snake fears. There also appears to be a stronger fear association in ontological fears if the object is paired with an appropriate cue (e.g. loud noise and a gun) (Ohman & Mineka, 2001).

The problem with all this research is that all the pictures of guns involved a barrel view. This can be extremely potent in any situation (Ohman & Mineka, 2001; Jacobs & Nadel, 1999). Guns, due to the prevalence in literature, movies, and newspapers have produced a strong fear in humans (Ohman & Mineka, 2001). The present research have shown that guns have developed almost as strong a fear reaction as phylogenic fears. This is possibly due to the dangerousness of guns in modern society. The authors suggest that guns would have been incorporated into the fear module due to their dangerous nature, but the direction factor needs to be further researched (Ohman & Mineka, 2001; Jacobs & Nadel, 1999; Andrews, 1966). With snakes, the directional factor is non-influential due to the fact that snakes can attack from any direction (Ohman & Mineka, 2001; Ohman, Flykt, & Esteves, 2001). Another problem with using gun fears is history bias. There is no control over whether a person has been in a threatening situation with a gun in the past. This could influence the strength of fear being shown (Ohman & Mineka, 2001).

Gun fears appear to be the only type of ontological fear that might have been incorporated into the fear module (Jacobs & Nadel, 1999; Ohman & Mineka, 2001). Guns have been in society much longer than electrical sockets, and henceforth they have had more chance to influence the fear module (Ohman & Mineka, 2001). There is still not full support that the fear module has evolved to incorporate guns as a phobic stimuli. Research has not focused on whether gun fears have been evolutionarily primed, or if they are feared due to cultural exposure (Ohman & Mineka, 2001). Gun fears counteract the cognitive feature of phobias in which the person has an intense reaction even though they know that they are in no real danger. Guns can produce a real danger and so there might be a more cultural aspect to gun phobias than has been tested (Ohman & Mineka, 2001).

Phobic Treatments.

Phobic treatments are part of each branch of psychology, but behavioral treatments are the focus of comparison for this paper. In behavioral treatments there is a focus on controlling the body in the feared situation. Flooding involves placing a person in contact with the feared stimulus in hopes that after the initial intense fear, it will eventually subside. After a number of trials the person will no longer fear the stimulus. The issue with flooding is that the initial fear may be too intense for some people and this lack of control can be dangerous for many people. Also, the number of trials needed to eliminate some fears may be extremely costly (Riva, 2003)

Systematic desensitization involves teaching the person ways of controlling their fear in order to confront it. The final confrontation can sometimes be intense and can sometimes be too expensive to perform numerous times (Riva, 2003). In imaginative desensitization people are told to imagine the feared stimulus and then keep imagining themselves in a more fearful situation. This is only as good as a person's imagination will allow. A final type of treatment that is of concern in comparison is *in vivo* desensitization, which is similar to flooding, except there is an increase in the level of exposure, until the person feels comfortable with the feared situation. The downsides of this treatment are the same as that in flooding (Riva, 2003). Each of these treatments has been proven successful in treating phobias but their downsides can be overcome in the use of virtual reality treatment.

The use of virtual reality in psychological treatment is very new, and a lot of the research involving virtual reality has been case study research (Riva, 2003; Difede, Hoffman, & Jaysinghe, 2002; Carlin, Hoffman, & Weghorst, 1997; Botella, Banos, Perpina, Villa, Alcaniz & Rey, 1998). Virtual reality has potential in the treatment of phobias because it is cheaper than *in vivo* desensitization. The researcher does not have to have access to the feared entity and it is more realistic than imaginative desensitization since the images created are based on reality, not just the persons memory or imagination which can be flawed (Riva, 2003; Difede, Hoffman, & Jaysinghe, 2002; Carlin, Hoffman, & Weghorst, 1997; Botella, Banos, Perpina, Villa, Alcaniz & Rey, 1998). The greatest virtue of virtual reality is that it is safer than *in* vivo desensitization and flooding. The researcher and the person with fear have complete control over the situation, and the situation follows certain predetermined steps that can be stopped immediately at any point in time (Riva, 2003; Difede, Hoffman, & Jaysinghe, 2002; Carlin, Hoffman, & Weghorst, 1997; Botella, Banos, Perpina, Villa, Alcaniz & Rey, 1998). The literature suggests that virtual reality treatment is just as effective as other forms of behavioral phobia treatments (Riva, 2003; Difede, Hoffman, & Jaysinghe, 2002; Carlin, Hoffman, & Weghorst, 1997; Botella, Banos, Perpina, Villa, Alcaniz & Rey, 1998; Maltby, Kirsch, Mayers, & Allen, 2002).

