2013

The Origins of Fear: An Exploration of the Social and Biological Foundations of Phobias

Rachel Isabella Finkelstein
Bard College

The Origins of Fear: An Exploration of the Social and Biological Foundations of Phobias

Rachel Finkelstein

This work hopes to explore the perceptions of fears and phobias common in today's world. The expectation is that each person will see the work through a separate lens – one viewer may see a piece as horrific and vile, while another finds the same object as utterly mundane.

The poster works on the exterior wall of the room serves two main purposes: to further set up the space as an environment, and to act as works themselves, priming the viewer to question what generates anxiety in themselves and others. It is important that this work feels like an environment, and not merely sculptures in a room. To further elicit the sense of a cohesive space, these posters sought to mimic vintage circus advertisements, showcasing elegant athletic acts and freaks of nature alike. Several forms are repeated on cheap paper and the text is placed with paint instead of print, resembling how such advertisements would appear in an urban space and provoking a sense of vandalism. The pieces themselves utilize microphotography images, often of uncomfortable origins, to evoke a sense of the unknown. They compromise several pieces, ranging from the more unusual sights, such as a woman with four breasts, to the more common scenes of an ethnic minority or two ladies kissing. Both on opposite sides of the spectrum of abnormality, yet to many they are both treated with the same level of disgust.

Once inside, the space plays on a plethora of fears and phobias drawn from research, first-hand accounts, and societal norms. Ideas such as fear of the dark, spiders, enclosed spaces, self-doubt, unsanitary conditions, being observed, heights, fetishism, areas of low socioeconomic status, the unknown, and imagined monsters are all throughout. Still, the work takes on an air of playfulness and parody, in a manner to simultaneously highlight and undermine the harsher underlying themes. Using softer materials such as fabric and toys, and employing an excess of

colors and childish patterns throughout, any sensation of anxiety at the subjects is muted by the frivolity. No matter how any one individual views each fear, they are all brought to the same level of humor to emphasize that, to some, the themes can be viewed with implications dissimilar to your own.

Which comes to the main question of the show: where do fears originate? Do we fear some things by an innate biological predisposition, by environmental cues and adverse events, or by societal expectations? As an example, a man with significant facial scarring could indicate the presence of disease, something we might innately avoid for safety, or it could be the aftereffects of a burn, something we might shy away from due to societal pressures. Even the simple nature of the colors black and white have opposite associations across cultures, and so both are used with frequency throughout the room – the only shades really present on the wall.

Pushing this further, how do ordinary fears – a necessary component in human development and survival – become disordered phobias? Given our diverse backgrounds, one individual's predispositions could compromise a perception that directly opposes that of another. Which frightens you more: a spider formed entirely out of toys, the demented mocking laughter from an abandoned old phone, or the discomfort of viewing a vibrant masturbating mannequin? Few of these answers are particularly straightforward, but I ask the participant to question how and why they react to each piece in this work the way they do.

The Implications for Augmented Reality in Preventative Treatment of Specific Phobia

Rachel Finkelstein

Bard College

Abstract

Fear is one of the primary motivators, and a necessary phenomenon in human development. However, when these fears become inhibitory of normal functions and develop into specific phobia, the adverse results can lead to a plethora of psychological and behavioral problems. Preventing the development of anxiety and phobias at an early stage could avert more debilitating disorders and behaviors at a later stage. Effective treatments of specific phobias have already been developed, but as of yet there is insufficient information on the implementation of preventative measures and the effects this has on demographic factors. Here, a study of potential preventative treatment using an augmented reality system is proposed. The hope is that the coping mechanisms taught to children at a young age will be generalized to alternate fear and anxiety inducing stimuli.

