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An evolutionary function of the depressive reaction: the cognitive map hypothesis

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Abstract

Existing hypotheses for an evolutionary function of depression are insufficient, primarily because they fail to show convincingly the advantages that might compensate for the high evolutionary costs of its features, such as general passivity, decreased appetite and sex drive.

In this article, it is shown that depression may have the function of motivating a period of reduced activity after a major loss. It thus allows for time out to update the cognitive structures for altered circumstances, and avoids dangerous actions based on the use of inadequate cognitive maps. This cognitive map hypothesis provides a viable evolutionary explanation for the high incidence of depression reaction, in spite of its apparently unfavorable characteristics. The article discusses how this hypothesis may also shed light on the occurrence of clinical depression, proposing that it is caused by a failure to update complex conceptual cognitive structures. Finally, recommendations for the treatment of depression that derive from this hypothesis are presented.

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1. Introduction

Though the evolutionary importance of primary emotions such as anger and anxiety are easily understood as motivating self-preserving fight and flight behaviors, sadness and depression have puzzled several authors for some time (McGuire, Troisi, & Raleigh, 1997; Nesse, 1990, 2000). The hypotheses so far put forward are mostly based on functions of energy preservation or invoking social support, and have not been entirely satisfactory in explaining depression from an evolutionary standpoint.

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Because it is such a frequent experience, sadness and depression are usually not questioned and regarded as a normal reaction to unfavorable changes in one's life. It is so common, that its absence, for instance after the death of a significant person, would make one feel strangely inhuman. But this experience of normality is only caused by its familiarity, because there is no reason why it should be normal or necessary to feel sad and to mourn after an important loss. Would not it be more convenient and practical to simply forget and go on living—it is no use crying over spilled milk? For instance, [Nesse \(2000\)](#) remarks about the characteristics of depression: “they are the exact opposite of the optimism, energy, and a willingness to make changes that would help a person get out of a bad situation” (p. 17).

Depressed persons become inactive, lose their appetite and even their sexual drive; all of these are primary functions necessary to survive and procreate. Even more puzzling is that this precarious state is so universal: it is estimated that about 10% of the US population suffer yearly from a severe form of depression ([Kessler, McGonagle, Swartz, Blazer, & Nelson, 1993](#)). The incidence of short-lived depressive reactions is a common, probably universal, phenomenon. Is it possible that depression, in spite of its apparent costs, has an evolutionary function?

2. What is depression?

The literature about depression is vast, and many distinctions can be found: major depression, endogenous depression, melancholic depression and depression in bipolar disorder (see, e.g., [American Psychiatric Association, 1994](#)). For the sake of this article, it will not be necessary to make such fine distinctions. These psychiatric phenomena will be referred to as “clinical” depression as opposed to “normal” (reactive) depression as a common response to significant unfavorable (and sometimes, as will be discussed later, also favorable) changes in environmental conditions. Though some symptoms may be exclusively found in clinical depression, clinical and normal depression share most features, the main difference being their intensity and duration. While discussing the function of depression, this article refers to depression as a normal non-clinical phenomenon. Only at the end of the article will clinical depression be specifically considered.

Depression is a complex of affective, cognitive and behavioral components. Its expression can vary widely from case to case, but the following characteristics of depression can be considered as basic and universal. At the affective level, the depressed person feels sad and has lack of motivation for undertaking action. At the cognitive level he/she is more pessimistic ([Alloy & Abrahamson, 1998](#); [Taylor & Brown, 1988](#)) in estimating success in influencing the environment. At the behavioral level, the depressed person is less active, usually with loss of appetite and sexual drive.

Depression is sometimes equated with mourning. However, mourning is not depression. Rather, it is a ritual for dealing with affective loss, which varies from culture to culture. Catholics hold their wake silently in a church, Arabs hire crying women, yet other cultures lash themselves. Depression is the organismic reaction of

reduced activity and withdrawal universal in humans and some higher animal species.

Normal depression is not a permanent condition but a periodic one, in reaction to an unfavorable environmental state. Charles Darwin understood that this state was marked by suffering: “Pain or suffering of any kind, if long continued, causes depression and lessens the power of action; yet it is well adapted to make a creature guard itself against any great or sudden evil” (Darwin, 1885/1993). Beck (1976) and Beck, Rush, Shae, and Emery (1979) argued that depression is invariably connected with the notion of “irreparable loss”.

The most typical example of a cause of depression is the death of a close family member. Other examples of loss may be less radical, such as divorce, the ending of friendship or prolonged (forced) separation from family or friends. Several authors (e.g., Archer, 1999) refer to the work of Bowlby (1969) on affective bonding to explain depression. But this conception of loss as loss of affective bond is certainly too limited. Depression can also be caused by the loss of physical health as in (partial) invalidity, or the loss of physical beauty. It can also be caused by losing one’s job or house. Here the loss is at a material rather than an affective level.

