Brain and Body "Fingerprints" of Existential Anxiety and Their Relevance for the Identification of Potential Terrorists: A Research Note

by Linda Wendelberg

Abstract

The literature on radicalization documents that the identification of individuals who might take part in terrorist acts is difficult. In the field of terrorism studies, there is a lack of research on how the mind of individuals would present itself in conditions that are supposed to be related to radicalization processes. On the other hand, in the fields of crime prevention and forensic investigations, knowledge about brain processing and behavior is used to a greater degree. The lack of major longitudinal studies which focus on the period before vulnerable individuals become radicalized is noticeable—as are studies covering later stages of radicalization. Such studies would, however, be of vital importance to explain some of the mechanisms behind radicalization processes. By investigating already-radicalized individuals it is no longer possible to separate what was rooted in the radicalization process and what was rooted in prior life characteristics. By experimentally investigating non-radicalized subjects it is, on the other hand, not possible to make the link to heavy radicalization or actual terrorist acts. A new window to explore this link can possibly be found in investigations of Existential Anxiety [EA]. It has been shown that the condition of Existential Anxiety shares similarities with profiles found in some radicalized individuals—but a physical link to terrorist acts or severe radicalization has not yet been made. However, recent findings on EA could hypothetically explain the highly variable profiles found among terrorists. At present, there is a lack of knowledge about how this condition translates into actual behavior, which makes it difficult to use such information for the purpose of prevention. This review summarizes available evidence indicating that EA could be a risk factor in radicalization processes.

Keywords: Existential anxiety, behavior, vulnerability, brain, radicalization, profiling, terrorism

Introduction

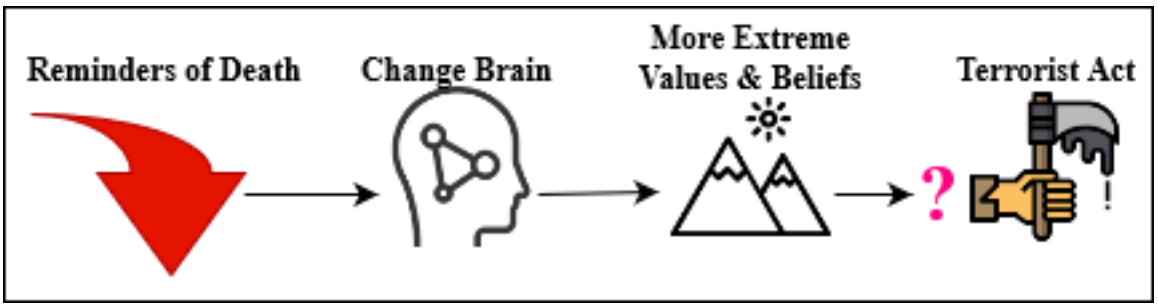
For a long time, the assumption that terrorists are shockingly normal has dominated the field of terrorism studies. This is beginning to change. Yet the study of the etiology of terrorism is still lacking robust indicators for high-quality risk assessments of potential perpetrators. [1][2] It has been credibly asserted that some types of radicalization are precipitated by certain personal experiences. Moskalenko and McCauley describe this in the following way: "The common denominator is that something happened to make the political personal."[3] Radicalization is defined as a process where individuals or groups undergo a transformation process characterized by increased support for the use of violence and coercion to promote political or social objectives and goals.[4][5] The radicalization process is also characterized by increased support for and/or use of illegal means.[6][7] However, the content and composition of the radicalization process is still unknown and even the definition of terrorism is still debated.[8] Existing findings related to terrorists show that such individuals manifest considerable diversity. These include individuals with and without known vulnerabilities, individuals who are suggested to have a very high level of psychological function along with apparently great prospects for a successful career in their society.[9][10] From media reports we know that even if the police or other parties have received warnings about possible serious radicalization, there seems to be a high degree of difficulty in identifying those who will actually commit violent acts. It is suggested that the reason for this may be that we might be searching for the wrong characteristics and also fail to consider some of the ways people may change.