The Implications for Augmented Reality in Preventative Treatment of Specific Phobia

Overview

Specific phobia is the anxiety disorder wherein the normal human reaction of fear develops into a debilitating disorder. Defined as a "marked and persistent fear that is cued by circumscribed or clearly discernible objects or situations," (Armfield, 2006, p. 746) specific phobia is characterized by a reaction to a fear-centered object or situation that is disproportionate to the "intensity of the perceived threat." (Meltzer et al., 2008, p. 781) How these phobias develop in one individual instead of another, especially when experiences are often similar, is still a relatively difficult topic of investigation. Influences such as culture, gender, socioeconomic status, and attention span all appear to factor into the onset of phobia, but the disorder itself "has received little empirical investigation." (Armfield, 2006, p. 746)

The onset of phobia during child development

Links have been found between childhood fears, working memory, and attention control in children, all of which are "soft signs" for children at-risk of developing anxiety disorders (Kushnir & Sadeh, 2010). These reduced scores on Neurobehavioral Functioning has been repeatedly associated with psychopathology, as well as lower school achievement and behavioral problems, although causality has not been established. Significant connections between childhood anxiety and later "anxiety, depression, and substance abuse in adulthood" (p. 787) have also been seen, and it has been suggested that identifying and managing specific phobias in children would help mitigate this effect (Meltzer et al., 2008).

Cultural Differences

Hofmann et al. (2010) reviewed literature on social anxiety and social anxiety disorder and found several differences between culture, gender, environment, and socioeconomic status. Though social anxiety and social phobia is markedly different from specific phobia, there are similarities in the development and presentation of symptoms. It is important to keep these disparities in mind however, and several known differences will be indicated. As Hofmann et al. (2010) indicates, there is a significant pattern in "race-ethnic differences in rate for psychiatric disorders (suggesting) the presence of protective factor that originate in childhood and have generalized effects on internalizing disorders." (p. 1118) This phenomenon has largely been attributed to the differences between independence and interdependence of cultural origin. Collectivist cultures, high in interdependence, are characterized by the focus on "harmony within the group…and individual gain is considered to be less important than improvement of the broader social group." (Hofmann et al., 2010, p. 1121) Individualistic cultures, high on independence, instead emphasize "individual achievements and success." (Hofmann et al., 2010, p. 1121) Collectivism is frequently associated with many Eastern cultures, and Individualism is often linked to Western cultures.

Cultural factors in treatment. Treatment presents a more complicated set of results on varied levels of response related to factors of culture, gender, and socioeconomic status. In willingness to seek treatment, it was found that "at moderate levels (of social anxiety), first-generation Chinese participants were significantly less willing to seek treatment compared to their European-heritage counterparts," (p. 1121) though this was not seen in low-level and high-

level social anxiety. Though some research shows that Asian and Hispanic subjects had a slightly

lower response to some treatments, and that Hispanic subjects showed a higher response rate to

placebos, results on the topic "do not provide any convincing evidence that race/ethnicity

predicts response or nonresponse to any psychological of pharmacological treatments" (Hofman

et al., 2010). In terms of specific fears, the stimuli reacted to tends to remain a constant between

countries, but frequency and intensity of these reactions may vary across cultures (Meltzer et al.,

2008).

Cross-cultural prevalence. Prevalence of diagnosed anxiety disorders (as well as

depression, obsessive-compulsive disorder, and dependent personality disorder) positively

correlates with collectivism scores and showed a negative correlation with individualism scores.

The opposite correlation was found where, "individualism was positively correlated with scales

for paranoid, schizoid, narcissistic, borderline, and antisocial personality disorders" (p. 1122) and

negatively correlated with collectivism. It has been suggested that this can be seen in regards to

external versus internal "motivations" for developing social anxiety, where external pressures are

more common in collectivist cultures whereas self-blame and similar internally based forces

have a greater influence in individualist cultures (Meltzer et al., 2008).

Gender and culture. In regards to the social constructs of gender, it was suggested that it

is not only which gender, but also the level of psychological androgyny that influences social

anxiety. It has been shown that frequently, femininity is associated with "shyness and social

subordination," whereas masculinity is associated with "social dominance and aggression." (p.

1123) Beyond the implications of being tied to one gender identity or the other, there is also the

option of being androgynous (where the individual endorses both genders) or undifferentiated (where the individual endorses neither gender). In regards to social anxiety, those who are "more adaptable and flexible in their behavior…perform well across a wide range of tasks." (p. 1123) Individuals who more closely identify with one gender or the other are more "motivated to restrict their behavior in accordance with cultural definitions of gender appropriateness" (p. 1123) and do not perform as well in tasks that challenge their gender identity. In relation to specific phobias, there are fears which may be "socially generated and indicate a conforming to gender roles, e.g. for girls to be scared of spiders." (p.1123) This was given credence by Meltzer et al. (2008), showing that girls were more likely than boys to have fears of animals, blood, injections or injury, elements in the natural environment, and specific types of people. Hofmann et al. (2010) cited similar results in reference to social anxiety disorder where women reported fear on a more intense level, though men an women reported similar fears in social situations. Keeping these results in mind, it will be necessary to eliminate the confounding variable of androgynous or unaffiliated gender identity in this study, though these factors may play an interesting role in later research.

