FACING DOWN YOUR FEARS

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Facing one's fears means acting, even if one feels anxious or fearful, to ultimately reduce fears that are a hindrance to acting and interacting with the world constructively. These are fears that do not protect the individual but interfere with life. Understanding the messages in these fears can provide important information for changes that benefit and reduce the fears.

Keywords: fear, anxiety, communication, psychotherapy

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Introduction

Facing one's fears means acting, even if one feels anxious or fearful, to ultimately reduce fears that are a hindrance to interacting with oneself and the world in a way which can increase happiness, satisfaction and contentment. These are fears that do not offer protection and interfere with life. The first important step is thus to identify what kind of response the fear is aimed at. Emotions are usually valuable signals, but an anxiety in a situation may be triggered by internal events that are not connected to the situation.

Emotional signals, such as fear, are at the most basic information that is assembled and communicated internally. (Haverkampf, 2018a) Foa and Kozak contended that emotions are represented by information structures in memory, and anxiety occurs when an information structure that serves as program to escape or avoid danger is activated. (Foa & Kozak, 1986) Even fear follows common information patterns, although the emotion is usually communicated between certain structures of the brain. The amygdala has many efferent projections and represents a central fear system involved in both the expression and the acquisition of conditioned and unconditioned fear. (Davis, 1997) Lesions of the amygdala block innate or conditioned fear, as well as various measures of attention, and local infusions of drugs into the amygdala have anxiolytic effects in several behavioural tests.

A Matter of Control?

Having a sense of control makes people feel more secure in life. However, fear ear and anger have opposite effects on risk perception. Whereas fearful people expressed pessimistic risk estimates and risk-averse choices, angry people express optimistic risk estimates and risk-seeking choices. In one study, appraisals of certainty and control moderated and (in the case of control) mediated the emotion effects. (Lerner & Keltner, 2001)

Important in overcoming fear is thus to assess the level of control that is really needed in a given situation. Often, fear is a result of the level of control that is perceived as being necessary to stay 'safe'. This can be addressed by thinking of what one means by safety. In communication-focused therapy, one way to address this is to look at the primary parameters, the needs, values and aspirations of the individual. (Haverkampf, 2018d) Quite often, patients find out that they were seeing safety in factors, such as relationships or material goods, that were not the highest priorities on their needs and value lists. So, rather than feeling safer, they often felt less safe when acquiring them.

Understanding Fear

When faced with threat, the survival of an organism is contingent upon the selection of appropriate active or passive behavioural responses. Freezing is an evolutionarily conserved passive fear response, for example. The central amygdala (CEA) is a forebrain structure vital for the acquisition and expression of conditioned fear responses, and the role of specific neuronal sub-populations of the CEA in freezing behaviour is well-established. Fadok and colleagues showed that active and passive fear responses are mediated by distinct and mutually inhibitory CEA neurons. Cells expressing corticotropin-releasing factor (CRF+) mediate conditioned flight, and activation of somatostatin-positive (SOM+) neurons initiates passive freezing behaviour. (Fadok et al., 2017) The selection of appropriate behavioural responses to threat seems to be based on competitive interactions between inhibitory signals on each other from these cell groups.

Understanding the messages in these fears can provide important information to bring about a change that reduces the fear. An emotion is an 'e-motion' because it is supposed to move something, because it needs to bring about change. Identifying the information behind, or underlying, an emotion required identifying and reflecting on the emotion, but in communication oriented therapies, for example, it can become a useful habit. (Haverkampf, 2010b, 2017c, 2017b, 2018b) The effect of fears and anxiety, and whether they can lead to positive adjustments and changes, depends on how one reads them, how one extracts and distils the signals contained in them. Often, the fear of being fearful prevents the resolution of fear. In this situation a focus on changes in internal and external communication patterns can lead to the needed information to resolve the fear in a better way than merely confronting an emotion.

Overgeneralization

The overgeneralization of fear is maladaptive and can be observed in conditions such as PTSD. Asok and colleagues examined how male and female mice generalize contextual fear at 3 weeks after conditioning that the test order of training and generalization contexts is a critical determinant of generalization and context discrimination, particularly for female mice, while tactile elements that are present during fear conditioning are more salient for male mice. (Asok et al., 2019)

Fear and cognitive abilities

Fear of physical injury includes matters that are perceived by human beings that depend on reality testing, abstraction ability, and capacity for self-preservation. (Blackman, 2018). Treating people who are afraid of physical injury involves helping them to understand the realities of life and to acknowledge their reality perceptions of danger. In cases where the reality of the danger is miniscule or non-existent but reality testing is adequate and abstraction ability good, insight-directed work can help people understand the contributions to their fears of physical injury from various stages of development where they experienced difficulty.

PTSD

Soldiers who witnessed atrocities in combat or rape victims are brought to and beyond the edge of normal human experience, perpetrated by other human beings where the basic parameters of what it means to be human seemingly no longer apply.

It is now generally believed that PTSD is due at least in part to a learning process in which formerly neutral stimuli (e.g., a bamboo placemat) are paired with extremely aversive events (e.g., the sight of a head without a body). This is a classic example of Pavlovian fear conditioning, a form of learning that has been studied extensively by psychologists and about which a great deal of basic information has been gained. Learning to overcome fear: Extinction: Inhibition of acquired fear is studied in the laboratory using a procedurally simple paradigm in which a rat or a human being is conditioned to fear some neutral stimulus, such as a light or tone, by pairing it with some aversive stimulus, such as a mild shock.

Learning

Learning by conditioning is a key ability of animals and humans for acquiring novel behaviour necessary for survival in a changing environment. Aberrant conditioning has been considered a crucial factor in the aetiology and maintenance of various types of fear.

