Care for the self, care for the world from neurophysiology to the Biosphere. Notes on the coronavirus, fear, and the environment*

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To my students at the Universidad Panamericana, Mexico City
me siento tranquilo, que el porvenir está en sus manos.

Abstract

Taking the impact of the current COVID-19 pandemic as an example, I investigate some aspects of care of the self and care for the world. Care of the self is considered with regard to the self-knowledge that can be gained by the neurophysiological study of fear, with particular reference to the role of the amygdala and the hormone oxytocin. Care for the world is studied, with reference to the thought of Hans Jonas and the Gaia hypothesis, in the form of a highly speculative suggestion that the COVID-19 pandemic may, in some sense, be envisaged as the result of humankind's lack of proper care for the biosphere. Some parallels are drawn with Pierre Hadot's interpretation of ancient philosophy.

Keywords: Hans Jonas, Gaia hypothesis, Pierre Hadot, Neurophysiology, COVID-19 Pandemic.

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1. Introduction: Care of the self, care for the world

What does it mean to care for oneself and for the world? Let us begin by separating the two. In the West, care of the self appears on the stage with Socrates' repeated admonition to his fellow citizens that they care for themselves (*epimelein heautou*; Plat., *Apol*., 30b). As Guido Cusinato (2017, p. 41) has pointed out, such care

> consists [...] in giving the right nutrition and the correct exercize to all one's faculties [...] so that they may reach a harmony among each other and make the soul "as good as possible".

Yet such care devoted to the self, in which, according to the *Alcibiades*, we are to distinguish what we *have* – wealth, physical beauty, social standing, etc. – from what we *are*, devoting our attention exclusively to the latter, is not intended as a mere narcisistic navel-gazing. Instead, as Cusinato continues, the process recommended by Plato's Socrates takes place

> in the sense of a *paideia* of self-transcendence that is carried out by following the virtue of self-control (*sophrosyne*), and urges us to "transcend ourselves", in the sense of ensuring that the better part of oneself prevails (Plat., *Resp*., 431a).

Indeed, as Pierre Hadot has emphasized throughout his work, for an important trend of Greek thought, philosophical or spiritual progress, while it began with care for the self in the sense of coming to know oneself, was only the beginning. As in some techniques of meditation, this intense, voluntary, concentrative introspection was to be followed by an expansive phase of open, expansive contemplation of the world, the goal of which was to achieve what Hadot called "cosmic consciousness", that raises us above the petty concerns of our individualistic lives, and makes us aware that we are parts of the All (Chase, 2013, p. 264). By "Cosmic consciousness", Hadot means «the awareness of being a part of the cosmos; the expansion of the ego into the infinity of universal nature» (Hadot, 1995, p. 266). In ancient Stoic thought, it was held to be a characteristic of the Sage, consisting in «the feeling of belonging to a whole which goes beyond the limits of [...] individuality», and was the result of «a spiritual exercise that consisted in becoming aware of the place of one's individual existence within the great current of the cosmos and the perspective of the whole» (Hadot, 1995, p. 273). It means, then, overcoming the erroneous sense of isolation most of us feel in our day-to-day lives. We tend to think that the world revolves around us, in our individuality, and to evaluate persons and events as a function of what we perceive as advantageous or deleterious to this isolated self. For Hadot, however, this identification of

our self with our perceived, short-term interests is in fact erroneous. We are not, in fact, isolated, but integral parts of the cosmic Whole, and this realization is the prerequiste for the transformative work of philosophy, the ultimate goal of which is enable us to live lives that are less anxiety-ridden, more free, more intense and more authentic.

The realization of our inseparable belonging to a larger Whole must carry with it a re-orientation, not only of our attention, but also of our responsibilities. Whereas, as Cusinato points out, ethics begins with care for the self and expands to care for other human beings, the notion of cosmic consciousness, consisting as it does in the realization of our kinship, and ultimate consubstantiality, with the world, implies that our ethical concerns, too, should be expanded to include the interests of the entire biosphere[1]. True care of the self, from this perspective, entails care of the world.

In what follows, we shall use the case-study of the current COVID-19 pandemic to investigate both the microcosmic and the macrocosmic aspects of care. On the microcosmic level, we shall study care of the self as exemplified by the self-knowledge that can be promoted by the neurophysiological study of fear; while on the macrocosmic level, we will deal with care of the world, in the form of a highly speculative hypothesis that the COVID-19 pandemic may, in some sense, be envisaged as the result of humankind's lack of care for the biosphere.

2. The coronavirus and the environment

We are in the midst of the greatest health crisis the world has undergone in recent memory – the COVID-19 pandemic. Almost no one has been exempt from the impact it has had on our lives. For the moment, we all have to come to terms with the fear and uncertainty caused by this radically new, strange, and worrisome situation (cf. Heyd, 2020, p. 2)[2].