Existential Anxiety

Mortality salience, also called death anxiety, is one of the more prevalent theories about Existential Anxiety [EA].[11][12][13][14] EA is defined as apprehension about the ultimate meaning of life and (fear of) death.[15] Within the perspective of the Terror Management Theory (TMT), "the something that happened" could be subconscious reminders of death.[16] TMT proposes that reminders of death trigger a worldview defense to protect individuals against their fear of death.[17] Extreme behavior and/or attitudes could be part of the defense as well as part of an eventual radicalization process.[18] Fear of death is only one type of existential concern and different types of existential concern can be related to different types of psychological states.[19] For example, social exclusion is related to a perception of life as less meaningful.[20] Human beings are social creatures with a need for social inclusion or integration, which is one aspect that is suggested to be an important factor related to radicalization processes.[21] Existential concern can be considered as a universal basic feature of mankind that can be filled with different meanings closely tied to individual differences and collective cultures.[22][23] The TMT argues that EA is the fundament for many types of existential concerns—which is the reason why TMT is often viewed as a biological theory. Figure 1 shows the change process related to existential anxiety: reminders of death subconsciously influence an individual's brain and contribute to changed behavior as well as the strengthening of already existing values and beliefs. EA might also contribute to the radicalization of already existing values and beliefs. Whether EA is involved in the process leading to the perpetration of a terrorist act is, however, still an open question. The issue which is debated is whether there is a path going from reminders of death to the execution of terrorist acts. This question [the question mark in Figure 1 below] will be discussed in a later section.

Figure 1: Process of Change due to Activation of Death Anxiety

[Reminders of death contribute to changed brain processing. This changed brain processing is related to the radicalization of values and beliefs. Change in brain activation patterns could be driven "mechanically" by sensitivity for repetition of stimuli—described below].



The phenomenon of EA can be investigated experimentally. However, it is difficult to measure existential anxiety during real-world events (as opposed to controlled laboratory environments where subjects are experimentally primed with subtle mortality reminders). Nor do we know whether it is possible to measure the priming effect of EA in already-radicalized subjects, which, after all, would not give us information about an individual's condition before radicalization. However, if we hypothesize that some experiments related to EA might also describe the start of a radicalization process, there exists a great amount of potentially useful knowledge. This holds true despite the fact that there are few studies about how this condition manifests itself in actual behavior.

The following short literature review aims to present a few physiological findings that suggest that EA may be able to explain at least parts of radicalization processes. This review is limited to findings related to the Terror Management Theory (TMT). Since this is a short Research Note, the different subjects are not described exhaustively but rather briefly highlighted in terms of their potential relevance to the study of radicalization, extremism and terrorism, inviting interested readers to further explore a probable connection by following the notes.