Anxiety

The learning of fear seems to be facilitated in patients suffering from anxiety. Duits examined in a meta-study the differences in fear conditioning between anxiety patients and healthy controls using meta-analytic methods and the extent to which study characteristics may account for the variability in findings across studies. Forty-four studies (published between 1920 and 2013) with data on 963 anxiety disordered patients and 1,222 control subjects were obtained through PubMed and PsycINFO, as well as from a previous meta-analysis on fear conditioning. Results demonstrated robustly increased fear responses to conditioned safety cues (CS−) in anxiety patients compared to controls during acquisition. This effect may represent an impaired ability to inhibit fear in the presence of safety cues (CS−) and/or may signify an increased tendency in anxiety disordered patients to generalize fear responses to safe stimuli resembling the conditioned danger cue (CS+). In contrast, during extinction, patients show stronger fear responses to the CS+ and a trend toward increased discrimination learning (differentiation between the CS+ and CS−) compared to controls, indicating delayed and/or reduced extinction of fear in anxiety patients. Finally, none of the included study characteristics, such as the type of fear measure (subjective vs. psychophysiological index of fear), could account significantly for the variance in effect sizes across studies. (Duits et al., 2015)

Social Networks

Our social network are the outcomes of our communication patterns and interactions with other people. Social networking sites (SNS) are especially attractive for adolescents, but it has also been shown that these users can suffer from negative psychological consequences when using these sites excessively. Particularly, the fear of missing out (FOMO) has becomes a major problem. At the same time, it is important to remember that the need to communicate is a basic biological requirement of life, and that the fear of missing out is connected with this basic need. The main problem is that if meaningful sources of information cannot be identified effectively, the person may look to plug into communication networks, including social networks, merely for the sake of connecting, rather than really benefiting from it. As mentioned before, fear can be reduced by meaningful information (Haverkampf, 2018c), but that requires the skills and insight to identify sources of meaningful information.

In an online survey, 1468 Spanish-speaking Latin-American social media users between 16 and 18 years old completed the Hospital Anxiety and Depression Scale (HADS), the Social Networking Intensity scale (SNI), the FOMO scale (FOMOs), and a questionnaire on negative consequences of using SNS via mobile device (CERM). Using structural equation modelling, it was found that both FOMO and SNI mediate the link between psychopathology and CERM, but by different mechanisms. Additionally, for girls, feeling depressed seemd to trigger higher SNS involvement. For boys, anxiety triggers higher SNS involvement. (Oberst, Wegmann, Stodt, Brand, & Chamarro, 2017) In another study by Blackwell and colleagues that investigated whether extraversion, neuroticism, attachment style, and fear of missing out (FOMO) were predictors of social media use and addiction, 207 participants completed a brief survey measuring levels of extraversion, neuroticism, attachment styles, and FOMO. Younger age, neuroticism, and fear of missing out predicted social media use. However, only fear of missing out predicted social media addiction. Attachment anxiety and avoidance predicted social media addiction, but this relationship was no longer significant after the addition of FOMO. (Blackwell, Leaman, Tramposch, Osborne, & Liss, 2017) In a study by Elhai and colleagues, smartphone use was most correlated with anxiety, need for touch and FoMO. The frequency of use was most correlated (inversely) with depression. In regression models, problematic smartphone use was associated with FoMO, depression (inversely), anxiety, and need for touch. Frequency of use was associated with need for touch, and (inversely) with depressive symptoms. Behavioral activation mediated associations between smartphone use (both problematic and usage frequency) and depression and anxiety symptoms. Emotional suppression also mediated the association between problematic smartphone use and anxiety. (Elhai, Levine, Dvorak, & Hall, 2016)

Extinction

The goal of any therapeutic approach to fear, or to managing fear in life generally, is to manage fear. While this should not mean extinguishing all fear, as this is an important informational signal for survival, but to be able to reduce or extinguish the fear which is interfering with life in unhelpful ways. In fear extinction, the positive experience of an omitted aversive event drives the reduction of fear responses and the formation of long-term extinction memories. Dopamine emerges as key neurobiological mediator of these related processes. (Kalisch, Gerlicher, & Duvarci, 2019) Exposure therapy is a form of cognitive intervention that specifically changes the expectancy of harm. (Hofmann, 2008)

Extinction is possible even without exposure to the feared situation or location in real life. A number of studies have shown that exposure to virtual stimuli works as well. Investigators have, for example, shown that VRT was successful in reducing the fear of the public speaking. (North, North, & Coble, 2015) In other words, the information is again what is important and the way in which it is communicated.

Flexibility

Fear can be highly adaptive in promoting survival, yet it can also be detrimental when it persists long after a threat has passed. Flexibility of the fear response may be most advantageous during adolescence when animals are prone to explore novel, potentially threatening environments. Two opposing adolescent fear-related behaviours—diminished extinction of cued fear and suppressed expression of contextual fear—may serve this purpose, but the neural basis underlying these changes is unknown.

Memory

Memory is a store of information available for retrieval by the individual. As meaningful information can reduce fear, the ability to store it, can have a lasting effect of reducing or mitigating fear. Fear memory is formed in the hippocampus (contextual conditioning and inhibitory avoidance), in the basolateral amygdala (inhibitory avoidance), and in the lateral amygdala (conditioning to a tone).

The circuitry involves, in addition, the pre- and infralimbic ventromedial prefrontal cortex, the central amygdala subnuclei, and the dentate gyrus. Fear learning models, notably inhibitory avoidance, have also been very useful for the analysis of the biochemical mechanisms of memory consolidation as a whole. These studies have capitalized on in vitro observations on long-term potentiation and other kinds of plasticity. The effect of a very large number of drugs on fear learning has been intensively studied, often as a prelude to the investigation of effects on anxiety.

Learning

Fear memory was thoroughly investigated mostly using two classical conditioning procedures (contextual fear conditioning and fear conditioning to a tone) and one instrumental procedure (one-trial inhibitory avoidance).