[1] To my knowledge, Hadot does not formulate this consequence of his views in precisely these terms. Yet his love of nature was intense and lifelong, and his concern over the results of what he saw as the prevalence of mankind's exploitative, "Promethean" attitude to nature, in which it is viewed as the source of riches that are to be wrested from it, violently if need be, over an "Orphic" approach, in which human beings observe natural phenomena with an attitude of disinterested respect, in the hopes of learning something from it, is the main theme of his *Veil of Isis* (2006), among other works.

[2] I consider the present study to be complementary to Heyd's: while this author focuses on structural *parallels* between human-generated climate change and the COVID-19 pandemic, I hasard to suggest an – avowedly highly speculative – *causal* relation between the two.

Despite the fact that it seems to have been raging for an eternity, it is still too early to discern the ultimate causes and long-term effects of the pandemic. Yet its radical novelty – the fact that none of us have ever experienced a global health crisis quite so severe and dramatic in our lifetimes – perhaps authorizes us to engage in some speculation, however unorthodox and implausible it may seem to some.

The toll of the pandemic in terms of human death, sickness, and economic suffering caused by the pandemic has, of course, been atrocious (Heyd, 2020, pp. 2 ff.). Yet during the first months of the pandemic, at least, it seems hard to deny that from an ecological perspective its effects were not exclusively negative. Owing to the shutdown of the economy, various types of pollution, particularly emissions of greenhouse gases (GHG), were reduced[3]. According to Roberto Cazzola Gatti (writing in April 2020):

> In the last months of the virus outbreak, China has reduced its greenhouse gas (GHG) emissions by about 25%, which means more than 200 million tons of carbon dioxide compared with emissions levels in 2019. Nitrogen dioxide and small-particle air pollution [...] decreased about 40% [...]. Airplane traffic has significantly dropped worldwide and, because it accounts for about 3-5% of total GHG emissions, this change could have a major impact on the atmosphere. Similarly, forecasts for oil demand in 2020 have been lowered by energy agencies (Cazzola Gatti, 2020).

More recent studies large back up Cazzola Gatti's findings. Any doubts on the subject seem to have been rendered largely obsolete by the authoritative recent study by Liu *et al.* (2020), which has concluded that during the first six months of the pandemic, coal-fired power utilization, and global travel, especially by air, declined precipitously worldwide, leading to a overall 8.8% global decrease in global emissions of CO^2, or 1551 megatons, a decrease «larger than during previous economic downturns or Word War II» (Liu *et al.*, 2020)[4]. These reductions were most pronounced in the world's most industrialized and industrializing regions: US, Europe, India and China.

These positive environmental effects of the COVID-19 pandemic may be only temporary, of course: indeed, many have already begun to erased as nations start to ease lockdowns and "restart" economic activity in the late spring and early summer of 2020. The pandemic's positive effects

[3] See the studies by Helm (2020), Lenzen *et al.* (2020), Ahora *et al.* (2020), Zambrano-Monserrate *et al.* (2020). Heyd (2020), following Harvey (2020), strikes a more cautionary note with regard to such figures, but the unequivocal findings of Liu *et al.* (2020) now seem to render such reservations obsolete.

[4] This study by 35 authors in the prestigious journal "Nature Communications", published October 14, 2020, is the definitive study of the subject to date.

were, in any case, partially offset by such negative phenomena as reduced recycling and relaxed environmental restrictions. Nevertheless, some, at least, of the positive aspects of the COVID-19 pandemic may be longer-lasting. According to Cazzola Gatti (2020):

> Humanity may rediscover the pleasure of a slower life, spending more time at home with family, reducing useless travelling towards offices when teleworking can be a win-win solution, giving more value to time and more time to values, getting back to nature, spending more time in local, creative purposeful pursuits such as growing food, etc. Our species may also understand that it does not actually need to buy and accumulate cheap, polluting, useless stuff, which are not essential in a pandemic-risk world [...]. In *a time of moderation*, we may realize that most of our previous needs and habits, which we thought as unavoidable, were just trifles [...]. Nowhere it is written that economic growth and environmental exploitation should restart as they were. We are receiving warning messages from Gaia, some of the strongest and clearest of all our evolutionary time. If we ignore them, we can blame only ourselves.

3. Were the positive environmental effects of the COVID-19 pandemic merely adventitious?

Let us imagine, for a moment, that the earth were an organism. If so, and this mega-organism had been suffering for decades, at an increasing rate, from the effects of human-induced climate change, would one not expect its immune system to react by attempting to rid the organism of what very much resembles a debilitating and life-threatening infection? And might the results of such an attempt by the Earth's immune system to reduce the negative effects of anthropogenic climate change look very much like the results we have indeed witnessed in the first months of the COVID pandemic?

