

The Emotion-Processing Part of Brain and Pyromania: Can More be Known?

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ABSTRACT

Damasio's continued research on the hold of the emotional part of the brain in decision making provides us with more and better insights about what it means to be human. Our conscious choices define who we are, separating us from lower animals and enabling us with the power of creation or destruction and the attendant responsibility that accompanies it. The decision to either create or destroy lies in the workings of the prefrontal cortex, which comes alive when decisions are about to be made. Decisions are always made with a particular kind or kinds of emotion operating underneath, sometimes known and at other times not known (but not unknown). Patients with lesions to the prefrontal cortex have shown an intense amount of dullness in emotional response, ranging from little to nothing in terms of how they process their emotions. The prefrontal cortex therefore is strongly involved in all that relates to the emotions in the human person, because it processes emotions. In pyromania, we know that there is an outburst of emotion, tied to the attainment or the achievement of the desired objective namely - setting the place or thing on fire, the gratification one derives from it, the release of tension that one has when it is done etc. Nonetheless, MRI scan has shown that the amygdala, the cingulate cortex, the hippocampus, and the basal ganglia, also light up when emotions are on display. This has led neuroscientists to dub it as emotional network arenas (ENA) or emotion processing network (EPN) of the brain. This only proves what I have constantly aligned my research upon namely the nonlocality of brain functions. Therefore, can an inquiry into the emotion processing part of the brain enable a better understanding of pyromania? Considering how under-researched this aspect of mania is, the aforementioned question will be the major issue amongst others that will be confronted.

Keywords: Pyromania; Pyrophilia; Arson; Impulse Control Disorder (ICD); Emotion; Brain; Emotional Brain; Antonio Damasio

Abbreviations: PFC: Prefrontal Cortex; CC: Cingulate Cortex; SMA: Supplementary Motor Area; PSSC: Primary Somato Sensory Cortex; IPC: Inferior Parietal Cortex; VPMA: Ventral Premotor Area; BA; Broca Area; WA: Wernicke's Area; FG: Fusiform Gyrus; AG: Angular Gyrus; PMC: Primary Motor Corte; EPN: Emotion Processing Network; ENA: Emotional Network Arenas; IED: Intermittent Explosive Disorder

More on the Emotional Part of the Brain

There are six basic known emotions: happiness, disgust, jealousy, anger, sadness and fear. Recent day research, working from findings provided for by MRI scans, show that the parts of the brain that light up with the influx of emotions includes the prefrontal cortex (PFC), amygdala, the cingulate cortex (CC), the hippocampus, and the basal ganglia [1]. Other parts of the brain that witness to the expression of emotions includes, the left insula, the precuneus, hypothalamus, occipital lobes [2], and a part of the midbrain called periaqueductal gray. A diagrammatic look at these locations indicate that are quite dispersed and wide spread, yet they all fire at the same time when

emotions are evoked. In the brain the PFC and the amygdala are very well connected and work harmoniously in tandem with the expression of emotions [3]. In physiological conditions, the PFC shows inhibitory control over the activity of the amygdala, a control that moves from top to down. This puts a wedge over its output, allowing thus for the needed or appropriate emotion to be expressed [4]. However, when there is a malfunctioning of the PFC, that distorts the activation processes of the amygdala, then what is noticed is a deficit in behaviour and emotion display [5]. My research on nonlocality of functions in the brain has shown that the brain operates more as a unit, even though they are areas of the brain that are notably linked to

certain activities of and in the human person. Nonlocality is a term that is used more in quantum physics that refers more to entanglement of different systems that are spatially distinct [6].