The literature shows that virtual reality treatment has worked in the case studies presented (Carlin, Hoffman, & Weghorst, 1997; Botella, Banos, Perpina, Villa, Alcaniz & Rey, 1998). Research by Maltby, Kirsch, Mayers, & Allen (2002) shows that virtual reality treatment is as effective as attention desensitization on the treatment of fear of flying. Their attention desensitization technique incorporated imaginative desensitization with videos of flight takeoffs, and landings. The virtual reality group was set up in a booth that was equipped to simulate a plane taking off and landing. More members from the virtual reality group departed on a flight within six months than those from the attention desensitization group and neither group relapsed to a fear of flying even after six months.

It would be improper to assume that virtual reality is a better choice than other forms of psychological treatment, but the literature suggests that there is a possibility for virtual reality treatment having major success in phobic patients. The case studies for people with fear of spiders (Carlin, Hoffman, & Weghorst, 1997) and claustrophobia (Botella, Banos, Perpina, Villa, Alcaniz, & Rey, 1998) show successful treatments of fear using virtual reality. In the case of spiders, the person was placed in a virtual room and walked around investigating. One kitchen drawer contained a virtual spider and the bathroom contained another virtual spider, bigger than the kitchen drawer spider (Carlin, et. al., 1997). The subject knew where the spiders were, and during the trials was asked, when comfortable to open the drawers containing the spiders. The subject over a three month period was able to overcome the fear, and actually reached out to where the spiders were and essentially virtually touched the spider. After treatment the subject was able to be outdoors, and was even able to go camping (Carlin, et. al. 1997).

In the treatment of claustrophobia (Botella, et. al., 1998) the virtual reality mechanism was set up in a graded exposure. The subject was placed in a virtual room that could be shrunk by the experimenter. Different measures of claustrophobia were used before and after the testing and showed a significant decrease in stress and fear of closed spaces.

These few short case studies (Carlin, et. al., 1997; Botella, et. al., 1998) and the comparative study (Maltby, Kirsch, Mayers, & Allen, 2002) show that virtual reality treatment is successful, and has potential to replace other forms of treatment for certain phobias (Riva, 2003; Difede, Hoffman, & Jaysinghe, 2002). The added benefits of virtual reality comes from the fact that it is cheaper for treating some types of phobias (e.g. fear of flying) and it can be quicker than actual *in vivo* exposure. To understand this lets look at a hypothetical example of fear of flight. This fear of flight is localized to the take off of the plane. To do *in vivo* exposure the person would be placed in the seat, strapped in, the fuel added to the plane, and then we would have take off. To repeat this the plane would need to land first before doing anything. Another problem occurs when we look at the safety concern (Riva, 2003). If the person does start having problems during takeoff, the plane would have to land before the treatment could stop. With virtual reality exposure we eliminate the landing phase and the in flight phase. There is the opportunity to do many repeated exposures with virtual reality in the time it takes to do one trip with the in vivo experiment (Difede, Hoffman, & Jaysinghe, 2002). In dealing with safety, the operator has the chance to stop the exposure at any point during exposure if the fear becomes too much (Riva, 2003).

In this example we can see the benefits of virtual reality exposure, and the research leads us to believe that it has the potential to be just as beneficial as other types of treatment (Riva, 2003; Difede, Hoffman, & Jaysinghe, 2002; Carlin, Hoffman, & Weghorst, 1997; Botella, Banos, Perpina, Villa, Alcaniz & Rey, 1998; Maltby, Kirsch, Mayers, & Allen, 2002). Virtual reality is cheaper, more convenient, and safer and these three reasons make it superior to other types of phobia treatment (Riva, 2003).

Discussion.

Mammals have adapted a type of evolved fear module that has allowed them to avoid harmful creatures in their habitats (Ohman & Mineka, 2001; Ohman, Flykt, & Esteves, 200; Andrews, 1966; Ainslie & Engel, 1974; Mineka, Davidson, Cook, & Keir, 1984). This fear module has further evolved in humans as well. This is seen in the quick acquisition of phylogenic fears in humans, and their strong resistance to extinction (Ohman & Mineka, 2001; Ohman, Flykt, & Esteves, 200; Andrews, 1966; Ainslie & Engel, 1974; Mineka, Davidson, Cook, & Keir, 1984; Jacobs & Nadel, 1999).