Empathy and Fear

The relationship between empathy, a connective signal, and fear, a potentially disconnective signal, is interesting. Olsson and colleagues investigated how social (vicarious) fear learning is affected by empathic appraisals by asking participants to either enhance or decrease their empathic responses to another individual (the demonstrator), who received electric shocks paired with a predictive conditioned stimulus. A third group of participants received no appraisal instructions and responded naturally to the demonstrator. During a later test, participants who had enhanced their empathy evinced the strongest vicarious fear learning as measured by skin conductance responses to the conditioned stimulus in the absence of the demonstrator. Moreover, this effect was augmented in observers high in trait empathy. Their results suggest that a demonstrator's expression can serve as a "social" unconditioned stimulus (US), similar to a personally experienced US in Pavlovian fear conditioning, and that learning from a social US depends on both empathic appraisals and the observers' stable traits. (Olsson et al., 2016)

Stress

Stress has a critical role in the development and expression of many psychiatric disorders and is a defining feature of posttraumatic stress disorder (PTSD). Stress also limits the efficacy of behavioural therapies aimed at limiting pathological fear, such as exposure therapy. Here we examine emerging evidence that stress impairs recovery from trauma by impairing fear extinction, a form of learning thought to underlie the suppression of trauma-related fear memories. We describe the major structural and functional abnormalities in brain regions that are particularly vulnerable to stress, including the amygdala, prefrontal cortex, and hippocampus, which may underlie stress-induced impairments in extinction. We also discuss some of the stress-induced neurochemical and molecular alterations in these brain regions that are associated with extinction deficits, and the potential for targeting these changes to prevent or reverse impaired extinction. A better understanding of the neurobiological basis of stress effects on extinction promises to yield novel approaches to improving therapeutic outcomes for PTSD and other anxiety and trauma-related disorders. (Maren & Holmes, 2016)

Fear and Society

Society is built on communication links, which are not entirely flexible. Since fear and anxiety are both lower the more meaningful information there is, their level depends on how messages are formed and can be transmitted within a community. More rapid and efficient communication networks can make more meaningful information from more sources more easily and quickly available, but their effectiveness in the end depends on how information streams are selected and the individual's ability to choose information sources most efficiently and beneficially. Messages of fear can reduce openness and put a narrower focus on the sources and the content of these messages. Tannenbaum and colleagues have studied fear appeals in a comprehensive meta-analysis investigating their effectiveness for influencing attitudes, intentions, and behaviours. Results showed that fear appeals were effective at positively influencing attitude, intentions, and behaviours, that there were very few circumstances under which they were not effective, and that there were no identified circumstances under which they backfired and lead to undesirable outcomes. (Tannenbaum et al., 2015) Group messages can even give rise to irrational or illogical fears, which then have the potential to become entrenched. Research results imply that there is a fear of the feminine in men, which prevents them from infringing on prescribed gender boundaries. This may also take the form of the use of psychological defences to distance from thoughts and behaviours perceived as not masculine. (Kierski & Blazina, 2009)

Misattribution

Schachter and Singer postulated in the 1960s that physical arousal played a primary role in emotions. The arousal was hypothesized to be the same for a wide variety of emotions, so physical arousal alone could not be responsible for emotional responses. The arousal must be identified to feel a specific emotion. An experimental design based upon an explication of Schachter's theory of emotion demonstrated that fear reduction through induced misattribution of the physiological concomitants of fear could be accomplished. A test situation was utilized in which reduced fear would be reflected by test subjects' willingness to work on a puzzle which would gain them monetary reward while leaving unsolved a puzzle which could allow them to avoid impending electrical shock. (Ross, Rodin, & Zimbardo, 1969)

Fearing the Fear

Fear can inhibit communication, which happens to be the instrument to resolve it. The reason for this may be to conserve resources for more automatic problems of fight or flight. In today's world, however, more complex ways of reacting to fear are required, and new sources of information to be able to do so have to be tapped. An important strategy to counter fear is thus to communicate nonetheless. An adjustment and change in communication patterns can make this easier and less fear inducing. On the inside, more effective and gentler ways of connecting with oneself are helpful. Towards the outside, adjusting communication patterns, more questioning and reflecting, and more openness can make it easier to get the information one needs, while reducing the fear and anxiety.

Fear of Change

Often, people are afraid of connecting with themselves and others because they fear the changes which can be brought on by the additional information, the impact it can have on their lives. In the case of anxiety and OCD, the ability to distinguish between a mere thought and reality is often reduced, which leads to more anxiety in a world which seems more uncertain and unpredictable. Breaking down fears is thus made easier when one is able to take a step back and identify the type and source of communicated messages, while also trying to determine the meaning in them relative to oneself.

Reasonable vs Unreasonable Fears

Our mind may tell us that a fear of tall buildings is unnecessary, but our emotions tell us otherwise. Some of these fears may be linked with experiences from one's own past, others with innate programs in our brain. Emotions have an evolutionary function to guarantee our survival by providing simple signals to induce action or stop an action. However, the brain circuits leading to fear, for example, are partly hardwired for specific information. A fear of heights on top of a tall building makes sense, because tall buildings have only been around for a fraction of human history. In earlier times, standing close to a precipice on a tall cliff or mountain was indeed a dangerous affair.

Neurobiology

Tremendous progress has been made in basic neuroscience in recent decades. One area that has been especially successful is research on how the brain detects and responds to threats. Such studies have demonstrated comparable patterns of brain-behaviour relationships underlying threat processing across a range of mammalian species, including humans. This would seem to be an ideal body of information for advancing our understanding of disorders in which altered threat processing is a key factor, namely, fear and anxiety disorders. But research on threat processing has not led to significant improvements in clinical practice. The authors propose that in order to take advantage of this progress for clinical gain, a conceptual reframing is needed. Key to this conceptual change is recognition of a distinction between circuits underlying two classes of responses elicited by threats:

- behavioral responses and accompanying physiological changes in the brain and body and
- conscious feeling states reflected in self-reports of fear and anxiety.

This distinction leads to a "two systems" view of fear and anxiety. The authors argue that failure to recognize and consistently emphasize this distinction has impeded progress in understanding fear and anxiety disorders and hindered attempts to develop more effective pharmaceutical and psychological treatments. The two-system view suggests a new way forward. (LeDoux & Pine, 2016) Fear conditioning and extinction learning in animals often serve as simple models of fear acquisition and exposure therapy of anxiety disorders in humans.