What the nonlocality of the functions in the brain attests to is that “the dynamics of the brain are very rapid to be explained with the classical idea of neuron synapticity” [7]. Today instead of talking about single neuron working, we speak of a community of neurons, what we refer to as a neuronal network; the emotional processing in the brain is not exempted from this neuronal network working. A look at the diagram provided for (Figure 1) by the Frontiers for Young Minds online journal gives credence to what is being said here [8]. In the above picture, what is noticed is the how far spread these areas are. One should not consider that the human brain is a small organ, therefore such distance be considered negligible. That

these regions are far separated from each other indicates and aligns itself to the nonlocality of brain functions. We speak of brain areas in communication with one another, as the PFC and the Amygdala, however, as Globus and Carroll notes, “Communication between brain regions is near instantaneous via soliton signalling in the nanolevel web of protein filaments percolating through brain tissue. This accounts for what Lashley called the brain’s ‘mass action’ [9]. According to Iwuh, A good example is highlighted in the mirroring functioning of the brain (neuron mirroring). The area specific to this function has been noted to be contained in diverse areas of the brain such as the Supplementary Motor Area (SMA), the Primary Somato Sensory Cortex (PSSC), the Inferior Parietal Cortex (IPC), the Ventral Premotor Area (VPMA), Broca Area (BA), Wernicke’s Area (WA), Fusiform Gyrus (FG), Angular Gyrus (AG), Primary Motor Cortex (PMC).



Figure 1: Areas of the Brain that Light Up During a Processional Activity of Emotions [8].

A visual look at these areas will indicate how spatially distinct they are. Yet they act in near instantaneous fashion. This near instantaneous dynamic functioning of the brain defies classical understanding, thus probing further it is evident that the structures and parlance of Quantum physics, better explain this cortical phenomenon [10]. We can better comprehend the functioning of the brain, as differentiated into regions, by looking at it using quantum physics (I mean Quantum Field Theory). However, that is not the purview of this research. Emotions are biologically relevant to mobile beings (man and animals). It is so important to living organisms that they have evolved in order to procure the continuation of species. According to A. Damasio, the biological relevance of emotions are two folds namely:

1. The first function is the production of a specific reaction to the inducing situation. In an animal, for instance, the reaction may be to run or to become immobile or to beat the hell out of the enemy or to engage in pleasurable behavior. In humans, the reactions are essentially the same, tempered, one hopes, by higher reason and wisdom.

2. The second biological function of emotion is the regulation of the internal state of the organism such that it can be prepared for the specific reaction. For example, providing increased blood flow to arteries in the legs so that muscles receive extra oxygen and glucose, in the case of a flight reaction, or changing heart and breathing rhythms, in the case of freezing on the spot [11].

He continues, In either case, and in other situations, the plan is exquisite and the execution is most reliable. In short, for certain classes of clearly dangerous or clearly valuable stimuli in the internal or external environment, evolution has assembled a matching answer in the form of emotion. This is why, in spite of the infinite variations to be found across cultures, among individuals, and over the course of a life span, we can predict with some success that certain stimuli will produce certain emotions. (This is why you can say to a colleague, «Go tell her that; she will be so happy to hear it») [12]. According to Wagner, Krishnan and Hitchcock, the network of neurons that mediate the emotional response and expression of the human person is based on a complex web of processes that occur when emotions are expressed. They note saying that It is not possible to identify a

brain representation for an emotion per se, because an emotion is not a single process, but rather a collection of processes. We typically associate emotions such as 'sadness' with subjective experience, but changes in physiology, action tendencies, motivated behavior, memory, and perception are also often included in the definition. Thus, 'sadness' is a word that we use to describe the sum of many representations in many systems [13]. While it stands as a fact that indeed the expression of an emotion is not the a single process, we nonetheless reiterate that even if it was a single process, single neuron decoding of such process will be unable to decipher the intricacies hidden in the elaboration of an expressed emotion.

If it happens that these brain areas that mediate the expression of emotion are affected, then it is most probable that there is either a distortion or a misrepresentation of emotions; and in very dire cases, a lack of emotional expression. A vivid example is the clinical tests carried out by A. Damasio et al., as regards a man known as Elliot. Emotion thus cannot be separated from the operation of the brain. That is to say that the brain has to be in right working conditions for an emotion to either be expressed or suppressed.