But what is one to think about depression after a car accident or after flunking an exam? Here it seems that there is no loss of a permanent or irreparable kind, so how could it cause depression? Beck (1976) and Beck et al. (1979) showed that this kind of depression is caused by *mental* loss. A car accident may cause one to be confronted with one’s vulnerability; the idea of apparent safety is lost. It is common among university students that the discovery of not being the best any more, as used to be the case in high-school, causes depression.

Apparent insignificant changes or small events in a person’s life may cause depression because of the meaning that is attributed to them. Humans have sophisticated mental constructs about the world that may be lost (proven invalid), such as loss of self-esteem, hope of attaining happiness, faith in god or trust in people. It is, for instance, rather common in young adults to get depressed when they have to abdicate from a rather romantic, adolescent view of people, realizing that people are often selfish and egotistic. Thus, depression may be understood not only as the reaction to affective loss but to *any kind of permanent loss, affective, material as well as conceptual*.

3. Evolutionary explanations for depression

One of the hypotheses that has been offered is that depression has come to existence as a by-product of selection on a correlated trait or as an adaptation that has gone awry, being maladaptive and having no function at all (see Nesse, 2000). Though this possibility may not be excluded this hypothesis is not very likely. Because of the high incidence of depression and the obvious costs of inactivity, it is more likely that depression has to be a functional response.

Classical Darwinism argues that characteristics that provide the organism with fitness in a given environment will be inherited by the next generation. The strongest

animals with the largest territory, the fastest hunter, the best protected against predators, will procreate their genes. Useful equipment will be selected, useless energy consuming characteristics will wane.

New insights have led to the refinement of the classical theory by introducing new parameters guiding evolution. From studying animals that live in groups, it has become clear that not necessarily the most fit at basic survival procreate most. Alliances provide entitlement to help from group members, and other strategies can provide dominance or mating privileges. Thus, not the strongest, but the most intelligent in taking advantage of group dynamics, will procreate most (van de Waal, 1998). From sociobiology, it has become clear that the crucial factor is not the survival of the individual and its offspring, but genes themselves. Puzzling behaviors like not having offspring or self-sacrifice now become understandable (Wilson, 1975). In some circumstances, caring for close family members with whom many genes are shared may generate statistical advantages for the propagation of (part of) one's genes. Various hypotheses have been offered to explain depression, from classical, social and sociobiological evolutionary theory.

One of the most common explanations of the existence of depression revolves around the idea that depression helps to preserve energy (e.g., Schmale & Engel, 1975; Thierry, Steru, Chermat, & Simon, 2000). Nesse (2000) objected to this hypothesis with the argument that: "while conserving energy during bad times seems sensible, depression seems poorly designed for this purpose" (p. 16).

Another problematic aspect of this hypothesis is that it is not very clear why it is favorable to preserve energy after loss. At first sight it would seem better to increase activity to compensate for the loss, and to find substitute resources. Many plants, for instance, are known to increase effort while under stress through blooming.

Another common hypothesis that has been offered is that depression serves to communicate the need for help (Klerman, 1974; Hagen, 1999). Crying certainly communicates this need, and inspires compassion (Barr, 1990; Lummaa, Vuorisalo, & Lehtonen, 1998). Depressed people often cry, and this certainly has a communicative effect. Passive withdrawal, or loss of appetite or sexual drive are not necessary to communicate this need, and remain unexplained. Moreover, depressed persons are usually experienced as unpleasant (Coyne, Kessler, Tal, & Turnbull, 1987), which contradicts this hypothesis.

Another group-dynamical explanation is that depression may signal yielding in a hierarchy conflict (Price, Sloman, Gardner, Gilbert, & Rohde, 1994; Sloman, Price, Gilbert, & Gardner, 1994). This hypothesis has at least two problems: there are many less costly alternatives, and behaviors with a signaling function are usually short (see van de Waal, 1998) and momentary communicative acts, while depression is a longer lasting state. Pinker (1997) suggests that the painfulness of grief may serve as a deterrent, that is necessary to seal loving relationships. Though far-fetched this hypothesis might have some value in explaining depression, but is limited to affective loss and not other types of loss.