Potential predictors

Predictors of phobias and recovery are somewhat difficult to ascertain, especially with the majority of the research as retrospective. Beard et al. (2010) conducted a prospective, longitudinal study on predictors of social phobia recovery, finding that the "absence of psychological and medical comorbidities, as well as better psychosocial functioning" (p. 843) was one of the most significant predictors of recovery. There was no significant influence of demographic variables on recovery, but this topic was not considered in depth by the researchers

and there was a disproportionately large presence of Caucasians and females in the sample. Cited studies prior to the Beard et al. (2010) report have also indicated that characteristics such as full-time employment and less daily stress are indicators of recovery.

Philosophical theories on fear

One underlying question that should be mentioned is the simple "why do we experience fear?" In discussing pain, Dennett (1978) posits, "the bare phenomenon of pain could occur on the evolutionary scene before there were organisms that reacted appropriately to stimuli that were harbingers of injury." (p. 17) Fear and pain, though distinctly different, are significantly intertwined. In many cases, fear is elicited in anticipation and avoidance of pain; Dennett indirectly suggests here that fear developed as a method of avoiding injury, following the onset of pain as a sensation. Indeed, many common fears and phobias are centered around the potential for physical harm. In reference to evolutionary history, it is not so far of a leap to infer that fear was this method for avoiding personal injury prior to the sensation of pain, which itself indicates the existence of some level of physical trauma.

The reaction to pain is immediate and intense, and frequently associated with an immediate withdrawal response, such as removing one's hand from a hot stove. It is not a sensation that needs to be pondered, "for one does not distinguish the sensations that hurt or feel painful by applying some criterion; one simply distinguishes them." (p. 18) Though pain is distinctly based more directly in our neural network, fear has the tendency to provoke a similar immediate response. When one sees an object or enters a situation that evokes a fear response in them, they do not frequently take the time to contemplate their emotional state. Because fear is, "considered a normal response…provided that the fear is proportionate to the intensity of the

perceived threat," (Meltzer et al., 2008, p. 781) the question is where this expected response, necessary in human survival, becomes a phenomenon that interferes so significantly with daily functioning that it must be labeled as a disorder.

Armfield's Cognitive Model

Previous theories. In developing a new model on the development of fear and its transition to phobias, Armfield (2006) discusses the significant previous models of fear acquisition and how they fall short of adequately explaining all factors. Classical conditioning, modeled partially after Pavlovian conditioning, dictates that fears arise when relatively neutral stimuli are paired with fear inducing input, therefore linking the adverse response and associations to the initial stimuli. This helps explain how phobias are developed following traumatic experiences, but it fails to account for several factors, including irrationality, resistance to extinction, and recent developments in neurobiology. The preparedness model attempts to account for many of these discrepancies, citing genetic and biological sources of innate fears. Phobias develop as a result of "prepared learning," citing that many phobias, "commonly involve objects or situations that have been a threat or danger to the human species throughout its evolutionary history." (p. 748)

A contemporary subset of this theory includes Öhman's multiple-level evolutionary perspective, which integrates the influence of the "availability of coping resources" in an attempt to account for the more irrational responses present in phobic individuals. The factor of cultural preparedness is also integrated into preparedness theory, citing that "certain cultural factors and developmental events prepare individuals to respond more to some stimuli than to others." (p. 749) Research has shown some questioning results, however, as one cited study found that

"supposed survival-relevance was not related to fearfulness." (p. 749) Integrating more cognitive theories into these existing premises includes Bandura's self-efficacy theory, positing that an individual's perceived ability to "perform specific, effective courses of action, as well as their expectations about the likely outcomes of such actions, are major determinants of action." (p. 752) Though research has shown some support to this idea, the connections have not successfully determined causality and still cannot fully account for factors such as uneven distribution of feared stimuli.