Pyromania: An Understanding

Pyromania was first used by Marc in 1833 [14]. Kraepelin dubbed pyromania as an impulsive insanity, and Freud described it as resulting from aberrant psychosexual development [15]. A landmark study by Lewis and Yarnell in 1951 heralded the modern age of pyromania and fire setting research [16], one that has continued till today. Pyromania is a male-prone disorder that is not so frequently witnessed, and this has led to paucity of research in it, largely due to limited number of patients [17]. Over the years it has moved from a DSM-I classification, in which it was considered as an obsessive-compulsive disorder, to a DSM-V classification, presently conceived as an impulse control and conduct disorder (although it was left out in the DSM-II manual, but later came back in the III, IV and V manuals) [18]. To underscore how relatively unknown this phenomena is, Scott Johnson and Netherton notes that "In a study of 90 arson recidivists, only three met criteria for pyromania" [19]. The prevalence of pyromania is not well established, but one study reported a rate of 1% in a college student sample [20]. A review of 282 arsonists' hospital records (who were referred for a pre-trial psychiatric assessment) found that 23.6% who had committed other non-violent crimes and 12.4% who had committed other violent crimes met DSM-II-R criteria for pyromania [21]. Studies of psychiatric patients found that 5.9% met lifetime criteria for pyromania and 2.8–3.4% met current criteria for pyromania [22]. A study of 102 adolescent psychiatric inpatients reported that 6.9% met criteria for current pyromania [23].

Although research into this, is very much still ongoing, the DSM manual lists out certain criteria for certifying that a certain case is termed as pyromania includes:

1. Deliberate and purposeful fire setting on more than one occasion.

2. Tension or affective arousal before the act.
3. Fascination with, interest in, curiosity about, or attraction to fire and its situational contexts (e.g., paraphernalia, uses, consequences).
4. Pleasure, gratification, or relief when setting fires or when witnessing or participating in their aftermath.
5. The fire setting is not done for monetary gain, as an expression of sociopolitical ideology, to conceal criminal activity, to express anger or vengeance, to improve one's living circumstances, in response to a delusion or hallucination, or as a result of impaired judgment (e.g., major neurocognitive disorder, intellectual disability, substance intoxication).
6. The fire setting is not better explained by conduct disorder, a manic episode, or antisocial personality disorder [24].

The DSM Manual Continues

Individuals with this disorder are often regular 'watchers' at fires in their neighborhoods, may set off false alarms, and derive pleasure from institutions, equipment, and personnel associated with fire. They may spend time at the local fire department, set fires to be affiliated with the fire department, or even become firefighters [25]. In pyromania, one is thrilled by the reality and the element of fire that spans beyond the childlike fascination and impish glee that is shown. One who is dubbed as a pyromaniac will not feel bad or sorry about what they have done as regards the setting of the fires that has been done. What yet stands as yet to be considered is why they do not direct this fire setting attempt on themselves. It is yet to be noted that pyromaniacs are majorly not suicidal. They do not consider the fire setting as a means to an end, but a means to an end itself. The destruction that is wrought brings more delight than despair. And this is why it falls under the scope of mania. Pyromania is not arson, for while the former carries an objective (mostly vengeful), an intention that is rational although criminal, the latter has no objective inspiring it. More to that the intention behind its occurrence is irrational, thus making it not a non-offense. Pyrophilia is an uncanny love for fire. According to the Mental Health America of Eastern Missouri, when fire setting is aligned with sexual gratification, then it is termed properly pyrophilia [26]. Pyromaniacs are pyrophilics but the latter is not the former. This is because Pyromaniacs fail to control the impulse that triggers this love for fire, but pyrophilics have this under control. Arsonry although arising from a lack of control, is yet objective aligned. Pyromania is "associated with high rates of lifetime psychiatric comorbidity, such as affective (14-61.9%), anxiety (33.3%), substance use (33.3%), and impulse control (66.7%) disorders [27].