The Fear Network

Fear is mediated by a brain-wide distributed network involving long-range projection pathways and local connectivity. The disinhibitory microcircuit is a common motif in the basolateral amygdala (BLA), central amygdala and the prelimbic region of the medial prefrontal cortex, and is instrumental in fear acquisition and expression. (Tovote, Fadok, & Lüthi, 2015) Stress promotes a shift from a hippocampus-dependent, 'cognitive' memory system to a dorsal striatum-dependent, 'habitual' memory system, which also plays an important part in fear-related disorders. Importantly, glucocorticoids have similar effects on memory processes in both cognitive and habitual forms of memory. (de Quervain, Schwabe, & Roozendaal, 2017) There is overlap of neuronal circuits that mediate negative and positive valence in areas such as the VTA. Understanding the interplay between these circuits is of vital importance for understanding adaptive behavioural states. (Tovote et al., 2015)

Serotonin

Brain serotonin system dysfunction is implicated in exaggerated fear responses triggering various anxiety-, stress-, and trauma-related disorders. Waider and colleagues investigated the impact of constitutively inactivated serotonin synthesis on context-dependent fear learning and extinction using mice, which are completely devoid of serotonin synthesis in the brain. The mice displayed accelerated fear memory formation and increased locomotor responses to foot shock. Furthermore, recall of context-dependent fear memory was increased. The behavioural responses were associated with increased c-Fos expression in the dorsal hippocampus. The hippocampus controls contextual representation of fear-related behavioural responses and c-fos expression indicates neuronal activity. It also showed resistance to foot shock-induced impairment of hippocampal long-term potentiation. (Waider et al., 2019)

Oxytocin

Brain areas supporting the formation romantic attachment are those rich in oxytocin (OT) receptors (Acevedo et al., 2011), underscoring the potential role of OT in romantic bonding. (Schneiderman, Zagoory-Sharon, Leckman, & Feldman, 2012) OT is a nonapeptide hormone associated with affiliative bonding in mammals (Insel et al., 1997) that is known to mediate social behaviour, pair-bonding, and parental attachment across a variety of species (Carter, 1998). Specifically, OT has been shown to play a critical role in the regulation of pair-bond formation in monogamous mammals (Ross and Young, 2009). It has been repeatedly shown that the Mating-induced release of OT reverses social fear in mice (Grossmann, Sommer, Menon, & Neumann, 2017)

The Amygdala

Conditions such as anxiety, autism, depression, post-traumatic stress disorder, and phobias are suspected of being linked to abnormal functioning of the amygdala, owing to damage, developmental problems, or neurotransmitter imbalance. The amygdala is a key brain region that is critically involved in the processing and expression of anxiety and fear-related signals. It is an almond-shape set of neurons located deep in the brain's medial temporal lobe and forms part of the limbic system. The amygdala has been shown to play key roles in the processing of emotions. In humans and other animals, this subcortical brain structure is linked to both fear responses and pleasure. Its size is also positively correlated with aggressive behaviour across species. In humans, it is the most sexually-dimorphic brain structure, and shrinks by more than 30% in males upon castration.

Fear without the Amygdala?

The amygdala's role appears to extend to both recognition and recall of fearful facial expressions. Bilateral amygdala damage in humans compromises the recognition of fear in facial expressions while leaving intact recognition of face identity (Adolphs et al., 1994). This impairment appears to result from an insensitivity to the intensity of fear expressed by faces. The amygdala seems to be required to link visual representations of facial expressions, on the one hand, with representations that constitute the concept of fear, on the other. Adolphs and colleagues reported of patient “S.M.” who lost her left and right amygdalae to disease. Initial testing suggested that S.M.’s most defining symptom was an inability to recognize fear in other people’s facial expressions. (R Adolphs, Tranel, Damasio, & Damasio, 1995; Barrett, 2018) Returning to the patient ten years later, Adolphs and colleagues showed that her impairment stems from an inability to make normal use of information from the eye region of faces when judging emotions, a defect they traced to a lack of spontaneous fixations on the eyes during free viewing of faces. Although the patient failed to look normally at the eye region in all facial expressions, her selective impairment in recognizing fear was explained by the investigators by the fact that the eyes are the most important feature for identifying this emotion. Her recognition of fearful faces became entirely normal when she was instructed explicitly to look at the eyes. (Ralph Adolphs et al., 2005)

Fast Pathways

A fast, subcortical and phylogenetically old pathway to the amygdala is thought to have evolved to enable rapid detection of threat, which could also explain nonconscious emotional responses. Mendez-Bertolo and colleagues recorded human intracranial electrophysiological data and found fast amygdala responses, beginning 74-ms post-stimulus onset, to fearful facial expressions, which had considerably shorter latency than fear responses that were observed in the visual cortex. They were limited to low spatial frequency components of fearful faces and were not evoked by photographs of arousing scenes. (Méndez-Bértolo et al., 2016)

The Microbiome

There are at least as many bacterial cells as human cells in the body, of which many are in the intestinal tract. They are commonly called the microbiome in their entirety. They seem to influence brain development, activity and behaviour. A growing number of preclinical and human studies have implicated the microbiome–gut–brain in regulating anxiety and stress-related responses. Hoban and colleagues demonstrated in their study that the presence of the host microbiome is crucial for the appropriate behavioural response during amygdala-dependent memory retention. (Hoban et al., 2018)

Inferior Frontal Gyrus

There appears to be a link between cerebral correlates of cognitive processing in the inferior frontal gyrus and emotional processing in the amygdalae – insulae - anterior cingulate cortex axis during symptom improvement across time in panic disorder with agoraphobia. In a randomized, controlled, multicentre clinical trial Kircher and colleagues studied medication-free patients with panic disorder with agoraphobia who were treated with 12 sessions of manualized CBT. Patients' functional MRIs compared to those of control subjects revealed reduced activation for the conditioned response in the left inferior frontal gyrus. This activation reduction was correlated with reduction in agoraphobic symptoms. Patients compared to control subjects also demonstrated increased connectivity between the IFG and the amygdalae – insulae - anterior cingulate cortex axis across time. (Kircher et al., 2013)

Learning

The link between specific stimuli and fear responses is often learned. Input specificity is a fundamental property of long-term potentiation (LTP). (Maren, 2017) Kim and Cho showed that fear conditioning is mediated by synapse-specific LTP in the amygdala, allowing animals to discriminate stimuli that predict threat from those that do not. (Kim and Cho, 2017) In rats, brief electrical stimulation of the infralimbic cortex has been shown to reduce conditioned freezing during recall of extinction memory. This finding has been translated to humans with magnetic resonance imaging–navigated transcranial magnetic stimulation (TMS). (Raij et al., 2018)