Political Radicalization and Religiosity—Shared Aspects

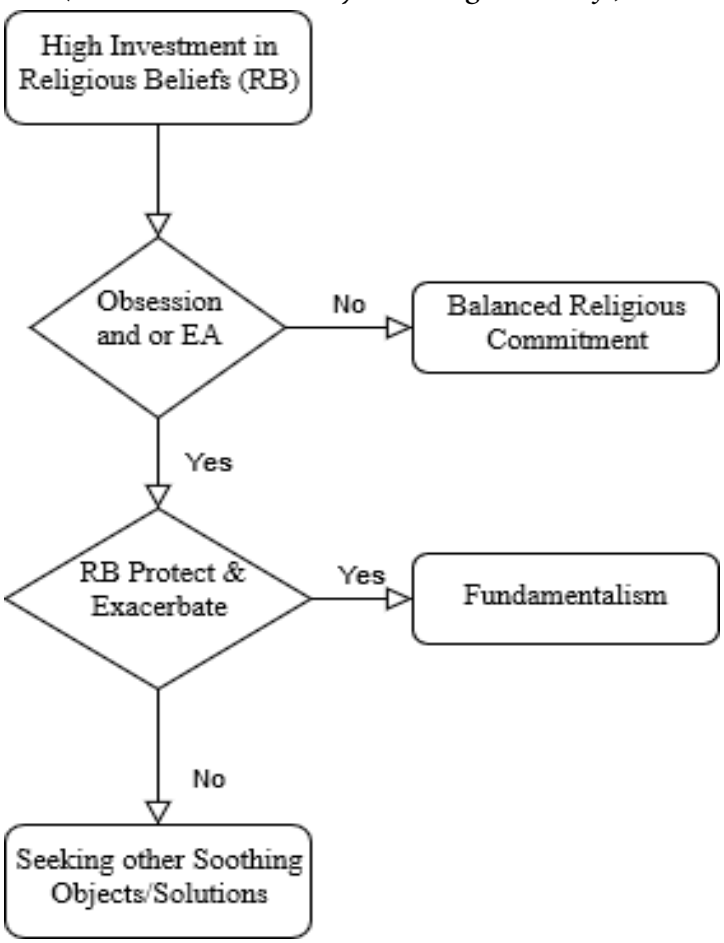
Existing research has shown that EA is related to political radicalization as well as to extreme forms of behavior.[24][25][26][27] However, due to the experimental conditions used in this type of research, a direct link to radicalization to extremism has been difficult to establish.[28]

The link between radicalization and deep religiosity has also been questioned. It has been found that religiosity can be, but does not necessarily need to be, a protective factor against EA.[29][30][31][32] The field of terrorism studies and the field of existential anxiety studies may, however, reach some similar findings. Some research findings suggest that religious fundamentalism is related to changes in the brain's prefrontal region which is responsible for cognitive flexibility and openness.[33] The research literature in the field of EA suggests that change in the form of a brain lesion may not be necessary to develop fundamentalism. Religiosity may protect vulnerable individuals with respect to becoming radicalized.[34] However, some research studies have also found that subjects with strong religious beliefs may be more obsessional.[35][36] EA is related to the strengthening of obsessional symptoms in already-vulnerable subjects.[37] This suggests that religiosity among extremists can be related to obsessional patterns and not necessarily to religiosity [see Figure 2]. Research has shown that religiosity only mitigates EA for people who already have invested much in their religious beliefs.[38] This suggests that religion could hypothetically be replaced with something else.

This also suggests that radicalization tends to be based on already-existing beliefs and values (as in the case of 're-born believers') and that a radicalization process is (also) driven by psychological needs (e.g., obsessional, sexual, need for closure) activated by psychological vulnerabilities in combination with external factors. In short, the radicalization process in an individual often tends to be an exacerbation of already-existing values and beliefs.

Figure 2: Path for the Development of Fundamentalist Religious Beliefs

(EA=existential anxiety, RB=religious beliefs).



Brain Regions

Neurophysiology deals with physiological observations of the nervous system while neuropsychology combines information about behavior and mind, based on neurological observations. Neurophysiology and neuropsychology contribute to information about brain functioning and are frequently used in safety and security evaluations as well as in psychological and medical evaluations.[39][40][41][42][43][44] For example, functional Magnetic Resonance Imaging (fMRI), which is one of the neurophysiological methods, has contributed to new information about brain functioning in situations of EA. Extremism has been related to increased activity in the left inferior frontal gyrus (IFG) and to heightened activity in the same region as well as in surrounding areas linked to EA.[45][46][47] Overall, EA seems to affect one or more circuits in the brain, which may have far-reaching significance for sensorimotor function, motivation and behavior. Evidence that EA contributes to changed processing in the brain's insula is well documented. This region is strongly related to sensorimotor function.[48][49] Alteration of sensorimotor function can be observed or measured by neuropsychological and or neurophysiological testing as well as by computer systems related to human-computer interaction.[50][51] The brain regions found to be altered as a result of priming with EA stimuli (e.g., in the form of verbal reminders of a person's mortality), are related to aggressive and violent behavior.[52][53]