Armfield's Vulnerability Schema. Before fully delving into the theory, it is vital to understand the four underlying variables (vulnerability schema) that Armfield asserts are necessary in understanding the etiology of fear. Danger, disgust, unpredictability, and uncontrollability all play into fear-inducing stimuli, whereas many of the previous theories primarily account only for danger. Danger is a relatively straightforward concept here although fears are frequently over-predicted, such as with snakes. Nonetheless, it is a significant factor in the development of phobias, as one study found that 39% of participants indicated that their specific phobia centered around the potential for physical harm. Disgust is thought to originate in relation to food aversion, but has since expanded in the course of "human cultural evolution." Although many animals fall into the variable of danger, many others deemed harmless (such as mice) also become the object of fear. Several animals cross over both schema, such as spiders, which are deemed both dangerous and revulsion. Frequently, animals become the objects of disgust over associations of those animals with various forms of unsanitary conditions. These two factors of fear and disgust together account for both disease-avoidance and predator-defense mechanisms.

The third of Armfield's vulnerability schema is unpredictability, suggesting a "lack of knowledge concerning some aspect of a stimulus, such as its identity, movement, or location." (p. 755) Armfield cites research linking this variable to both the "development and maintenance of anxiety and fear," (p. 755) and in regards to animal-centered anxiety highlights the impact of the animal's movement. In one study, participants showed significantly increased levels of fear towards their fear-targeted animal if they believed that its movements were unpredictable than the participants who believed the actions of the animal to be foreseeable. The intensity of anxiety in regards to perceived unpredictability also presents different levels between individuals with and without animal-directed phobias, as shown in another study demonstrating that individuals with high levels of self-reported fear of snakes or spiders regarded them as "significantly less predictable than did control subjects." (p. 756) It was also found that self-reported fear and perception of unpredictability went down significantly following the observation of a modeling video. Armfield suggests that these findings, though correlational and not causal, could indicate that an "increased knowledge of the fear-eliciting animal's movement served to decrease perceived unpredictability which then contributed to a reduction in subjective fear." (Armfield, 2006, p. 756)

Finally, uncontrollability appears to influence fears, again tying in with the previous factors. Although "several studies have found that perceived controllability decreases the adverse nature of a stressor," (p. 757) the causal role between control and fear has produced inconsistent results. Nonetheless, the variable still has seen significant correlational results in studies. The belief that one has influence over the outcome of a situation has significant impact on their perception of an object or situation, and has been shown to provoke anxiety. Regarding animal phobias, the dimensions factored into this perception includes "(1) the inability to exert influence

over the movement, approach, or behavior of an animal; (2) lack of control by the person over their response to an encounter with an animal; (3) the inability to control when an encounter with an animal will occur; and (4) the inability to avoid or terminate an encounter with an animal." (p. 757)

Cognitive Vulnerability Model. The perception of these four variables, either as independent beliefs or in combination, all contribute to the development and survival of phobias. The term "vulnerability" has already been used in reference to anxiety disorders, and Armfield uses it to compose his cognitive vulnerability model. This is compromised of a stimulus "automatically and unconsciously" triggering one or more of the four vulnerability schema listed above. This cognitive schema is "based on learning experiences associated with a particular stimulus" (p. 760) and is "moderated" by an individual's personality traits. This is immediately followed by two parallel processes: a "rapid automatic affective reaction" which may elicit the display of fear response, and a slower cognitive appraisal which "incorporates various other evaluations and appraisals." (p. 760) These reactions are all subject to changes based on personalized differences in various individual characteristics such as attention span.

Technology in Treatment

Both augmented reality (AR) and virtual reality (VR) technologies have already shown to be effective in treating phobias of insects and small animals. Whereas VR immerses the user in an entirely generated scenario, AR is an application to "enhance the user's perception of an experience in the real world, wherein 3D virtual objects appear to coexist with real elements in the actual world," (p. 705) allowing for real-time interaction within the natural environment

(Bretón-López et al., 2010). It was was demonstrated that following one trial with the AR technology to reduce the phobic reactions to cockroaches, individuals "felt a strong sense of presence and thought they were confronting real cockroaches." (p. 708)