Reversal

Learning mechanisms can also explain how the link between specific stimuli and a fear response can be attenuated and eliminated. Learning-related changes of synaptic connections in the cortex seem to be at least partially reversed after unlearning. Lai and colleagues examined in their study the impact of auditory-cued fear conditioning and extinction on the remodelling of synaptic connections in the living mouse auditory cortex. They found that fear conditioning leads to cue-specific formation of new postsynaptic dendritic spines, whereas fear extinction preferentially eliminates these new spines in a cue-specific manner. (Lai, Adler, & Gan, 2018)

Neuronal coordination

Coordination dynamics provides a unifying framework for understanding the neurophysiological mechanisms underlying the integration and segregation of cortical areas in large-scale networks. A goal of coordination dynamics is to identify the key variables of coordination (defined as a functional and/or task-dependent ordering among context-sensitive interacting components) and their dynamics (rules that govern the stability and change of coordination patterns), and the nonlinear coupling among components that gives rise to them. In the context of cognitive neuroscience, the aim of coordination dynamics is to understand the functional interactions within and between different areas of the brain in relation to cognitive task performance. (Bressler & Kelso, 2016)

Precise spike timing through the coordination and synchronization of neuronal assemblies is an efficient and flexible coding mechanism for sensory and cognitive processing. In cortical and subcortical areas, the formation of cell assemblies critically depends on neuronal oscillations, which can precisely control the timing of spiking activity. Fear behaviour relies on the activation of distributed structures, among which the dorsal medial prefrontal cortex (dmPFC) is known to be critical for fear memory expression.

The results of a study by Dejean and colleagues identified a novel phase-specific coding mechanism, which dynamically regulates the development of dmPFC assemblies to control the precise timing of fear responses. Fear behaviour relies on the activation of distributed structures, among which the dmPFC is known to be critical for fear memory expression. In the dmPFC, the phasic activation of neurons to threat-predicting cues, a spike-rate coding mechanism, correlates with conditioned fear responses and supports the discrimination between aversive and neutral stimuli. However, this mechanism does not account for freezing observed outside stimuli presentations, and the contribution of a general spike-time coding mechanism for freezing in the dmPFC remains to be established. They used a combination of single-unit and local field potential recordings along with optogenetic manipulations to show that, in the dmPFC, expression of conditioned fear is causally related to the organization of neurons into functional assemblies. During fear behaviour, the development of 4 Hz oscillations coincides with the activation of assemblies nested in the ascending phase of the oscillation. The selective optogenetic inhibition of dmPFC neurons during the ascending or descending phases of this oscillation blocks and promotes conditioned fear responses, respectively. (Dejean et al., 2016)

Memory

Strong aversive memories lie at the core of several fear-related disorders. Therefore, the memory-modulating properties of glucocorticoids have become of considerable translational interest. (de Quervain et al., 2017) Evidence indicates that the effects of glucocorticoids on both the consolidation and the retrieval of memory depend on interactions with the endocannabinoid system, which may open novel therapeutic avenues. (de Quervain et al., 2017) The evidence that genetic and epigenetic variations in the glucocorticoid system are related to traumatic memory, as well as to post-traumatic stress disorder (PTSD) risk and treatment, adds to the understanding of individual risk and resilience factors for PTSD. (de Quervain et al., 2017) Collections of cells called engrams are thought to represent memories. Although there has been progress in identifying and manipulating single engrams, little is known about how multiple engrams interact to influence memory. In lateral amygdala (LA), neurons with increased excitability during training outcompete their neighbours for allocation to an engram.

Rashid and colleagues examined whether competition based on neuronal excitability also governs the interaction between engrams. Mice received two distinct fear conditioning events separated by different intervals. LA neuron excitability was optogenetically manipulated and revealed a transient competitive process that integrates memories for events occurring closely in time (coallocating overlapping populations of neurons to both engrams) and separates memories for events occurring at distal times (disallocating nonoverlapping populations to each engram). (Rashid et al., 2016)

The Thalamus

The prelimbic prefrontal cortex, which is necessary for fear retrieval sends dense projections to the paraventricular nucleus of the thalamus (PVT). Do-Monte and colleagues showed that the PVT may act as a crucial thalamic node recruited into cortico-amygdalar networks for retrieval and maintenance of long-term fear memories by demonstrating that the dorsal midline thalamus of rats is required for the retrieval of auditory conditioned fear at late (days), but not early (hours) time points after learning. (Do-Monte, Quiñones-Laracuente, & Quirk, 2015)

Shift in Retrieval Circuits

Do-Monte also showed that there may be a shift in the retrieval circuits along the time axis. The PVT showed increased c-Fos expression, indicating neuronal activity, only at late time points, indicating that the PVT is gradually recruited for fear retrieval. Retrieval at late time points activated prelimbic prefrontal cortex neurons projecting to the PVT and silencing of these projections impaired retrieval at late time points. In contrast, silencing of prelimbic prefrontal cortex inputs to the basolateral amygdala impaired retrieval at early time points. Retrieval at late time points also activated PVT neurons projecting to the central nucleus of the amygdala, and silencing these projections at late time points induced a persistent attenuation of fear. (Do-Monte, Quiñones-Laracuente, & Quirk, 2015)

Fear vs Anxiety: Information

As mentioned previously, fear and anxiety are two distinguishable phenomenological entities. The amount of information available about the threat appears to be a critical deciding factor. Fear is elicited by a defined threat, while one feels anxious when the threat is uncertain or not clearly defined. The distinction is also reflected on a neuro-morphological level. Anxiety is usually associated with activation in ventromedial prefrontal cortex and hippocampus, while fear is correlated with activation in the periaqueductal grey. At the same time, the amygdala seems associated with both.