Brain Visual Paths

The dorsal and ventral pathways of the human brain are referred to respectively as the thalamic path and the hypothalamic path.[54] Alterations in the dorsal and ventral pathways are related to changes in an individual's psychological condition and include his or her sexual problems.[55] Older published research data[56] (and new research data to be published by the current author) suggest that the ventral and dorsal visual paths are affected when subjects are primed with a fear of death and might also be related to different types of vulnerability. In mainstream psychology, vulnerability is often related to high neuroticism, psychopathic traits and low self-esteem, while research on EA suggests that there may be also other vulnerability paths.[57] What if vulnerability traits could be changed as part of the radicalization process? It may well be that a high focus on the more common vulnerability factors may reduce the ability to detect that there may also be common traits or common processes in extreme radicalization. On the other hand, it is possible that detection of change can be of greater importance than the identification of vulnerability factors. Repeated testing shows that subjects primed with EA have a higher degree of variability in data even if the self-reported personality profiles in themselves are not different. This suggests that a focal view on the more general vulnerability factors and a high focus on generalizability may not track the diversity. Moreover, behavior and cognition seem to be altered in specific patterns that can be identified. It suggests that cognition, emotion and motor function are all influenced by EA. Such information could be obtained by researchers working with radicalized individuals. For example, the ventral path is related to sexuality (see below).[58] Published research data [59] and new research data to be published by the current author support the thesis that EA influences the ventral path in a more complex way—rather than only in one direction. Decreased activity in the ventral hypothalamic pathway could, for example, indicate hyposexuality while increased activity could indicate hypersexuality.[60] However, brain activation patterns and cognition for EA are documented at a wider scope than behavioral measures. This restricts the possible use of such findings in counterterrorism work, because concrete behavioral *measures* can be more easily directly implemented in computer algorithms or used in fieldwork.