These phobic developments originate the same way that panic attacks do with one important difference, panic attacks do not have a conscious object of focus, they just occur (Jacobs & Nadel, 1999). Fear reactions override all other parts of the neurological structure and force a mammal to revert to the fear module that has been developed (Jacobs & Nadel, 1999; Ohman & Mineka, 2001). This fear module has been primed by evolution and is also aided by the memory gap localized during early childhood (Jacobs & Nadel, 1999).

This fear module has evolved through three stages proposed by Ohman & Mineka, 2001). The first stage involved primates with phylogenic fears. Since this stage was the first developed, it is the most evolved (Ohman & Mineka, 2001). This is seen by the quick acquisition of phylogenic fears and their superior resistance to extinction (Ohman & Mineka, 2001; Ohman, Flykt, & Esteves, 200; Andrews, 1966; Ainslie & Engel, 1974; Mineka, Davidson, Cook, & Keir, 1984; Jacobs & Nadel, 1999). The second stage involves a pre-industrialized civilization that had to protect itself from other members (Ohman & Mineka, 2001). During this stage people began being able to recognize angry and unhappy faces in a crowd (Ohman & Mineka, 2001). The final stage involves ontological fears such as open electrical sockets and guns. This stage does not seem as evolved as the other two, because only guns appear to develop a quick fear that is resistant to extinction (Ohman & Mineka, 2001, Jacobs & Nadel, 1999; Muhlberger, Wiedmann, Hermann, & Pauli, 2006). The problems associated with gun fears are apparent and there are problems inherent in the way it is conducted (Ohman & Mineka, 2001).

The theory of an evolved fear module developed by Ohman & Mineka (2001) has a lot of potential for describing certain phobias, but lacks an explanation of all phobias. It encompasses phylogenic fears like snakes and spiders, but does not address another threat to early primate survival, such as alligators and crocodiles. These fears were mentioned by Jacobs & Nadel (1999), but they are not included as an adaptive function of the fear module. Another problem that needs to be addressed is the connection between phobias and cognition. If phobias are adaptations of the fear module, then there should be a limited number of phobias. There are actually phobias for almost every entity known to man, because each one could actually cause fear in someone's life. The final problem is that many ontological fears are actually very difficult to extinguish (e.g. fear of flying and gun fears). These fears are difficult to extinguish compared to other fears in their stage (Ohman & Mineka, 2001; Jacobs & Nadel, 1999; Maltby, Kirsch, Mayers, & Allen, 2002), yet they are not considered part of Ohman & Mineka's (2001) stage theory. Cultural differences in ontological fears need to be addressed and examined to see if fears in the latter stages are being adapted into the fear module, or if they are only linked to changes in culture.

Even though these stages have evolved into a fear module in humans, it is not without hope (Riva, 2003; Difede, Hoffman, & Jaysinghe, 2002; Carlin, Hoffman, & Weghorst, 1997; Botella, Banos, Perpina, Villa, Alcaniz & Rey, 1998; Maltby, Kirsch, Mayers, & Allen, 2002). Many types of treatment are available for people with phobias, with many different variations (Riva, 2003). The newest form of these showing promise is the use of virtual reality machines in treatment (Riva, 2003; Difede, Hoffman, & Jaysinghe, 2002; Carlin, Hoffman, & Weghorst, 1997; Botella, Banos, Perpina, Villa, Alcaniz & Rey, 1998; Maltby, Kirsch, Mayers, & Allen, 2002). Virtual reality has shown to be cheaper and safer than many types of desensitization (Riva, 2003; Difede, Hoffman, Jaysinghe, 2002).

Future research will need to be conducted to find out the actual benefits of virtual reality exposure, but it does show promise in spider fears (Carlin, Hoffman, & Weghorst, 1997), claustrophobia (Botella, Banos, Perpina, Villa, Alcaniz, & Rey, 1998), and fear of flying (Maltby, Kiersch, Mayers, & Allen, 2002). There are many other types of phobias that can be used with virtual reality, but more research will need to be examined to find out their affective use.

In the end, even though phobias can develop easily, and sometimes without the knowledge of the individual (Jacobs & Nadel, 1999), these fears are part of an evolutionarily primed fear module in mammals (Ohman & Mineka, 2001). Even with an evolutionarily primed fear module, there is potential with different types of treatment, especially with the new advancements in modern technologies (Riva, 2003). These treatments need to be tested as to their effectiveness for different fears, but the fact that fears have been evolutionarily primed, they can be extinguished.

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