To test this, Rigoli and colleagues used functional MRIs to record participants' brain activity while they performed a computer-based task which required to press a button to move an artificial agent to a target position while an artificial predator chased the agent. In the fear condition the predator was visible, while in the anxiety condition the predator was invisible. Ventromedial prefrontal cortex, hippocampus, and amygdala showed increased activity when the predator was invisible compared to visible, while the opposite effect was observed in periaqueductal grey. They also observed that participants with high but not low trait-anxiety showedhippocampal activation with invisible threat at an earlier time stage during the trial. (Rigoli, Ewbank, Dalgleish, & Calder, 2016)

Extinction

A single session of exposure therapy can eliminate fears of objects or situations. Encoding of fear extinction involves many of the same brain areas that are involved in fear acquisition and expression; however, different circuits within the amygdala and prefrontal cortex are involved. Indeed, fear extinction circuits may in fact inhibit fear circuits to dampen fearful responding. (Tovote et al., 2015) The extinction of fear learning involves to an extent a reversal of the flow of information in the pre- and infralimbic ventromedial prefrontal cortex, the central amygdala subnuclei, and the dentate gyrus. and is used in the therapy of posttraumatic stress disorder and fear memories in general. (Izquierdo, Furini, & Myskiw, 2016)

Hauner and colleagues studied changes in brain activity as a result of one successful 2-h exposure treatment. Before treatment, fear eliciting images excited activity in a network of regions, including amygdala, insula, and cingulate cortex, relative to neutral images. Successful therapy dampened responsiveness in this fear-sensitive network while concomitantly heightening prefrontal involvement. Six months later, dampened fear-network activity persisted but without prefrontal engagement. Additionally, individual differences in the magnitude of visual cortex activations recorded shortly after therapy predicted therapeutic outcomes 6 months later, which involved persistently diminished visual responsiveness to fear eliciting images. (Hauner, Mineka, Voss, & Paller, 2012)

Change

Throughout development, an important process is to arrive at a point where the amount of fear signalled in daily life is at the correct measure where it sustains survival without interfering too much in life. Flexibility of the fear response may be most advantageous during adolescence when living beings in general are prone to explore novel, potentially threatening environments.

Two opposing adolescent fear-related behaviours—diminished extinction of cued fear and suppressed expression of contextual fear—may serve this purpose. Using microprisms to image prefrontal cortical spine maturation across development in mice, Pattwell and colleagues identified a dynamic blasolateral amygdala – hippocampus - medial prefrontal cortex circuit reorganization associated with behavioural shifts. (Pattwell et al., 2016) The same circuit also seems to play a role in social defeat and some of its consequences. (Qi et al., 2018)

The Cortical Neural Network

Emotional states of consciousness, or what are typically called emotional feelings, are traditionally viewed as being innately programmed in subcortical areas of the brain and are often treated as different from cognitive states of consciousness, such as those related to the perception of external stimuli. Ledoux and Brown argued that conscious experiences, regardless of their content, arise from one system in the brain. In this view, what differs in emotional and non-emotional states are the kinds of inputs that are processed by a general cortical network of cognition, a network essential for conscious experiences. Although subcortical circuits are not directly responsible for conscious feelings, they provide nonconscious inputs that coalesce with other kinds of neural signals in the cognitive assembly of conscious emotional experiences. (LeDoux & Brown, 2017) When subjective state words are used to describe behaviours, or brain circuits that control them nonconsciously, the behaviours and circuits take on properties of the subjective state. Subjective state words should be limited to the description of inner experiences, and avoided when referring to circuits underlying nonsubjectively controlled behaviors. (LeDoux, 2017)

Anxiety

Anxiety is an emotion characterized by an unpleasant state of inner turmoil. It is the subjectively unpleasant feelings of dread over anticipated events, such as the feeling of imminent death. Anxiety is, as mentioned, not the same as fear, which is a response to a real or perceived immediate threat, whereas anxiety involves the expectation of future threat. Anxiety is a feeling of uneasiness and worry, usually generalized and unfocused as an overreaction to a situation that is only subjectively seen as menacing.

As with fear and fear extinction, a brain-wide neuronal network underlies anxiety, with identified local microcircuits within the bed nucleus of the stria terminalis, the lateral septum, the ventral tegmental area (VTA) and the basolateral amygdala. Importantly, there is potential overlap between fear and anxiety circuits. (Tovote et al., 2015)

Biological Approaches

While psychotherapy should be the first line of treatment when it comes to unhelpful fears, there are biological tools that may be of use in more extreme cases of fear. Psychotherapy and medication both work on the information receiving and processing system in the brain.

Memory

Glucocorticoids affect distinct memory processes that can synergistically contribute to a reduction of fear-related symptoms, for example, by both reducing aversive-memory retrieval and enhancing the consolidation of fear-extinction memory (de Quervain et al., 2017). Clinical trials have provided the first evidence that glucocorticoid-based pharmacotherapies aimed at attenuating aversive memories might be helpful in the treatment of fear-related disorders. In particular, the strategy to enhance extinction processes by combining exposure-based psychotherapy with timed glucocorticoid administration seems to be a promising approach to treat fear-related disorders. (de Quervain et al., 2017)

C-Cycloserine

D-cycloserine is a molecule that binds to the NMDA receptor and improves its efficiency. Because D-cycloserine facilitates extinction in rats, Davis and colleagues investigated whether D-cycloserine might facilitate the loss of fear in human patients. It indeed seemed to help reduce fear of heights substantially after seven or eight sessions. (Davis, 2010) The ability of D-cycloserine to improve psychotherapy been replicated in other studies in obsessive- compulsive disorder, social phobia, and panic disorder.

MDMA

MDMA used as an adjunct during psychotherapy sessions has demonstrated effectiveness and acceptable safety in reducing PTSD symptoms in Phase 2 trials, with durable remission of PTSD diagnosis in more than two thirds of participants. MDMA enhances release of monoamines (serotonin, norepinephrine, dopamine), hormones (oxytocin, cortisol), and other downstream signalling molecules (BDNF) to dynamically modulate emotional memory circuits. By reducing activation in the amygdala and insula, and increasing connectivity between the amygdala and hippocampus, MDMA may allow for reprocessing of traumatic memories and emotional engagement with therapeutic processes. (Feduccia & Mithoefer, 2018)

Other Approaches

Transcranial magnetic stimulation (TMS) is a non-invasive procedure that uses magnetic fields to stimulate nerve cells in the brain to improve symptoms of depression, for example. During a repetitive TMS session, an electromagnetic coil is placed against the scalp near the forehead, which is thought to activate regions of the brain that have decreased activity in depression. Liston showed that transcranial magnetic stimulation targeting a human homolog of a rodent fear regulation circuit enhanced extinction learning in healthy human subjects. (Liston, 2018)

Change

The brain processes information, and fortunately we can consciously select information and teach our brain new ways of dealing with information. But this requires taking a close look at our basic values and fundamental interests, which ultimately drive any change. If you feel that something is important to you, you are more likely to spend energy on figuring out a way to effect a change. Knowing why doing something is valuable and important to oneself is an important force in doing something even if one is fearful (as long as there is no real threat of harm from the activity).