The fact that depression often follows frustrated attempts to attain a goal has caused authors to hypothesize that depression may foster disengagement from unreachable goals (Hamburg 1974; Wortman & Brehm, 1975; Klinger, 1975; Gut,

1989). Thus, depression would have the function of reassessment or reorientation of where to direct one's motivation. The insufficiency of this hypothesis is that the pessimism of depression lacks specificity for this purpose; it causes disengagement, not only from unfruitful but from all activities. It leads to helplessness (Seligman, 1975) rather than a functional and adaptive re-evaluation of reachable and unreachable goals.

Nesse (2000) recognizes this problem and refines the original hypothesis. He first makes an important contribution in reasoning that "Decreased motivation and activity would obviously be useful in situations in which actions would be futile and dangerous" (p. 16). He then hypothesizes that depression is adaptive for dealing with *unpropitious* situations: those situations where the individual is confronted with an unreachable goal, and no alternatives with a positive pay-off are available. When the cost of every action is higher than its yield it is better to do nothing at all. The problem of Nesse's version is that situations without positive alternatives at all seem rather rare in order to justify the high incidence of depressive reactions. Nesse's examples of these situations, such as the absence of a viable life plan, insufficient internal reserves or the lack of a crucial resource, are not very convincing.

4. The cognitive map hypothesis for the depressive reaction

Taking into account the fact that depression is preceded by loss, a much better hypothesis can be formed to explain why depression in fact protects against futile and dangerous actions. Loss always implies a change in environment, a decrease in the availability of resources; the circumstances in which the individual is living have changed. Pinker (1997) is the author who gets closest to this hypothesis when he mentions that grief may enforce reassessment: "one must take time to plan how to cope with a world that has been turned upside down" (p. 420). This means that an individual who, for instance, loses a close family member, or who acquires some physical disability has to adapt his cognitive structures to the new living situation. Depression provides the necessary time out in order to update the cognitive maps. Depression may thus provide a definite evolutionary advantage after loss, protecting the individual from dangerous situations caused by actions based on inadequate cognitive information.

Most of human action is based on habits. They are not pondered but executed automatically, based on experience and knowledge about the (social) environment and the individual's capacities. Knowledge about physical capacities, social resources and the ongoing relation with them is represented in cognitive maps and schemas (see, e.g., Sandler & Rosenblatt, 1962; Lazarus & Folkman, 1984; Markus & Wurf, 1987; Baldwin, 1992). These cognitive maps contain knowledge like: how fast can I move, I can count on the help of a friend if necessary, my husband will bring the children to school on Monday and Wednesday; an enormous amount of information about the environment that is used in automatic day-to-day functioning. It is difficult to appreciate how pervasive the use of these maps is; since automatic functioning is designed to liberate attention, most of its working is unconscious. But it is precisely when change occurs that these behavior patterns are being noticed.

Everybody who has temporarily lost the use of a hand has become suddenly aware of the hundreds of things that cannot be executed normally or automatically. Simple actions, such as preparing or eating food, dressing or even sitting down, suddenly have to be monitored carefully for them to be carried out without accidents.

This example may also serve to illustrate that introducing changes in cognitive structures will take considerable time, since cognitive maps form an extensive network, where the elements of the individual's environment and existing resources are included numerous times. If a resource disappears, all relevant acts and behaviors in which this resource is present have to be updated. This process is probably at work when, in countless situations, one "misses" someone or something, signaling inadequate mapping. When our dog dies, he does not come running to us when we get home, we miss him in the kitchen, in the bedroom, in the garden, while watching television; we feel unprotected. We feel the inclination to give him food, or to let him out. After the death of a significant person in one's life, for months or even years, situations will pop up were the other person is missing. I cannot call him, ask him for advice, I have to go to the bank myself, the car is not washed, he used to make me toast for breakfast.

Various deductions can be made from this hypothesis. Firstly, the length of the depression should correlate with the number of schemas that have to be updated. Thus, the time a depression lasts is dependent on the prominence or significance of the loss, which in fact seems to be the case. It would also follow that, in animals that have less elaborate cognitive structures, depression should be less frequent and episodes should be shorter. Animals do, in fact, seem to have short-lived depressions (van de Waal, 1998), and anybody with a dog or cat that has lost its puppies can acknowledge this phenomenon. It also becomes clearer why body retrieval after accidents and natural disasters is of crucial importance for those left behind. The insecurity about the loss is not only emotionally taxing, but also leaves the person in a cognitive impasse, prolonging the depressive state, since cognitive maps cannot be adapted due to ambiguous information.

Finally, since the need for change in cognitive structures seems to be the crucial factor for the occurrence of depression, one might wonder if depression should not also occur after significant changes for the better. Of course, in these situations, the need for time out is less urgent, since opportunities increase, and incomplete maps are thus less likely to cause dangerous situations. But, in fact, depression has been reported after important life events, for instance after exams or big financial success and important career advancements (Lowen, 1975). Also relevant, in this respect, is the fact that the life-event scale for stress (Holmes & Rahe, 1967) includes both negative and positive life events, to an almost equal degree.