Here I want to emphasize that this idea is extremely speculative and probably wrong. But if such a hypothesis could be entertained, then the coronavirus could be interpreted as a kind of a wake-up call from Nature or Mother Earth to humanity, warning us to change our ways. If we don't, she will eliminate us as ruthlessly and mercilessly as our own immune system declares war on an invading army of infectious agents[5].

[5] Cf. Lovelock (2006, pp. 188-9): «the great Earth system, Gaia, behaves like the other mythic goddesses [...] she acts like a mother who is nurturing but ruthlessly cruel towards transgressors, even when they are her progeny [...] our self-regulating Earth [...] evolved from those organisms that left a better environment for their progeny and by the elimination of those who fouled their habitat [...] Gaia now threatens us with the ultimate punishment of extinction». Writing in 2006, Lovelock called attention to the fact that «our

4. The Gaia hypothesis

Such an idea may seem absurd. Yet that the Earth is indeed, in some relevant respects, analogous to a self-regulating organism is precisely the viewpoint defended by the Gaia hypothesis, set forth by James Lovelock and Lynn Margulis beginning in the 1970s. This is not the place to enter into a sustained and detailed exposition of this extremely controversial theory, which remains marginal in the view of most professional scientists[6]. It has, moreover, been formulated in a variety of forms even by its proponents, sometimes being demoted to the status of a metaphor[7] intended to incite persons, organizations and governments to take action to alleviate anthropogenic climate change. In its strong form, most widely diffused in the popular media, it maintains that the Earth is alive. Lovelock himself adheres to a weaker form of the theory, which simply maintains that the earth is a self-regulating organism or self-reproducing autopoietic system which, by means of purely natural chemical and biological processes, tends to maintain its atmosphere and surface in conditions that are propitious to life[8]. Lovelock arrived at this theory by noticing that the earth has an atmosphere the chemical composition of which is highly unlikely from the viewpoint of standard equilibrium chemistry – in particular, the fact that since the emergence of life on Earth, the planet has maintained environmental conditions propitious to the existence of life, despite the fact that over this period of several billion years, the Sun has increased its radiation dramatically[9]. He reached the conclusion that this continuous regulation of the Earth's atmosphere can only be attributed to the collective properties of organisms.

Thus, the Gaia hypothesis in the form set forth by Lovelock does not entail that the earth is conscious in any sense we might recognize[10].

only significant predator is the occasional micro organism that briefly mounts a pandemic» (Lovelock, 2006, p. 182).

[6] For a critical overview cf. Serrelli (2015); for a more sympathetic evaluation cf. the papers collected in Clarke (2015).

[7] Cf. Lovelock (2006, p. 197) on the importance of considering «metaphor seriously as a path to the primitive feelings of the unconscious part of our minds». This protreptic or propaedeutic use of metaphor in order to mobilize public opinion would not, I think, have been disowned by Jonas, as we shall see below.

[8] Cf. Lovelock (2006, p. 208), who defines the Gaia theory as «A view of the Earth that sees it as a self-regulating system made up from the totality of organisms [...] tightly coupled as an evolving system. The theory sees this system as having a goal – the regulation of surface conditions so as always to be as favourable as possible for contemporary life».

[9] Perhaps by 25% (cf. Lovelock, 2006, p. 80). Without countervening factors, this would translate into a disastrous global temperature increase of 20° C.

[10] Although we may not know all there is to know about what kinds of consciousness

It does, however, entail a re-evaluation of the notion of evolution as propelled exclusively by the self-reproduction of the "selfish gene". For Lovelock, rather than individuals, or genes, «the unit of evolution is the Earth system, and self-regulation is an emergent property of that system» (Lovelock, 2004, p. 2). This self-regulation functions by the following mechanism: individual life-forms, particularly bacteria, react to climate crises and resist assaults on their integrity, and these individual actions lead to a general maintenance of conditions favorable to life. Life, in sum, is autopoietic, in the sense that it makes and remakes its own environment. According to Dorion Sagan and Lynn Margulis, in at least one of its possible formulations, the Gaia hypothesis amounts to the claim that «all life forms a body that responds physiologically to environmental threats and insults in order to assure its survival» (Margulis, Sagan, 1986, pp. 268-9).

Whatever the ultimate merits of Gaia as a scientific theory, what is at stake in the current discussion is primarily this question: is there, or is there not, a non-random, and perhaps causal, correlation between the current COVID-19 pandemic and anthropogenic climate change? And if there is, might the former be regarded as, in a sense that would require careful specification, a response to the latter? For such a hypothesis to be confirmed, much further research would be required. One would have to explain precisely how, i.e. by what natural, biological and physical methods, Gaia goes about creating the coronavirus. That's not going to happen anytime soon.