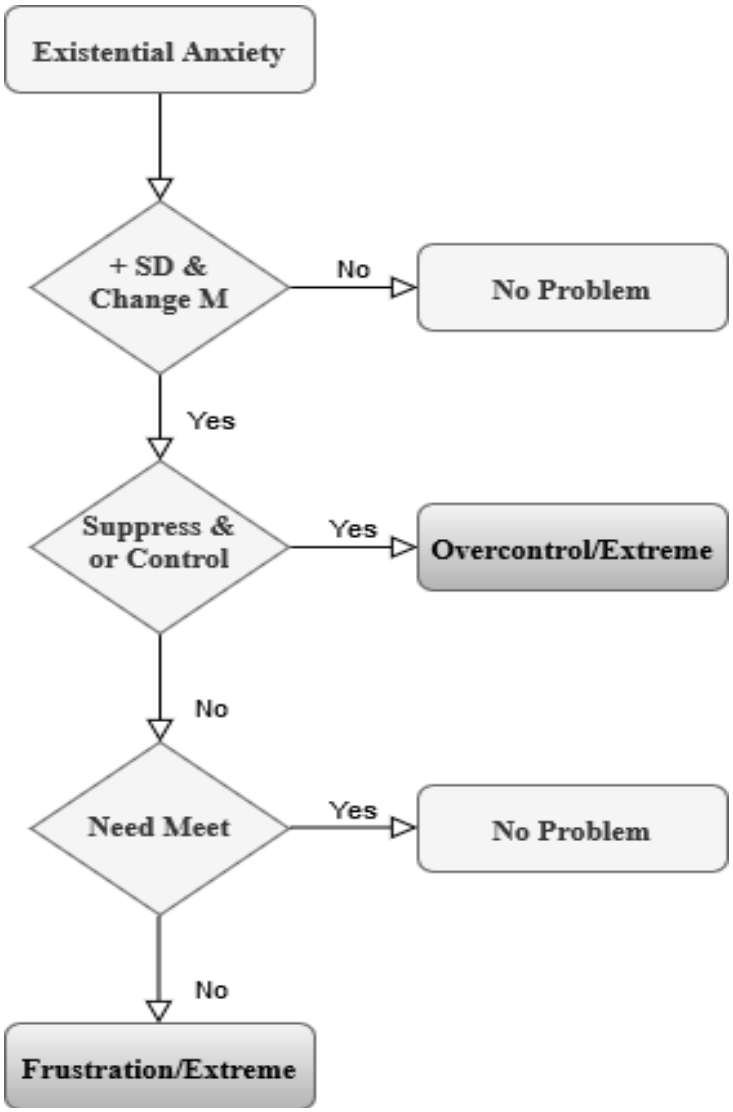
Sexuality and Radicalization

Law enforcement agencies (LEA) and academic research have repeatedly suggested that sexuality is part of the complex that has been linked to radicalization and terrorist acts.[61][62] A large number of studies document that EA contributes to a change in sexual behavior. This change is thought to be part of the psychological defense that is activated when an individual is facing reminders of death.[63][64] However, even though anecdotal observations as well as qualitative studies have described that sexuality appears to be related to

radicalization, few, if any, studies have shown how such issues can be measured. Moreover, researchers have questioned the lack of focus on the existential perspective in studies on sexual dysfunction and other sexual problems, including lack of access to a partner.[65] The existential perspective on sexual problems can be viewed as the deeper psychological reason(s) for sexual distress, including etiological psychological conflicts.[66] This perspective goes far beyond the physiological sexual function and addresses some of the deeper layers of the human mind. Sexual problems cover the entire range from total abstinence of sex to hypersexuality. However, existing research suggests that radicalization appears to be related to more restricted attitudes and motivation towards sexual matters, as well as linked to a higher degree of guilt when exposed to sexual stimuli.[67] On the other hand, the literature indicates that the effect of reminders of death on sexual attitudes and behavior can be related to different paths, including hypersexuality, depending on individual characteristics and circumstances related to, for example, civil status.[68][69] This is illustrated in Figure 3, showing two possible paths that both may be part of the radicalization process. The model is based on the presumption that EA contribute to alteration of sexual needs as also documented in a large quantity of studies.[70][71][72] Blocking of possibilities to fulfil biological needs and self-inflicted punishment by restrict fulfilment of own biological needs can be seen as two sides to the same story. In summary the research suggests that EA increases sexual desire but the motivation (pursuing sexual matters) may go in different directions.

Figure 3: EA's Contribution to Increased Sexual Desire

[These may develop in different paths. The path leading to suppression and the path leading to frustration may be associated with the risk of developing extremism. (+SD=increased sexual desire, M=motivation). Suppression and/or control is based on findings with respect to the behavioral inhibition system (BIS)—see section on avoidance below].



Ventrolateral Prefrontal Cortex (VPC) Connectivity

Self-esteem has repeatedly been found to moderate EA, and high levels of self-esteem are related to resilience towards effects that can be evoked by reminders of death.[73][74] Human beings with high self-esteem, compared to individuals with low self-esteem, have been found to develop increased amygdala-Ventrolateral Prefrontal Cortex (VPC) connectivity after priming with EA.[75] Research suggests that the VPC activation is stronger for death-related words for young adults while older people have been found to display an activation pattern in the opposite direction.[76] Changes in the VPC region are related to psychopathy and to religious fundamentalism.[77][78][79]

Avoidance and Respiratory Sinus Arrhythmia (RSA)

Existential Anxiety has been shown to be related to the inhibition (avoidance) system (BIS) and to a decrease in Respiratory Sinus Arrhythmia (RSA).[80][81][82] RSA is defined as an increase in heart rate during inhalation, and a diminished heart rate during exhalation (or heart rate variability related to respiration).[83][84] Low RSA is related to internalization and externalizing behavior, which have been suggested to be risk factors for violent acts, including acts of terrorism.[85][86][87] Moreover, it is found that hostile individuals have a reduced parasympathetic activity (lower RSA) compared to less hostile individuals.[88]