Similarly, robotic social companions such as the Sony robotic dog AIBO have been used in the field of robot-assisted therapy (RAA), primarily for autism spectrum disorders, behavioral problems, dementia, and emotional wellbeing. In a non-therapeutic setting, both children and adults attributed the AIBO dog as having attributes of real animals such as "having mental states, being a social other, and having moral standing," (p. 546) despite recognition that it was a technological artifact (Melson et al., 2009). The AIBO unit does have a rather sophisticated system to interact with its environment and emulate the actions of a live dog. Beyond employing movements that mimic those of a real dog and the ability to detect "distance, acceleration, vibration, sound, and pressure," (p. 546) each AIBO unit is also capable of learning behaviors from its interaction with different people. Despite the obviously artificial metallic form, AIBO units have shown to increase the social activities of elderly patients with dementia more than a stuffed animal, and have been attributed with "intentionality" in previous studies. However, use of such robotic units in treating specific phobias is limited, and as such has not been validated as a method of treatment.

For the purposes of this study, augmented reality will be used in place of virtual reality or a robotic unit similar to AIBO for reasons of validity and to more accurately resemble actual interactions with fear-inducing animals, as will be discussed later.

Enhancing artificial intelligence. Full artificial intelligence (AI) is still far from being realized, but directions towards this achievement are gradually coming into light. Evolutionary

computation, the method by which the concepts of biological evolution are applied to the

development of computational algorithms, has shown significant growth in the fields of science

and engineering and shows potential for fully realizing AI (Fogel, 2000). Very much related to

this is Brooks' (1991) approach to "incrementally building complete intelligent Creatures," (p.

139) through the gradual introduction of capabilities to these "Creatures." In developing these

Creatures, Brook describes an engineering methodology which elucidates four basic

requirements: the ability to "cope appropriately" in a timely manner to changes in the

environment, to be "robust" in its environment (change gradually along with the changes in its

world), maintain multiple goals and alter the primary intent according to changes in the

environment, and have some "purpose in being." These ideals directly relate with those of

evolutionary computation, wherein the algorithms must be capable of adapting to changing

situations in a timely manner, but through a more direct process of learning by evaluating all

possible solutions and selecting the most desirable outcome. Fogel (2000) details how such a

method of engineering, in removing as much reliance on "human expertise" as possible, will

likely lead to "truly intelligent machines." (p. 32)

  The expansion of artificial intelligence has significant implications in the field of

treatment, where social technologies are being used with increasing frequency. In regards to

treatment of specific phobia, the use of augmented reality in combination with artificial

intelligence could make treatment and prevention of the disorder easier. More accuracy in

representation of feared stimuli has noteworthy potential to improve generalization and

applicability, and advances in technology could make the implementation of such therapy

economical and easily accessible.

Experiment

I propose a long-term study of the potential use of augmented reality as preventative treatment for specific phobia, composed of one session with AR therapy and several follow-up procedures. The purpose of the experiment will be dual: evaluate the overall effect of AR as preventative treatment on the development of specific phobias and related factors anxiety, and observe the varied effects this may have across variables including gender, culture, ethnicity, and socioeconomic status. Because of the applicability to Armfield's cognitive vulnerability model (in reference to the variables of danger, disgust, unpredictability, and uncontrollability) and the prevalence of spider-directed fears in both children and adults, spiders will be the animal used in the AR treatment.

To clarify, this is in no way an attempt to prevent or eliminate fear – an entirely normal event in the range of human emotion – but rather reduce the likelihood of developing phobias or other related anxiety disorders. The hope is that some of the coping mechanisms shown to the children in relation to their fear of spiders will be generalized to other anxiety-provoking factors.

Methodology

Participants. Initial questionnaires will then be sent to the parents of all children aged 11-12 in the participating school districts. This age range will be used due to findings by Kushnir & Sadeh (2010), which found that older children (in this age range) reported more fears than younger ones. Because parent-reported accounts of childhood fears can frequently show bias (Meltzer et al., 2008), child-directed questionnaires will also be included. Details such as academic achievement and perceived levels of anxiety will be assessed, and demographic information such as religion, ethnicity, socioeconomic status, gender, and cultural background

will be gathered. The child-directed questionnaires will be pilot tested prior to use, and will test for levels of spider-directed fear, as well as general anxiety and other specific fears.