Meanwhile, however, there is nothing to stop us from *acting as if* it were true. We could *entertain the hypothesis* that the Coronavirus is an immune response on the part of the organism Gaia as a kind of regulative principle: something which, like the principle of teleology according to Kant, we cannot prove is true, but which can nevertheless guide our judgement and our action. As Hans Jonas recommends, we can learn to live *as though* the future well-being of Nature and the Earth were the immediate object of our interest: guiding our ethical behavior by principles such as «let everything you do be in the interest of the furtherance of life in this planet», or, in its negative form: «do nothing that will endanger the indefinite continuance of life on this planet».

there are. A growing body of studies, for instance, tends to show that plants have some kind of consciousness, communicate with one another, and perhaps even engage in some activity we might call empathetic. For a popular account of these issues, see for instance Wohlleben (2019).

5. Hans Jonas and the heuristics of fear

What Emidio Spinelli (2020) calls the «tempo del coronavirus» brings to the foreground the important role of the human emotion of fear, which, according to Maria Antonietta Foddai (2012), «is born in the amygdala and is linked to the instinct of self-preservation that has enabled us to evolve and to survive». Elena Pulcini (2014, pp. 502-3) speaks of the need to «carry out a metamorphosis of fear» that will «break the paralyzing dynamics of anguish and hence reawaken that which, to take up the proposal of Hans Jonas, I would like to define not as fear *of*, but as a fear *for*: for the world, the environment, future generations». This, for Pulcini, is «a mobilizing fear that is born from an empathetic relation with the other, and is a prelude to the ability to take charge of the fate of humanity and the planet». This mobilizing or motivating fear is, moreover, not the result of some vague feeling of empathy, but is «generated by the awareness of an analogous and universal condition of vulnerability».

Spinelli goes on to point out, following Jonas, that we *need* fear: not the kind that blocks, paralyzes and freezes us, but the kind that unleashes energy and promotes solutions that may be able to solve the problems raised by what frightens us. He believes this approach may lead to a new anthropology, which must be based on ethics. This, in turn, implies rethinking the very concept of freedom. Unlike our usual conception of freedom as merely being free from constraints, as a state in which we are free to do whatever we like, this new freedom must be guided by responsibility.

This triad of morality, freedom and responsibility was the basis of the ethico-ecological thought of the German-Jewish philosopher Hans Jonas (1903-1993). Initially a student of Heidegger, he began by working on ancient philosophy, and wrote pioneering books on Gnosticism. Forced to flee Germany to Palestine in 1933, he returned to Europe in 1940 to join the British army and fight against the Nazis. He later taught for many years in Canada and US, where he died. After his studies of Gnosticism, Jonas made a radical career change, turning to the philosophy of biology, where he worked on such concepts as the philosophy of life, and then to ethics and the critique of modern technology, in which field he published his most famous work, *The Imperative of Responsibility* (1979).

Here and in other works, Jonas called for «an ethics for technological civilization». In the opening lines of *The Imperative of Responsibility*, he writes that

> [...] the irredeemably unchained Prometheus, upon whom science confers heretofore unknown powers, and the economy imposes a restless impetus, calls for an ethics which, by means of voluntary restraint, prevents its power from becoming disastrous for human beings (Jonas, 1983, p. 7).

As Spinelli points out, following Jonas, science is becoming more self-aware. But since it is still very much under the control of a society devoted exclusively to unlimited profit, we need to carefully keep it under control. This, in turn, requires «a radically profound change, that concerns the very essence of mankind's actions» (Spinelli, 2020). It is no longer merely a matter of individuals obeying laws, nor even, as in Pierre Hadot's interpretation of ancient Stoic ethics (see, for instance, Hadot, 1998, pp. 73-97), of ensuring that all our actions are for the benefit of the human community. Henceforth, according to Jonas, it is nature itself that demands that its own rights be taken into account:

> it is, at least, no longer meaningless to ask whether the condition of extra-human nature, that is, the biosphere as a whole and in its parts, has come to be something that has been entrusted to mankind, and has something like a moral claim on us [...] for its own sake on the basis of its own rights. If this were so, it would demand no minor rethinking of the foundations of ethics. It would mean seeking not only human well-being, but also the well-being of non-human things, that is, extending the recognition of "ends in themselves" above and beyond the sphere of the human, and including the care for it within the concept of human well-being (Jonas, 1983, p. 29).

In other words, as Spinelli (2020) comments, «our anthropological structure can no longer close itself up in itself, nor forget the intrinsic dignity of nature as a whole. In other words, this structure must become ecological».

To guarantee this safe space for the entire biosphere, Spinelli continues, we must re-learn how to be afraid. Here he appeals to what Hans Jonas calls the "heuristics of fear": we will have to learn, once again, respect and horror. From horror, we must recuperate respect, and from foreseeing what is negative, we must recuperate the positive. Concretely, this means recovering, from our horror at what mankind *might* come to be, the respect for what man *has been* and *is*.