The Serotonin Transporter Polymorphism (5-HTTLPR)

Existential Anxiety is also related to the serotonin transporter polymorphism (5-HTTLPR) [89] in the human brain. The 5-HTTLPR describes biological genotypes and certain types have been related to psychological vulnerability and aggression.[90][91] The 5-HTTLPR is part of the serotonin deficiency hypothesis, which has been associated with human aggression. For example, there are differences in the 5-HTTLPR genotype related to criminal convictions.[92] It is argued, however, that this hypothesis lacks confirmatory evidence or is at least uncertain due to contradictory findings, unreliable measurements and high levels of complexity.[93]

Novelty and Familiarity

EA is related to the avoidance of novelty and to reduced variety seeking.[94] Human reactions towards novel as well as familiar stimuli have been thoroughly tested because such processing contributes to better information about memory processing and motivation.[95][96][97] Preference for novelty or familiarity activates in different ways in the human brain and can be associated with different types of behavior such as, for example, repetitive restricted responses versus search for novelty.[98][99] Individual patterns of activation related to familiarity and novelty can be a potentially important tool in criminal investigations and crime prevention.[100][101]

Findings from the Field of Eye Tracking

Data gathered by an individual's eye tracking can contribute direct information about behavior as well as indirect information about the human brain; such data can, for instance, be used in relation to human-computer interaction.[102][103] Existing findings suggest that individuals who experience EA avoid threatening stimuli and are avoidant in general.[104][105] Priming a person with EA stimuli is found to influence frequency of update (time between eye movements), length of fixations as well as some other eye-tracking measurements linked with intersubjective differences.[106] EA is, as mentioned above, additionally related to changes in ambient and focal processing and with familiarity versus novelty. Current information about eye-tracking measures is drawn from only a limited number of studies (so far, such studies are noticeably scarce). Behavioral indicators gathered by eye tracking can be used to perform observations, including observations related to

human-computer interaction, while information about body states (e.g., RSA, levels of serotonin and brain connectivity) cannot directly be used as robust indicators. Eye tracking is one of many neurophysiology methods with a potential to discover neuropsychological phenomena generally and cognitive processes that affect behavior in particular.[107]