From these responses, participants will be selected if they show warning signs of anxiety disorders such as low academic achievement, somatic complaints, and attention control. Additional prerequisites include a lack of any diagnosed psychological disorder and significant health issues; as indicated earlier, these could be considered confounding variables. Children must also disclose a fear of spiders at a "reasonable" level, but they will be assessed for spider-specific phobia according to the DSM-IV-TR prior to the experimental procedure and excluded from the study if they meet the criteria for the disorder. Parents will be given informed consent, but both parent and child will be told that the study is on the perception of artificial intelligence to avoid bias. Information on mental healthcare will be available at all points to both the parents and the children. An incentive for participation will be determined and offered to the subjects and parents. Children and at least one of the parents must be fluent in English.

Tools. Augmented Reality (AR) has already been used in the treatment of specific phobia, as detailed above. Because such technology has already been validated through relatively extensive use in the field, a new format does not need to be entirely composed. However, due to the nature of the proposed interaction certain qualities in the AR spider will need to be accounted for. An evolutionary algorithm will be employed to more realistically mimic the actions of a real spider in reacting to the participant and respond in ways more similar to that of an animal with intentionality and mental capacity. In following the concept of, "it's more scared of you than you are of it," the program will be allowed to "learn" prior to use in this experiment. It will additionally have the capability of learning within each session and will adapt its behaviors

accordingly, but will be reset at the beginning of each trial to exclude any differences in interaction.

An interview-administered assessment will be used to evaluate levels of anxiety, performance in school, the child's perception of the vulnerability schema of danger, disgust, unpredictability, and uncontrollability (Armfield. 2006) in relation to the spider. The DSM-IV-TR will also be used at each point to test for specific phobia of spiders. If a significant number of symptoms for any other anxiety disorder present themselves at any point, the participant will also be evaluated for that disorder.

Procedure. Administrators of the interview and the AR treatment will be blind to the purpose of the study, also informed that the research is on AI. Because of the possibility that the interaction with the AR program itself could have an impact on the development of anxiety disorders, a randomly assigned control group will use the AR system to interact with a non-feared animal in a manner similar to that of the experiment group. Children will be informed that they can take a reprieve or opt-out at any point in the exercise, which will be compromised of one 45-minute session with the AR and several interview-administered questions.

Upon immersion in the AR program, the participant will be informed that the spider they see is not real, and this will be demonstrated by having the administrator move their hand through the spider. As a method of gradual introduction, the AR spiders will be programed to act with three different "motivations" in interacting with the participant: neutral, avoidant, and defensive. Initially, the AR spider will be programmed to perform in a neutral state. This would still involve some movement from the spider, but at a significantly lower scale. The AR spider would in no way acknowledge or interact with the participants. After 15 minutes of various

gradual introduction and familiarity tasks, the child will then be told to move their hands towards the spider, and the second motivational act will be imparted on the AR program. In "recognizing" the participant's presence, the AR spider will then enter into an avoidant state, attempting to hide and distance itself from the child. The participant will then be asked to perform a slightly different set of tasks of gradual introduction and familiarity, with significantly more interaction with the spider. Following another 15 minutes in this stage, the AR spider will enter the final stage of a defensive state, characterized by more aggressive movements and the "motivation" of protecting its environment. The child will be asked to interact with the spider in this state for 15 minutes, after which the spider will return back to the neutral state.

The interview-administered questionnaires will be performed prior to the treatment, directly following the treatment, one month after the treatment, shortly after the participant turns 18 years old, and shortly after the participant turns 25 years old. The questionnaires will be altered for the latter two ages to accommodate age differences. Following the final evaluation, participants will be debriefed. When all information is gathered, multiple statistical analyses will be run using Factorial ANOVA.

Projected Results

With such a long-term study, reduction of sample size due to health reasons, loss of interest, and various other factors is expected. This will be noted, and demographic information will be accounted for. Due to research by Hofmann et al (2010) and Meltzer et al. (2008) on cultural differences in fear and phobia acquisition, it is projected that there will be a small but significant dampening effect on the effectiveness of treatment seen in individuals from more interdependent cultures. Because of gendered expectations for girls to be more afraid of spiders

(Hofmann et al., 2010; Armfield, 2006; Meltzer et al., 2008), the influence on prevalence and intensity of spider fear in female participants will be reduced in comparison to the male participants, but the influence on the prevalence of spider-directed specific phobias will be comparable across gender.