Part of the usefulness of fear, as Jonas emphasizes, is that it acts quickly: fear inspires a «revulsion of feeling that acts ahead of knowledge»; similarly, «We know much sooner what we do not want than what we want». This explains why moral philosophy must «consult our fears prior to our wishes» (Jonas, 2018, p. 217). And indeed, as we shall see, the amygdala, that part of the brain's pre-reflective, unconscious limbic system that is largely responsible for our feelings of fear, does indeed act much more quickly that the rational, executive prefrontal cortex that is the seat of most of what we call "thinking"[11].

[11] When patients are shown fearful faces for only 300 milliseconds, the first gamma-wave

As a necessary prelude to the «ethics of the future» he calls for, Jonas (2018, p. 214) thus invokes the need for a kind of spiritual exercize, consisting in intentionally induced «creatively imagined evil». In other words, we are to picture, through a deliberate act of the will, a future scenario so atrocious that we have no precedent for it in our past or current experience. Only such an imaginative exercize can inspire the fear that will spur us on to effective action.

Here one may note both affinities and differences between Jonas' views and those of ancient Greco-Roman philosophy. As is well known, the Stoics, among other ancient philosophical schools, advised the practice of the imaginative pre-picturing of evils (*praemeditatio malorum*)[12], in which one is to imagine the worst thing that could possibly occur. The idea here is that in unpleasant, negative phenomena, the most painful element is that of surprise. By the constant imaginative depiction of negative outcomes, we can, it was believed, inure the soul, toughening it and making it ready for whatever negative outcomes may actually occur. In Marcus Aurelius, this exercize is linked to additional exercizes, whereby seemingly negative future events are broken down into their constitutive elements, circumscribed, and redefined (cf. Hadot, 1998, pp. 131 ff.), in order to enable the subject to realize that what had seemed to be awful, intolerable eventualities are in fact bearable, and perhaps not even negative, when viewed from the perspective, not of limited, individualistic interests (or rather, what we perceive as such), but of the interests of the Whole. In fact, for Marcus and other Stoics of the imperial age, our initial evaluations of events, whether past, present or future – for which neuroscience teaches us the amygdala is largely responsible –, as negative and frightening, are almost always mistaken. The correct evaluation is that which is based on the fundamental Stoic principle that the only good is moral good, and the only evil moral evil. This domain of moral choice and action is the only one that is "up to us", while all putatively negative external occurrences – sickness, poverty, exile, disgrace, and even death itself – are in fact *indifferent*, in the technical sense that no difference or preference is to be established between them (cf. Hadot, 1998, pp. 71 ff.; 2002, pp. 112-3; 221-2). All such events have been destined to us, or, as

responses in the amygdala are detected by magnetoencephalographical techniques only 25 ms later. In contrast, gamma synchrony was not detected in the more "rational" part of cortex, the inferior frontal gyrus, until 205 ms later (Austin, 2009, pp. 228 ff. with Table 15).

[12] See, for instance, Hadot (1998, pp. 205 ff.; 2002, pp. 137 ff.). This exercise was not limited to the Stoics: it was recommended by Philo of Alexandria, and later Galen attributed to this exercise the fact that, to the amazement of his colleagues, he was able to remain relatively unaffected when he lost his library in a fire; cf. *On Grief* (*Peri lupês*), now available in the excellent translation by Singer *et al*. (2013).

Marcus says, «woven together with our substance», from all eternity, by a benevolent, omniscient rational power, the *Logos*, which is ultimately consubstantial with our own innermost and most authentic being. Nothing that is good for the whole can be bad for its parts: therefore, our impression that some external events affect us in a negative or deleterious way is simply a mistake, based on our limited, selfish perspective which it is the task of philosophy to overcome. In terms of modern psychology, one might say that what the Stoics recommend is a technique of reappraisal, through which stressful events are reconstrued as beneficial, meaningful, or benign[13].

Jonas' invocation of an exercize analogous to the *praemeditatio malorum* has a quite different intent. Far from inuring us to future misfortunes, and farther still from leading to a reconciliation and acceptance of them, Jonas' «creatively imagined evil» is intended to shock us into action. In fact, it is intended to scare the living daylights out of us, in the belief that only such mobilizing, activating fear is capable of causing us to fundamentally rethink our ethical presuppositions, and to change our lives accordingly.

6. Care, Self-knowledge, and neurophysiology

As Luigina Mortari (2019, pp. 25 ff.) has emphasized, with reference to Plato's *Alcibiades*, Socrates holds that caring for oneself implies self-knowledge. Only by knowing ourselves can we understand how to care for ourselves. This investigation is hard, but it must be undertaken, for «if we know ourselves, we will also be able to learn how to care for ourselves, but if we don't know ourselves, we cannot know even that (*Alcib. I*, 129a)». While recognizing the difficulty, and perhaps the impossibility of ever arriving at a complete understanding of ourselves, Mortari therefore underlines the importance of what she calls "self-ethnography" (autoethnografia)[14].