Pyromania as an Impulse Control Disorder

Pyromania is an Impulse Control Disorder (ICD), and ICDs are characterized by urges and behaviors that are excessive and/or harmful to oneself or others and cause significant impairment in

social and occupational functioning, as well as legal and financial difficulties. ICDs are relatively common psychiatric conditions, yet are poorly understood by the general public, clinicians, and individuals struggling with the disorder [28]. ICDs, does not only include pyromaniacs but pathological gambling (PG), kleptomania (KM), trichotillomania (TTM), intermittent explosive disorder (IED), and all these have the following features in common:

- (1) Repetitive or compulsive engagement in a behavior despite adverse consequences;
- (2) Diminished control over the problematic behavior;
- (3) An appetitive urge or craving state prior to engagement in the problematic behavior; and
- (4) A hedonic quality during the performance of the problematic behavior [29].

These features have led to a description of ICDs as “behavioral addictions” [30]. According to the American Psychiatry Association, “the core characteristics of ICD is the difficulty resisting urges to engage in behaviours that are excessive and /or ultimately harmful to oneself or others” [31]. The etiology behind the ICD, is still very much under conjecture, as one can either consider it to be familial (that is genetic) or social. In the thoughts of Fariba and Gokarakonda, Much is unknown regarding the etiology of impulse control disorder (ICD); however, consensus understanding is that the origin is multifactorial.

Genetics may play a pertinent role as children with ODD (oppositional defiant disorder) are often the progeny of parents with mood disorders, whereas those with CD (conduct disorder) spawn from parents who have schizophrenia, ADHD (attention deficit hyperactive disorder), substance use disorder, or antisocial personality disorders. However, this association may manifest as a result of a confounding variable, as parents afflicted with the disorders mentioned above often provide a dysfunctional family environment, thus increasing ICD diathesis [32]. Social factors that are involved in ICD include “low socioeconomic status, community violence, lack of structure, neglect, abusive environment, and deviant peer relations” [33]. However, some thoughts on this maintain that ICD arises from “biological disturbances, distinguishable as reduced basal cortisol activity and functional abnormalities in frontotemporal-limbic circuits” [34]. Again, we see proposals noting that cognitive deficits are noted to be antecedents to the ICD that includes learning disabilities [35]. The extent to which genomes contribute in this maniac occurrence as noted in ICD, with specific reference to pyromania, is yet to be fully established. This is not to dispel the input genes have in impulse control. In a study done by Willems et al., as regards monozygotic twins and dizygotic twins, it was realized that genes play a huge role in the defining effects witnessed in individual impulse control. They situate the heritability of impulse control to 60% (it was actually a 31 included array of studies, to which 17 reported on individual samples, that was based on a sample size of >30,000 twins and published between 1997 and 2018.

It indicated the overall monozygotic twin correlation of 0.58, and an overall dizygotic twin correlation of 0.28,) [36]. It, however, might fluctuate between 50-70%. But if we cannot attain a 100% efficient reading of the study, then all we can say is that there genes play a major role in impulse control disorder. We cannot say that the children of pyromaniacs will eventually become one, however, since it is included as an ICD, it thus indicates that the impulse disorder in the parent must not be as regards fire setting, but the resultant in the child might be inclined towards fire setting. This conclusion nonetheless is contradicted by findings done by Khadka et al., insisting that those offspring whose parents have been noted to abuse substances or alcohols [37]. Fineberg et al. notes that ICD is genetically influenced and heritable [38]; this finding was corroborated by Balestri et al. [39] Verderjo-Garcia et al., opine saying that the offspring of parents with substance-use disorders have increased impulsivity [40]. Cservenka et al., and Dager et al., in different researches, notes that substance use disorders are those which may be transmitted as general risk factor for substance abuse [41]. Terracciano et al., identified some putatively related genes related to impulsive behaviors [42]. Pyromania has nothing to do with substance abuse, and even though some pyromaniacs might abuse substances, it yet does not imply that their mania’s etiology is traceable in its entirety to the substances they abuse (it also might be traceable, but the extent to which it is, would be minimal as compared to the lack of objective behind the fire setting they engage in, which actually defines pyromania).

