

Brains transform remote threats into anxiety

November 21 2014, by Kevin Labar



Credit: AI-generated image ([disclaimer](#))

Modern life can feel defined by low-level anxiety swirling through society. Continual reports about terrorism and war. A struggle to stay on top of family finances and hold onto jobs. An onslaught of news coverage about Ebola. At the heart of issues like these lies uncertainty – the unknown likelihood of how ongoing crises will evolve over time.

Worries knocking on the door

When [unpredictability or uncertainty](#) prods us to consider the prospect of a bleak future, it fuels a state of apprehension that scientists study in the form of anxiety. Anxiety sits along a continuum of defensive behaviors we use when threats are somewhat remote from our current experience. It's less extreme than the full-on fear elicited by direct, acute situations like an immediate physical attack.

Anxiety triggers the release of stress hormones and reorganizes our priorities to prepare for a future threat. Cognitive effects include repetitive worries, hyper-vigilant scanning for signs of trouble in the environment, **and attentional and memory biases toward threat-related material.**

In our age of terrorism, for instance, people worry about flying. When they do fly, people are prone to take particular notice of fellow passengers whose ethnicity resembles that of terrorist group members, and thoughts of prior terrorist attacks are likely to spontaneously come to mind.

At mild levels, anxiety can be beneficial for problem-solving and stimulating response actions to a future threat – think of Ebola preparedness drills at hospitals. Anxiety can motivate group action that will benefit society, such as fast-tracking some medical treatments or enacting a line of defense to prevent the spread of disease.

However, higher levels of anxiety hijack cognitive resources needed for other important tasks. In a [laboratory study](#), we investigated how anxiety affects performance on a visual search task that emulated airport weapon screening procedures. We cast participants in the role of security screeners and asked them to look for "T" shapes amidst others on a screen. When we made them anxious by issuing a few unpredictable shocks, people tended to miss seeing a second "T" in the display. This effect was strongest in individuals who reported high levels of anxiety.

Our findings suggest that high threat level alerts at US airports could be counterproductive, actually creating more weapon screening errors by elevating anxiety in workers.



Watch out everybody! We're under threat! Credit: suneko, CC BY

Beyond anxiety to full-on fear

In contrast to anxiety, fear operates at the other extreme of the defensive continuum. It's our response to clear and present danger. Fear elicits a full-blown fight-or-flight response and redirects bodily resources to deal with the imminent threat. You know the feeling: imagine you're walking down a dark alley alone at night and you hear a loud sound – you freeze in your tracks, your pulse quickens, your palms sweat and your muscles tighten.

Fear is adaptive in this context because it increases the chances of survival. For example, directing blood flow to muscles used for running means the odds are better you'll get away from whatever is threatening you. Fear engages the amygdala, an evolutionarily ancient brain structure in the temporal lobe, to exert a powerful influence over other brain systems.

In the throes of fear, attention is directed toward the threat, to identify what it is and figure out where it is located. In addition, coping mechanisms kick in. Once the immediate threat is gone, memories are updated so that it can be avoided in the future.

Because of fear's intense physiological demands, prolonged or repetitive fears are particularly damaging for the brain and body. We found that in posttraumatic stress disorder, the amygdala is [shrunk](#) and [less able](#) to create precise memories for threatening material. Patients are left with overgeneralized fear memories. Rather than being triggered by actual threats, these fears can be provoked by stimuli that only resemble the original danger; or they can even occur out of the blue.

The constant interruption of daily life by intrusive traumatic memories cumulatively takes its toll on the health and well-being of individuals living with PTSD and their families. If not properly treated, [PTSD](#) often leads to personal and professional difficulties, depression or substance abuse.

Fearful together

Communicating the existence of threats is important for protecting other members of our social groups. Special brain mechanisms facilitate the social communication of fear and anxiety. In animals, acoustic properties of defensive alarm calls often signal the presence of specific predators or their proximity to the group. [Hearing these calls](#) elicits

behaviors – like fleeing or directing an attack – that help the group escape or defend its territory. The amygdala and portions of the auditory cortex are tuned to the specific frequencies used in these calls and defensive vocalizations are initiated by dedicated motor circuits linked to emotional behavior.

In human beings, facial and vocal expression can serve a similar purpose. Interestingly, some brain regions respond to both the direct experience of fear and simply [observing others experience fear](#). Neural mechanisms that mirror the feelings of others based on their emotional expression permit empathy and help individuals prepare for threats without having to experience them directly. These capacities, which can be so useful among monkeys spotting a lurking predator, can be counterproductive in people, though, when they lead to an unending, low-level anxiety.

One potential benefit of collective anxiety is that it spurs society to engage in risk assessment behaviors and can guide public policy. Establishing international alliances in the wars on terrorism or Ebola are group actions that can protect the world at large.

Media outlets are an effective way to widely disseminate information about social threats. But a bombardment of [fear](#) through traditional and social media unnecessarily ramps up [anxiety](#) levels that can paralyze a nation, even when a majority of the audience is not at direct risk. A balance between precaution and heedless communication is important in trying times so we can keep calm and carry on.

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