She goes on to show that «knowing oneself means understanding what are the forces that act on the life of the mind, what implications they may have on one's own mode of being». Later in her important work (Mortari, 2019, p. 45), Mortari notes that such attempts at self-understanding are transformational:

[13] Studies have shown that such an approach, correlated with activation of certain areas of the prefrontal cortex and the anterior cingulate cortex, can indeed reduce symptoms of stress; cf. Hölzel *et al.* (2011). Reevaluation or reappraisal, by means of which patients assumed a more objective stance when viewing negatively-charged scenes, have been correlated with decreased activity of the amygdala and the orbitofrontal cortex; cf. Austin (2006, p. 93).

[14] From a neurophysiological perspective, self-reflection or focusing observation on the self, also activates the middle and pre-frontal regions of the brain, particularly the middle prefrontal and the anterior cingulate cortex.

When we think in order to understand what we are, it so happens that the act of thinking is not limited to understanding, but at the same time structures being.

It seems to me, then, that part of this goal of investigation *qua* the search for self-knowledge implies that we at least consider what modern cognitive sciences and neurophysiology have taught us about how the mind, the brain, and nervous system as a whole world.

7. What is fear?

As we have seen, the part of our brain that is primarily responsible for fear is the amygdala[15], or more strictly speaking the amygdaloid complex, a part of the limbic system buried near the inside tip of the temporal lobe of the brain. This tiny organ is itself a highly complex entity[16] that interacts in various ways with other parts of the brain by means of a variety of neurotransmitters. According to James Austin (1998, p. 179), the amygdala «enters early into a vital loop of incoming signals. It comes instantly to conclusions about their survival or reinforcement value. It then relays its biased affective valences on to other circuits». The amygdala intervenes quickly in these circuits:

> sensate input goes quickly through relay nuclei of the thalamus to the central and lateral nuclei of the amygdala, thus providing subliminal value judgments. Such judgments are deeply rooted, effortless, visceral, hard to put into words, hard to override.

This fast-acting pathway, in which the amygdala exchanges messages with the hypothalamus and the central gray (Austin, 1998, pp. 657-8; 2009, p. 231)[17], partly accounts for why we are so suggestible and so ready to jump to conclusions.

The amygdala is thus one major source of our sub-conscious biases and prejudices, the overcoming of which was the reasons why the Stoics advised us to pause and analyse our mental presentations to see whether they in fact correspond to objective reality, before we consent to and act

[15] The amygdala does not, of course, act alone in the production of fearful responses, but as part of a widely distibuted network, each component of which contributes to the end result in highly complex ways (Austin, 2006, pp. 90 ff.). Nor does it (co-)produce fear alone, but it can also promote anger and aggressiveness (Austin, 2006, p. 92).

[16] As Austin (1998, p. 175) points out, the circuitries of just one of its subdivisions, the basolateral nuclei, are so complex that they resemble a miniataure cerebral cortex.

[17] These effects can gradually be counteracted as a human being matures, and slower, cortical-limbic pathways are to some extent modified by slower, more thoughtful discriminations.

upon them[18]. A hyperactive amygdala also partly explains why some people are born with more anxious and worried personalities[19], and it has been found to contribute to a large number of psychological disorders[20]. Some infants are found to be highly reactive as early as four months of age, and many of them will still be unusually fearful in confronting new situations and unfamiliar people at later stages of their development[21]. Many young adults remain naturally anxious throughout their lives, some being subject to debilitating panic attacks.

We know from the study of animals that fear correlates with increased electrochemical activity in the pathway between the amygdala and the hypothalamus. A rat whose amygdalae have been chemically deactivated does not cower in the back of his cage after it has lost a fight, as do normal rats, but keeps wandering around in its cage and sticking its nose out to sniff in the direction of the rat that has defeated it: it is as if, as James Austin comments, he «hasn't learned his lesson» (Austin, 1998, p. 176). This is an example of how the amygdala contributes to "street smarts" or survival skills, or observing what we might call etiquette or acceptable social behavior. Yet it also plays a vital role in learning from unpleasant experiences. If a normal rat is given a mild shock when it hears a specific sound, it will develop a conditioned reflex and come to fear the sound: that is, its amygdala will make it freeze, and increase its heart rate and blood pressure (Austin, 1998, p. 177); but these reactions don't occur if the amygdala has been removed[22]. The amygdala is also responsible for primal, instinctual fears: rats naturally freeze when they see a cat, but if their amygdala has been deactivated they will happily climb onto the back of a sleeping cat, while monkeys with deactivated amygdalae are quite willing to handle snakes, which they would never do under natural conditions (Austin, 1998, pp. 178-9).