Thus, we might allude to the premises that ICDs are heritable, nonetheless, how this comes to bear with the case of pyromania is relatively unknown. That being said, we should note here that the evidences available indicates that heritability is acutely low in what pertains to pyromania. Thereby we would rule out the major contribution of the genes to this mania (thereby saying that its role is minor) and insist that it (pyromania) has more to do with the neurons in the brain. The reason why this is tied more to the neurons of the brain is the pyromaniacs experience a rush of pleasure after they have carried out the act. They enter into a state of joy, after success in carrying out an act that has no founded rationale. We thus insist that the emotions and the emotional processing part of the brain should be studied further in relation to this mania.

Unconscious Emotions?

With respect to pyromania, two questions arise: do unconscious emotions exist? and can the existential reality of unconscious emotions provide better insight to pyromania? Let’s start with the first. Unconscious emotions, do they exist? One can be privy to emotions, although one is not fully aware of what has triggered such emotional state. Emotional states are mental states that the human person occupies. If emotional states put the human person into a particular mental state, therefore we can conclude that emotional states are conscious in themselves. The consciousness that is being spoken of here is that which is particularly referent [43]. The particular state consciousness that the emotional state puts the individual into is

such that the reference point is the state that one is in. For instance, when one is sad, one knows that one is in the state of sadness. The individual might not be aware of what is making him or her sad, but he is certain that he is sad. The same applies to the other basic (primary) emotional states. It is apparent that there are many unconscious activities on operation that births this conscious state that one enters in. If these unconscious activities do not give rise to a particular conscious state, then the individual remains in that sphere of non-consciousness. That is to say that he is not aware of any emotion, and is not in any emotional state. That being said, the individual cannot be said to be expressing any emotion, this is because the emotion that is expressed is one that is known consciously. Can there be unconscious emotions? My answer will be No.

This is because emotional states are mental states that one is consciously aware of. Are there unconscious processes that operate beneath the conscious expression of the emotion? Yes. However, the human person is not privy to such. If we assert that emotions, since they are mental states and since their expression denotes consciousness, then the unconscious "behind the curtain operations of" emotions, is of no value to what happens in pyromania to the pyromaniac. What is noticeable however, is that they express their emotions, it is just that they lack the capacity to control a certain urge towards fire setting. Pyromaniacs are not emotion dead.

Discussion: Pyromania as a "Cry for Help"/How to Deal with It

We have ascertained that the genes (hereditary) play a role in the reality of pyromania, however such role is minimal. More to this, we have canceled the suggestion of unconscious emotions as the element to consider in what relates to pyromania. This arises from the fact that they actually do express their emotions, meaning that they are conscious of their acts. Their actions put them in a particular mental state that is indicative of consciousness. We need to elaborate on this a bit. But before we engage, we insist that pyromaniacs, owing to the fact that they are conscious of their acts, are responsible for their actions. They may not be in full control of their acts, nonetheless, it does not exclude culpability. Recent findings in this aspect have noticed abnormalities in the levels of the neurotransmitter's norepinephrine and serotonin, related to problems of impulse control and low sugar levels [44]. This indicates a linkage to depression, for such abnormality is noticeable in depressed persons (adults) [45]. The suspicion here is that pyromaniacs are depressed. This depression in children and adolescents that leads them to fire setting, has been dubbed as a "cry for help". Failure to meet with or attend to this cry results in either chronic or episodic pyromania in adulthood. Furthermore, people with cases of pyromania have other subliminal psychiatric problems ranging from ADD (attention deficit disorder) to mood disorder to learning disabilities. One can therefore place this mania as a "cry for help" mania even into the adult phase of life.