In addition, children that primarily exhibited the vulnerability schema of danger or unpredictability will show a greater reduction in spider-directed fear and anxiety towards spiders that those who primarily indicated that disgust or uncontrollability were their reasons for the fear regarding spiders. Similarly, prevalence rates of spider-directed phobia will be lower in the former group. On a smaller but still significant level, this may have a related effect on all animal-centered fears beyond that of spiders. For all other variables such as ethnicity (accounting for cultural influences) and socioeconomic status, it is predicted the impact of the preventative treatment will be relatively universal across groups.

Discussion

This is not to prevent or eliminate fears, but rather to reduce the likelihood of developing phobias and mitigate the consequences of fear-driven anxiety. The hope here is that the coping mechanisms developed through this experiment would assist the children in reducing their fear and anxiety in response to various stimuli. Results from this study could also have implications on the causal relationships between fear and anxiety in children, and disorders and behavioral problems that develop later in life. Especially in relation to the links shown between childhood anxiety and adult depression and substance abuse (Meltzer et al., 2008), finding preventative measures for the more debilitating fears in youth could have a plethora of benefits in practical application.

Though the use of such expensive technology in a more applicable use may be difficult to implement, the same principles used here can be generalized to other functions. Several "learning" video games are already being used for children of various ages, and it would not be hard to compose or integrate a similar fear-reduction functionality related to this proposed study. Even without the use of technology, if it is found that some degree of early intervention and preventative measures do have an influence, then a corresponding development of coping mechanisms could be integrated into developmental learning. It has been found that children with specific phobias "are significantly less likely to present to all public sector services, apart from teachers" (Meltzer et al., 2008, p. 787), so giving teachers the tools to alleviate fear-centered anxiety in children could have a noteworthy effect on the reduction of related disorders. However, if significant differences are seen between variables such as culture and gender are found, then more research may be required to discern what different types of preventative treatment would be more effective across these factors.

In best helping children reduce fear and anxiety, experts from fields including psychology, computer science, anthropology, education, and neurobiology must come together to effectively treat and prevent anxiety disorders. Fears develop through multiple realms of human development, so to best prevent the more detrimental consequences they must be approached from a holistic and comprehensive standpoint.

References

Armfield, J. M. (2006). Cognitive vulnerability: A model of the etiology of fear. *Clinical Psychology Review, 26*, 746-768.

Beard, C., Moitra, E., Weisberg, R. B., Keller, M. B. (2010). Characteristics and predictors of social phobia course in a longitudinal study of primary-care patients. *Depression and Anxiety, 27*, 839-845.

Bretón-López, J., Quero, S., Botella, C., García-Palacios, A., Baños, R. M., Alcañiz, M. (2010). An augmented reality system validation for the treatment of cockroach phobia. *Cyberpsychology, Behavior, and Social Networking, 13*(6), 705-709.

Brooks, R. A. (1991). Intelligence without representation. *Artificial Intelligence, 47*, 139-159.

Dennett D. C. (1978). Personal and Sub-personal Levels of Explanation. In *Brainstorms: Philosophical Essays on Mind and Psychology* (17-21). Montgomery, VT: Bradford Books; 1978.

Fogel, D. B. (2000). What is evolutionary computation? *IEEE Spectrum*, 26-32.

Hofmann, S. G., Asnaani, A., Hinton, D. E. (2010). Cultural aspects in social amxiety and social anxiety disorder. *Depression and Anxiety, 27*, 1117-1127.

Kushnir, J., Sadeh, A. (2009). Childhood fears, neurobehavioral functioning and behavior problems in school-age children. *Child Psychiatry Hum Dev, 41*, 88-97.

Melson, G. F., Kahn, P. r., Beck, A., & Friedman, B. (2009). Robotic pets in human lives: Implications for the human—animal bond and for human relationships with personified technologies. *Journal Of Social Issues*, *65*(3), 545-567.

Meltzer, H., Vostanis, P., Dogra, N., Doos, L., Ford, T., Goodman, R. (2008). Children's specific fears. *Child: care, health and development, 35*(6), 781-789.