Change from Within

In many cases, however, feeling pressure to go through with a feared activity can be counterproductive. As the need to take the elevator, for example, increases, the fear increases as well. The problem is that the activity is seen as a 'need' dictated by the outside world. Overcoming a fear should come from an internal need, the fulfilment of a basic value or fundamental interest.

Greater insight into the own needs, values and aspirations can thus be very helpful in confronting the own fears. This explorative process in itself can already be helpful in confronting the fears. It is facilitated through a better internal communication (Haverkampf, 2010b), a better emotional and cognitive communication, which can be trained in a communication-oriented therapy. (Haverkampf, 2010a, 2017a) An easier access to this emotional information can also provide more stability and trust in oneself, which helps whenever fears, whether internal or external, need to be confronted.

Change Without

Changing communication patterns within leads to changes in communication patterns without. This is how better boundaries can be drawn to the outside world, which also makes the world appear safer and more secure. The ability to stand up for one's needs, values and aspirations and to say 'No' as well as 'Yes' requires a good connection on the inside, which then makes it possible to work on one's communication patterns with the world. Better and more effective external communication patterns can make it easier to deal with everyday problems and other people who may hold different opinions.

Good external communication patterns are those which facilitate understanding on both sides, and understanding can reduce fears and anxiety, as thus feeling understood. Meaningful communication can reduce fears and anxiety because it can bring about changes in the communication partners and adjustments in as situation which benefit everyone. However, it can only accomplish this if the internal communication is also working on both sides.

Psychological Approaches

CBT: Fear of Flying

The Fear of flying (FOF) can be a serious problem for individuals who develop this condition and for military and civilian organizations that operate aircraft. People with fear of flying experience intense, persistent fear or anxiety when they consider flying, as well as during flying. They will avoid flying if they can, and the fear, anxiety, and avoidance cause significant distress and impair their ability to function. Take-off, bad weather, and turbulence appear to be the most anxiety provoking aspects of flying. The most extreme manifestations can include panic attacks or vomiting at the mere sight or mention of an aircraft or air travel. Around 60% of people with fear of flying report having some other anxiety disorder.

Krijn and colleagues compared the effectiveness of bibliotherapy (BIB) without therapist contact, individualized virtual reality exposure therapy (VRE) and CBT. Treatment with VRE or CBT was more effective than BIB. Both VRE and CBT showed a decline in FOF on the two main outcome measures. There was no statistically significant difference between those two therapies. However, effect sizes were lower for VRE (small to moderate) than for CBT (moderate). CBT followed by group cognitive-behavioural training showed the largest decrease in subjective anxiety. (Krijn et al., n.d.)

Virtual Exposure

Virtual Reality (VR) is a technological interface that allows users to experience computer-generated environments within a controlled setting. This technology has been increasingly used in the context of mental health treatment and within clinical research. VR aims to parallel reality and create a world that is both immersive and interactive. Users fully experience VR when they believe that the paradigm accurately simulates the real-world experience that it attempts to recreate. The sense of presence, or "being there" in VR, is facilitated through the use of technology such as head-mounted displays, gesture-sensing gloves, synthesized sounds, and vibrotactile platforms, which allow for the stimulation of multiple senses and active exploration of the virtual environment. Furthermore, some VR paradigms are programmed to react to the actions of the user. This dynamic interaction enables the participant to engage with the VR environment in a more naturalistic and intuitive way. VR's precise control of sensory cues, particularly for auditory, tactile, and olfactory systems, increases the sense of realism and memory of the virtual environment. (Maples-Keller, Bunnell, Kim, & Rothbaum, 2017)

Fear of Flying (FOF)

In a study by Rothbaum and colleagues, patients with FOF (N = 49) were randomly assigned to virtual reality exposure therapy, standard exposure therapy, or a wait-list control. Treatment consisted of 8 sessions over 6 weeks, with 4 sessions of anxiety management training followed by either exposure to a virtual airplane or exposure to an actual airplane at the airport. The results indicated that virtual reality exposure and standard exposure were both superior to the control group, with no differences between the two approaches. The gains observed in treatment were maintained at a 6-month follow up. (Rothbaum, Hodges, Smith, Lee, & Price, 2000)

Systematic Desentization

Systematic desensitization has become one of the most effective new therapeutic methods. There are clinical series and laboratory experiments demonstrating its success in alleviating fear and anxiety. Both stimulus and response control elements may contribute to the success of desensitization and similar fear modification treatments. (Lang, 2017)

Expressive Therapy

Fagen reported cases and analyses of terminal-cancer pediatric patients that display a variety of music therapy techniques to show how "grief work" is part of a larger therapeutic process. Fagan concluded that the creative life of the child must not be dismissed as secondary in times of illness, that it must share equal importance with other intellectual and physical needs. (Fagen, 1982)

Cognitive Processing Therapy (CPT)

Cognitive processing therapy (CPT) is based on an information processing theory of PTSD and includes education, exposure, and cognitive components. Its effectiveness was shown in smaller sample sizes. (Resick & Schnicke, 1992)

Thoughts and Emotions

The thoughts and emotions we perceive arise in an interconnected system of areas with nerve cells (neurons). Both are types of information, which can lead to change in the individual, whether resulting in changes in state, behaviours or thinking, if the messages are meaningful, that is if they lead to new meaningful information within the context of existing information, whether in memory or anywhere else in the nervous system.

Thoughts and emotions are thus messages representing sets of information being shuttled between different locations in the brain. The sense of this movement of information gives rise to the sense of self, which is not just a metacognitive ability, but the actual awareness of all those information flows. The greatest fear may be the fear that these information flows stop suddenly, which would resemble the death of the self. However, since the information flows continue throughout life, it is a fear of losing the awareness of them.