When one is not attending to this cry for attention or help,

noticeable changes occur in the brain, making this element more difficult to deal with. According to an fMRI study, decreased brain activity in the hippocampus was reported [46] in depressive patients. Reduced gray matter volume and reduced functional activity in the hippocampus would lead to negative emotion and the inability of cognitive processing in depressive patients [47]. The emotional procession part of the brain is also associated with the recall process and the reward rules. According to D. Iwuh, Memory (with particular reference to semantic and procedural memory) is enhanced more by rehearsal and recall (on the contrary, episodic memory introduces errors sometimes when the recall is made, and this explains the phenomenon of false memories) and more to that when it is attached to a particular "good feel" emotional state [48]. Emotionally arousing memories are better recalled and more susceptible to be repeated over and over again [49]. The result of this, in addition to the aforementioned reduction in gray matter levels is the enlargement of the amygdala, due to high levels of cortisol occasioned by the hippocampus. What is being said here is that if the symptoms are not curbed initially then it degenerates into full blown mania. One can engage in the use of anti-depressants to reduce the operative influence of the inner working of the brain as regards depression. However, it might not have the full blown effect that is needed in the case of pyromania.

What we are making known here is that pyromania that is full blown is a complex case that requires a step by step attention-laden confrontation. In addition to the usage of drugs as regards the depression, the recommendation is cognitive behavior therapy. Which includes: identifying the cause of the impulse, inhibiting the behavior by correction, change or elimination, finding effective coping methods, self-monitoring, using a buddy system in risky situations, parent (people) training, problem-solving skills training, relaxation training, thinking about and making known the negative consequences, fire safety and prevention, family therapy, individual therapy. Identifying the cause of the impulse and inhibiting the behaviour is not something that can be done internally, that is via a surgical procedure. It has to be done externally by the introduction of reinforcers. Reinforcers will only seek to reroute the neural pathway of the incoming impulse and the target of fire setting by latching onto the will of the pyromaniac and bringing about this change. However, since the pyromaniac trend is a steady and continued growth before it becomes full blown, its treatment would be likewise steady and continuous. Drawing excerpts from D. Iwuh's research on addiction, let it be stated here that We should recall that neural pathways, which is the connection of neural dendrites, are formed in the brain due to our habits and behaviours. As the habits and behaviours are actively carried out in steady continuity, the pathways are strengthened much like a groove created on level ground as water constantly passes through.

The communication between neurons, ensure, as already stated in the Hebbian principle, and enable those communicating neurons to become tightly bonded, leading to an ease of access as regards the

message transmission, what is known as automation (that is to say that the habit is carried out almost unconsciously). Thus rewiring can actually occur, when less of that habit is done, by replacing it with another). However, even in this case of replacement, there repetition of the new activity is vitally emphasized. Now owing to the fact that the activity is all nouvelle, conscious effort will be required in the initial stages of this operation. It will be a drag; the ease of access will be lacking and most likely there will be the occurrence of a relapse. Thus the vital relevance of conscious effort. This conscious effort arises from the faculty of the will. It is the will of the pyromaniac (addition mine), added to the his/her conscious effort that makes this rewiring possible. This is therefore to state that the human person is much more than his/her brain. The necessity of the will, in such wise should also be emphasized, this is because, choosing to repeat this nouvelle activity, is going to come with a lot of challenges, arising from the fact that it is all new to the neurons of the brain, who thus disengage and reengage in the formation of a pathway [50-55]. The recommendation therefore is to employ reinforcers, that will dissuade the fire setting neural impulse and encourage an alternate (positive) route by which that impulse can be better handled. By the neurons forming a new pathway or route, by means of the will through the instrumentality of reinforcers, the concept of neuroplasticity is presupposed.

Conclusion

There are no definitive drug for pyromania, although we have noted in this research that the other underlying psychiatric problems can be handled medically. The issue of pyromania bothers on the emotions, and that is a vital element of the human person. To deaden the emotion of the pyromaniac in a bid to solve the problem is to take away a vital aspect of the human person, it is tamper with his humanity. There we do not recommend that course of action. Our recommendation is simple, understand the etiology better and bring in reinforcers (whose target is the will). This is because there is an untapped source of power in the will, and since it is an element that is not open to medical science, its importance is most times not acknowledge. But we note here that the influence and power of the will to reroute and cause a change in the neural pattern of the pyromaniac as regards fire setting should be explored more.

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