5. How can clinical depression be explained?

The cognitive map hypothesis may also shed some light on the occurrence of clinical depression, which seems to exist exclusively in humans. As mentioned before, not only concrete resources like a loved person, physical ability or material resources may be lost, but also mental concepts like safety, self-esteem, identity, hope, religious

belief, or political conviction. Human cognitive schemas, unlike those of animals, include complex and abstract notions. Within this myriad of interrelated concepts, it is understandable that a person can more easily get lost, in the sense that he does not succeed in rebuilding his schemas into a new coherent and meaningful whole after a significant conceptual loss.

For example, clinical depression in adolescents very often happens after a disillusionment, either in a friendship or a romantic relationship. In his practice as a psychotherapist, the author has found that clinical depression in these cases is not caused by the loss of the particular person in question, but by the loss of a romantic ideal about human relationships. Usually, the clinically depressed adolescent has difficulty in coming to terms with the fact that people are often intrinsically egotistic, that the world is unfair, that friendships may not last forever. Realizing these aspects of human nature implies the loss of being able to trust (blindly), the loss of a friendship ideal and of unconditional love. Similarly, elderly people who get *clinically* depressed are seldom depressed about the loss of health or the approaching ending of life itself, but about existential issues like evaluating the life they have lived or how to create a meaningful and worthwhile last life-phase. After the death of a friend, a reactive depression may turn into a clinical depression because the person cannot adapt to the issue of vulnerability or the transience of things in general. Losing an affective bond forces reorientation in relation to the viability of relating to people in the light of pending loss.

As can be seen from these examples, the risk of clinical depression usually resides in abstract conceptual consequences of loss rather than the concrete loss itself. People can get lost in this reorientation process in several ways, and at least three treatment recommendations can be deduced from this model.

Most commonly, clinical depression is caused by the primary tendency of people to avoid pain. In this case the issue is “forgotten”, and since cognitive integration is delayed, the depressive state will be prolonged and turn into clinical depression. Here the primary task of psychotherapy is *confronting* the patients with their loss.

A second possibility of getting lost in rewriting cognitive maps is being too fixed on the concrete loss: “I don’t know why I can’t forget her”. Here psychotherapy should help the patient to *identify* the conceptual loss, as described in several examples above.

Finally, the patient may have difficulty in incorporating the new conceptual information, because it is in conflict with other conceptual structures. Convictions, beliefs and ideals of a religious, moral or political nature may impede acceptance. “I can’t believe the world is so unfair, I can’t accept that he gets away with this” Here the task of the therapist is helping the patient to *change* these deeper cognitive structures to more realistic proportions, so that a new coherent structure can be achieved, including the new information.

6. Discussion

Evolutionary explanations that have been offered so far have been unsatisfactory for several reasons. A new hypothesis about the evolutionary functions of

depression may be found in providing the organism with a period of time out to update cognitive maps, after having suffered social, physical and affective loss. Low motivation, apathy, lack of appetite and sexual drive prevent the individual from dangerous actions caused by the use of outdated cognitive maps. The evolutionary advantage of this time out outweighs the costs of temporary inhibition of primary survival functions. The hypothesis predicts correctly that depression is present in animals, but less frequent because of minor cognitive complexity.

It is coherent with the fact that depression occurs generally after situations of irreparable resource loss. This hypothesis may also shed some light on the existence of clinical depression in humans, possibly caused by the difficulty of incorporating loss at a conceptual level. With a failure to incorporate new information, either through avoidance, or through an inability to identify the conceptual loss, or through incoherence with existing conceptual structures, a normal depressive reaction may be prolonged into a clinical depression.

Only until some experimental evidence is obtained this hypothesis is merely conjectural. Several testable hypothesis may be deduced, however. Firstly, it must be true that any major environmental change leads to a periodically reduced activity in both higher animals and humans. Secondly, the reaction should be related to the type of change. Environmental changes that imply an increase in resources should have a smaller effect than changes that imply a loss of resources. Thirdly, a relation should be found between the “size” of the change and the duration of the depressive reaction. Those changes that imply modifications in many cognitive schemas should have a bigger effect than those that require updates in only few cognitive schema. Finally, the cognitive map hypothesis will have to be reviewed in the light of cultural and sex differences. For instance, how can it be explained that, at least in western cultures, women suffer more from clinical depression than men? (The lifetime incidence is 10–25% in women and 5–12% in men, [American Psychiatric Association, 1994, p. 341](#))

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