The emotions in conjunction with the ability to reflect about them help to identify the thoughts, actions, behaviours and situations which make a person feel better. Especially when confronting fears, whether on the inside or on the outside, this information can be helpful. Emotions are not as accessible to rationality because we are not conscious of the large amount of information that goes into them, a process that happens largely in our subconscious, but thinking about situations in the past and connecting emotionally can help to make it easier to identify them.

Meaningfulness

It is only worth facing one's fears where an action makes sense in the context of one's values and aspirations. This means using one's thoughts and feelings to find those things which make one happy and are enjoyable, as well as being in sync with one's values. This is a first important step in breaking down fears and developing the motivation and initiative to overcome them.

Meaningfulness is a practical concept. If something is meaningful, it can bring about a change in an individual. For example, if something triggers a feeling in a person, it is meaningful, particularly if it changes the affective state of the person. Whether something triggers a new though, a sadness, anger or happiness, it is meaningful. How a message fits into and corresponds with the information already in the nervous system, and other parts of the body, determines whether it is meaningful. If information about a situation, for example, corresponds with a past situation in memory, which is associated with other information and a feeling of sadness, both these thoughts and the sadness can be triggered. But something more happens, than the retrieval of information. The information about the new situation and the existing information have to be reconciled, which is essentially a creative act, leading to new information. There could, for example, be a new insight into oneself or the world, cognitively, emotionally or otherwise. Meaningfulness thus leads to innovation, which is of particular importance when it comes to facing fears, within and without. Anxiety in itself is not an emotion, but underlying it are usually emotions which need to be addressed to resolve the anxiety or panic attacks.

Communication and Fear

How we communicate with others has an influence of the fears we are experiencing. Meaningful helpful communication can reduce fears, if delivered with empathy and understanding, while negative communication or a lack of communication can increase fears. When we face those fears, communicating with someone else or others can be helpful in overcoming the fears.

Patterns and Communication Structures

Whether something is a fear or not depends on how one communicates with oneself and others. It is usually helpful to recognize the emotion of fear, but to see in it the question which it is. When one encounters a tiger in the wild, the fear really presses the question on one, what to do, whether to freeze or run away. Once the question has been answered, fear may also provide the increase in energy to initiate the action, such as running away. In other words, the purpose of the emotion is to get a new communication process going which often involves the non-emotional mind in the form of asking a question.

Questions

Many people who experience fears and anxieties have picked up on the need for answers, but they skip the crucial step of asking the right question. However, without an awareness of the question looking for an answer is futile, which usually increases the sense of helplessness and hopelessness. An employee who experiences anxiety and the workplace and begins to dread everything about it, and as a consequence is heading straight into a burnout, cannot change anything until the question is asked what needs to be changed. In essence, the fear or possible change and the uncertainty which comes with it lets him or her experience anxiety fears, anxiety or even emotional numbness and disconnect, which would end in the moment the question about change is asked. The mind would immediately focus on constructing a new future rather than on the helplessness and hopelessness of the situation.

Questions are so powerful because they change the communication patterns one has with oneself and with others. While they are a communication entity in themselves with message and meaning, the information they contain leads to a change in the information flows in oneself or in others, as long as they possess meaning to the recipient.

Building the Motivation to Overcome One’s Fears

Reconnecting with ourselves should allow us to identify our value and aspirations which can be very effective in building the motivation to overcome fears and even to reduce them. Doing something we feel strongly about might not reduce the nervousness we feel, but it can lower the amount of fear or even transform it into excitement. It is easier to overcome one’s fears if one knows why this is beneficial to oneself and others.

Information Overload

In the complex world we live in our brains can get overloaded with information, a situation that in itself can cause fears. So, an important first step is to untangle the web of complexity by picking out the information that is important to us. Being selective requires knowing what one wants and what one is looking for. This is why getting in touch with one’s values can be so important. They tell us what is important to us and what we should be looking for. Openness is important to find new interests, make better decisions, formulate new plans and aspire to even greater things, but if we do things that are not in sync with our core sense of ourselves as person and our basic values[1], there will be little happiness in these activities.

Relevance

Humans often spend too much resources on information that is not relevant to them or where they cannot change anything. If you cannot change an issue, there is not much sense in wasting mental or physical resources on it. In such a situation, it is more important to deal with your emotions, be they fears, sadness or anger. One way is to find a way to communicate them in a meaningful way. Communicating an emotion helps to resolve it. This could be in the form of talking about it, writing about it, or even making a movie about it.

Selecting Information

The way we select, process and manage information is important in alleviating fears. You may be anxious of something or of a situation, but maybe one reason is that you do not have enough information about it. We live in a world where information is very readily available, so informing oneself is often not that difficult. And if you do not find answers to a question you have, consider if you are asking the right question, one that is helpful to you.

The Right Question

Often, we ask questions that do not really provide us direction or useful answers, so we get lost in ruminations and endless spirals of meaningless thought cascades. Try to split up a question and see if you might not get at least partial answers to the component that is relevant, while leaving the irrelevant part unanswered.

Values and Basic Interests

Any information is helpful if it helps one live according to one's values and basic interests. Life is going along a path. You cannot know the entire path until you have lived your life, but your values provide a good compass and they help dispel fear whenever it pops up along the way.

[1] One's sense of self, one's personality and one's values usually change little over one's life span, except for exposure to extreme, and especially traumatic, experiences.

Generalisation

Quite often fears generalize in what is called a 'generalised anxiety'. This can lead to a general fear of life itself. Here it is important to determine which emotions and specific fears are underlying the generalised anxiety.

You may identify something that triggered the anxiety, but the reasons for it can go back a long time. Dealing with some of the underlying issues may require identifying your values and interests. You want to cut down on thoughts and fears that are irrelevant to you and focus constructively on the issue that are relevant to you by finding helpful information.

General Questions

Generalised anxiety occurs often when people feel they have to fix something or find answers or make decisions, when they do not know where to look for them, or even where to start. Take a step back, see the situations for what it is with its relevant and irrelevant components, and measure your options against what you truly need and want. Much in life is noise and irrelevant to one's path.

Communication to Counter Fear

It helps to be in contact with someone else to make the fears manageable. Facing fears with another may make it easier to deal with your fears and anxieties because you know you do not have to face them alone. When you talk to your neighbour on an airplane, for example, you might not even notice the take-off, and the brief interaction with the stranger reduces the emotional pressure on the inside.

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