[18] The goal was to avoid acting, or rather reacting to external stimuli in an over-hasty, precipitous way; cf. Hadot (1998, pp. 45, 69; 2002, p. 265).

[19] Austin speculates that interruptions of the messages that circulate between the amygdala and other regions of the limbic system, perhaps brought about when the amygdala is inhibited by endogenous opioids (Austin, 1998, pp. 619-20), may help to explain the feeling of detachment and non-reactivity that Zen Buddhist practitioners hope to achieve. Cf. Austin (1998, pp. 175-80, 531-2, 567-70, 620; 2006, pp. 89, 94).

[20] These include depression, bipolar disorder, borderline personality disorder, social phobia, obsessive-compulsive disorder, post-traumatic stress disorder, impulsive aggression, addiction, and generalized and trait anxiety; cf. Hölzel *et al.* (2011, pp. 543-4).

[21] This is due largely to the circuits of information sharing between the amygdala and such other limbic regions as the central grey and the hypothalamus, with the resulting fearful evaluations then being handed on to the frontal lobes.

[22] The same phenomenon is found in cats that have been conditioned to become fearful: once the central nucleus of their amygdala has been deactivated, their blood pressure lowers and their breathing rate slows (Austin, 1998, p. 178).

In human beings, fear is the result of a complex interaction between various subcortical and cortical parts of the brain, and the amygdala serves as a gateway through which fear is transmitted to these circuits of communication (Austin, 2009, p. 224). We have seen that, as Spinelli, Jonas and others have emphasized, fear can either immobilize us with panic or can drive us to heroic acts, and it is fear in this latter sense that Jonas and his interpreters argue persuasively is a prerequisite for mobilizing humanity to carry out the profound, far-reaching changes needed to moderate the damage humans are increasingly causing to the biosphere. The reduction of such damage resulting from the economic slowdowns occasioned – *nolens volens* – by the COVID-19 pandemic during its first six months proves that humanity is capable of effecting such changes, albeit only temporarily and at a high economic and social cost.

But what accounts for the difference in these two kinds of fear? How can we explain the fact that, as recent studies confirm, similar emotional experiences may lead to quite different behaviors, characterized by either active (potentially heroic) or passive (freezing and paralysis) behavioral coping strategies?

8. The role of oxytocin

Oxytocin is a peptide secreted by the hypothalamus, whence it passes to the posterior pituitary gland and is released into the bloodstream[23]. As its etymology implies (Greek ὀξύς, "quick" and τόκος, "childbirth"), it facilitates childbirth and is present in high levels in women during birth, lactation and suckling. Its presence in the lateral septal nucleus correlates not only with maternal behavior and sexual receptivity[24], but with all various other forms of approach or affiliative behavior, i.e. attitudes that bring human beings closer together socially (Austin, 2006, pp. 120 ff.; 2009, p. 244; Davis-Siegel *et al.*, 2015, p. 224). Oxytocin decreases the level of the stress hormone cortisol emitted by the adrenal gland, and tends to reduce anxiety. It may also promote neuroplasticity (Rajamani *et al.*, 2018), i.e. the brain's ability to change itself by rewiring its own synapses. Application of synthetic oxytocin, often by means of nasal spray, seems to have promising effects on persons suffering from autism[25].

[23] More specifically, the paraventricular, supraoptic and accessory nuclei of the hypothalamus; cf. Austin (2006, p. 120); Strathearn *et al.* (2009, p. 2644); Rajamani *et al.* (2018, p. 2).

[24] Oxytocin is released after orgasm in human females: cf. Siegel-Davis *et al.* (2015, p. 224), with further references.

[25] Interestingly, oxytocin appears to have differential effects in men and women. In women, it promotes positive amygdala responses to faces that seem supportive. In men, it increases negative amygdala activity in response to criticism (Froemke *et al.*, 2017).

In general, oxytocin is associated with personality traits of wishing to please and to give (Austin, 2006, pp. 120-1), and with the brain's inclination to «tend and befriend», as opposed to «fight or flight» (Austin, 2006, p. 121). In short, this hormone is at least partly responsible for the human expression of empathy and care for others (Froemke *et al.*, 2017)[26]. Studies have shown that women who hug their partners more often have higher levels of oxytocin and lower baseline levels of blood pressure and heart rate (Austin, 2009, p. 244).