The Missing Link

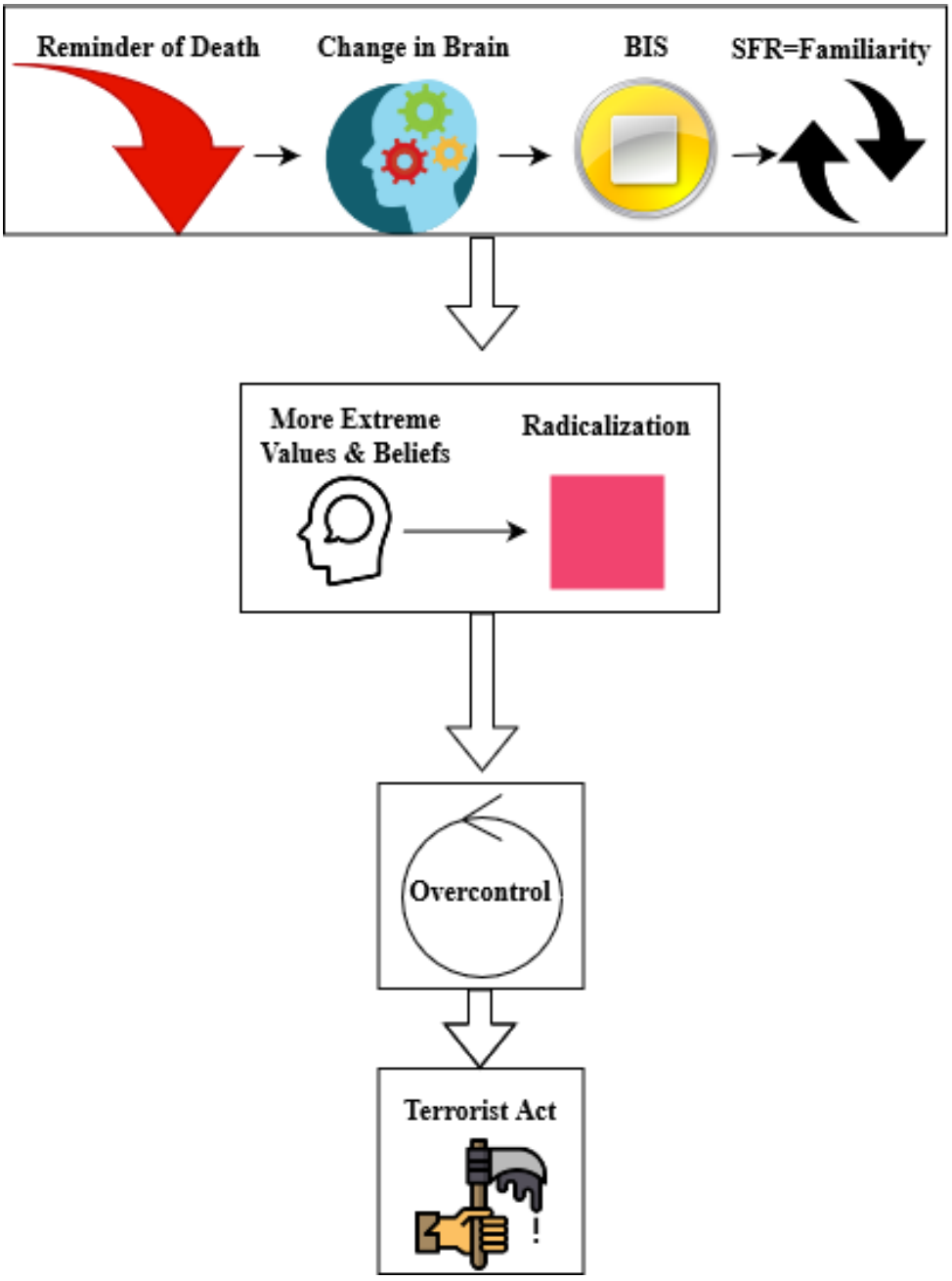
In research achieving simplicity is frequently one of the most difficult tasks. With respect to Existential Anxiety it is well documented that this condition is related to the behavior inhibition system. It is not obvious to associate avoidance with the extreme aggression shown in terrorist acts. However, research has shown that the behavior inhibition system predicts overcontrol.[108] Since the 1960s, overcontrol has been related to more extreme violence.[109] To the best of the author's knowledge, no studies have investigated overcontrol related to EA. However, the author has by means of an experiment discovered how others interpret behavior based on data from EA (results to be published in a separate paper). A simplified summarization of the main findings of importance as drivers for the radicalization process can be found in Figure 4. This model assumes that Sensitivity for Repetition of Stimuli (SFR) is a driver of the radicalization process. Moreover, it assumes that BIS predicts overcontrol, which is a possible connection to violent terrorist acts.

Main Drivers of the Radicalization Process

Existential Anxiety is frequently referred to as a special kind of anxiety. Recent findings about brain activation patterns during EA may, however, contradict any resemblance with common anxiety, especially for high-self-esteem individuals.[110] Research has shown that high neuroticism may be a vulnerability factor, and the EA is assumed to play a significant role in the development and severity of a range of anxiety disorders.[111] [112] Recent research in this direction shows promising results, which may lead to findings that can contribute positively to psychological health, for example with respect to anxiety and obsessions.[113][114] However, we do not know whether this may contribute to a better treatment of radicalization. Moreover, to offer treatment to subjects that may be unaware of their own challenges demands that society is capable to detect how people change. A model of the main drivers of the radicalization process with respect to EA is presented below.

Figure 4: Main Drivers in the Radicalization Process and Reason Why EA Can Contribute to the Execution of Acts of Terrorism (L.W.)

(BIS=behavior inhibition system, SFR=sensitivity for repetition of stimuli).



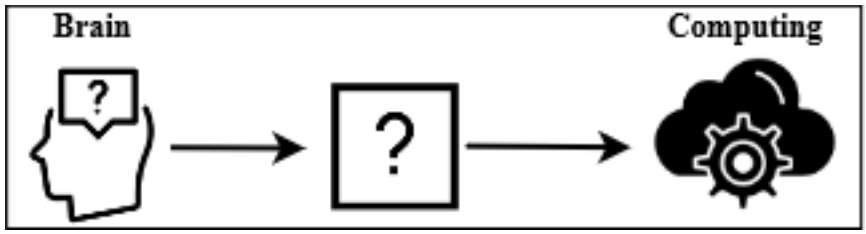
However, it is important to continue working on therapeutic solutions for already-radicalized subjects—an area where much work remains to be done.[115]

On Current State of Profiling

In the past, the field of profiling has been frequently criticized for producing inaccurate outcomes, e.g., false positives.[116][117] Digital forensics have, however, made advances in recent years and almost replaced the conventional profiling/investigation field due to its potential for higher levels of accuracy.[118][119][120] The paradigm of digital forensics changes our understanding of the type of knowledge that can offer extra value. It has been argued that digital forensics is more about detection than prevention; however, in the field of terrorism, detection *is* prevention.[121] Profiling is, according to the General Data Protection Regulation (GDPR)

Article 22, not allowed without consent from the subject. However, it is permissible when cases fall within the parameters of national security or international criminal law.[122] Information about brain processing and behavior can be used to detect risk factors and to profile individuals or groups, based on new and highly sophisticated technological tools and methods. Today's profiling focuses to a larger degree on measures that can be transformed and does not, as in the past, focus on static human traits. The field of terrorism studies has, in recent years, documented that individuals may radicalize more quickly than previously assumed.[123] To keep up with this acceleration, we need to link brain research with computing. For this, we need an intermediate variable that can connect the inside of the brain to the outer world.[124] The intermediating variable [the question mark in Figure 5 below] can be behavior but can also be exact measures related to brain activity, personality profiles, or other knowledge that can be transformed for use in the field of computing.

Figure 5: From Brain to Computing



Under normal circumstances, responsible citizens are all obliged to intervene when someone is a danger to themselves or to others. However, with respect to radicalization it is difficult to know when this is should be the case. Changes related to EA are subtle and difficult to detect and often operate at a subconscious level. This raises ethical and legal dilemmas because individuals influenced by EA may themselves not be aware of this influence while those in their environment may have difficulties in detecting relevant but subtle changes. Imaging and artificial intelligence (AI) technology can, to a larger degree than human beings, detect subtle changes but only if consolidated knowledge about behavior and behavioral change already exists. At present, we lack robust indicators for radicalization processes that can be used by human profilers and in technological (AI) systems within existing legal frameworks. At present, indicators do not offer full answers in the field of terrorism detection due to the complexity of pathways to radicalization. However, in domains of uncertainty, neurophysiological and neuropsychological decision support can be important.

Conclusion

Findings related to behavior and brain activation in the field of Existential Anxiety may share similarities with findings about terrorists within the field of radicalization studies. This could apply to patterns of brain activation, findings related to the main visual processing paths in the human brain, activation in the brain's Ventrolateral Prefrontal Cortex (VPC) region, lower Respiratory Sinus Arrhythmia (RSA), avoidance behavior and preference for familiarity. However, even if we now have access to sophisticated brain-scanning technology that can contribute to more accurate profiling, the field currently lacks measurements to build robust indicators and systems. Studies that document measures and observable behavior for diagnosing the condition of EA are still limited in number. The brief overview presented here suggests, however, that the fields of radicalization-, extremism- and terrorism studies could benefit from including knowledge gathered by neurophysiological and neuropsychological methods about EA in efforts to develop better instruments for risk assessments and prevention efforts.

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