Recently, Viviani *at al.* (2011) studied the way projections from the central amygdala to the hypothalamus and brainstem regulate how fear is expressed. Their experimentation on rats showed that fear was manifested in two quite different ways: either through freezing and paralysis (behavior which, as we saw, normal rats tend to display after they have been defeated in a fight), or through merely cardiovascular responses such as increased heartbeat and blood pressure, but *without* freezing. They found that oxytocin decreased freezing responses in fear-conditioned rats without affecting their cardiovascular response, by inhibiting neurons in the lateral part of the central amygdala (CeL)[27]. As a result, what decides whether an animal will respond to a fear-inspiring phenomenon by action or by freezing may be partly determined by which neuronal populations in the CeL are activated[28].

In these studies, then, oxytocin inhibited freezing response in rats, but not cardiovascular changes: in other words, under the influence of oxytocin, although such physiological symptoms of fear as accelerated heartbeat and increased blood pressure continued to be present, they were no longer accompanied by the freezing or paralysis response to fear. Thus, regulation by oxytocin might preserve the internal, visceral expression of fear, but alleviate behavioral inhibition that leads to freezing. According to the authors of this study, «such regulation may be optimal for cases when a proactive behavioral response is required while preserving an internal, visceral, adaptive response to fear» (Viviani *et al.*, 2011, p. 107). It was precisely such a «proactive behavioral response» that Jonas called for, forty years ago, in order to combat the human-caused dangers he saw as threatening the existence of the biosphere.

[26] Cf. Davis-Siegel *et al.* (2015, p. 224): «[...] it is clear that oxytocin plays a role in enhancing empathic and compassionate functions of the brain».

[27] It does so by exciting certain Gamma aminobutyric acid (GABA)-producing cells in the lateral part of the central amygdala (CeL). Anti-anxiety medications work primarily by enhancing the inhibitory action of GABA, which reduces the release of the excitatory neurotransmittor norepinephrine (Austin, 1998, pp. 567-8).

[28] The freezing response is modulated by the periaquedeuctal gray (PAG), while the active response is modulated by the dorsal vagal complex (DVC) (Viviani *et al.*, 2011, p. 105).

It looks, therefore, as though oxytocin, sometimes known as the "cuddle hormone", which has effects of promoting maternal, pro-social and empathetic behavior and attitudes, especially in women, may play an important role in determining how the amygdala makes us react to fearful situations: either by remaining frozen and paralyzed by fear, like a defeated rat cowering in the back of his cage, or, alternatively, although continuing to feel fear and the physical symptoms that accompany it, being able to react with courage and efficacy to find solutions to the threatening situation.

We seem, then, to be on the right track toward identifying the neurophysiological correlates of what Jonas and his recent Italian interpreters have identified as the optimal response to the current crisis brought about by the coronavirus and what I have suggested may be its putative cause: human depredation of the biosphere. What is needed, as we have seen, is not the kind of fear that paralyses us and renders us incapable of effective action, but a fear that mobilizes and motivates us, and which, when sufficiently intense, might even inspire us to undertake the acts of heroic self-abnegation and limitation required to change our lives in the sense of a more ecologically sustainable lifestyle. Unexpectedly, the key to the courage needed to metamorphize our fear, thus making it positively productive and efficacious in finding and acting upon solutions for the current crisis occasioned by the pandemic, might not be machismo and toughness, but the empathetic and caring attitudes paradigmatically embodied in young mothers.

Might these findings be reinforced by, and perhaps even help to explain, the way current politicians have reacted to and managed, or failed to manage, the pandemic (cf. Heyd, 2020, pp. 5 ff.)? In general, countries led by women[29] seem to have tended to react more quickly and effectively to the pandemic, thereby reducing the mortality rates in their population and the negative effects on their nations' economies[30]. In contrast, many

[29] I include under this heading Taiwan (President Tsai-Ing Wen, PhD Law), New Zealand (Prime Minister Jacinda Arden), Iceland (Prime Minister Katrín Jakobsdóttir), Finland (Prime Minister Sanna Mirella Marin), Germany (Chancellor Angela Merkel, PhD quantum chemistry), Denmark (Prime Minister Mette Frederiksen). In Canada, the chief medical health officer and seven provincial health officers are women: all have medical degrees (https://www.cbc.ca/news/health/women-chief-medical-officers-canada 1.5518974). Garikipati and Kambhampati (2020, p. 14) found that «COVID-outcomes are systematically and significantly better in countries led by women». The authors postulate (p. 16) neurobiogically-explicable «sex differences in feelings of empathy» as one contributing causal factor for the success of women leaders in handling the COVID crisis.

[30] Heyd (2020, p. 5) rightly identifies as important factors in effective responses to the pandemic «sufficient *trust* in government institutions to follow rules imposed and the needed *community coherence to support each other* while living with the hardships accompanying the

of those countries that have fared the worst in the coronavirus crisis have been led, not only by men, but by men, often of totalitarian inclinations, who, anxious to project a public image of toughness and machismo, have constantly downplayed the risks posed by the pandemic, often encouraging, if not inspiring, the tendency to denigrate citizens who behave responsibly and with concern for their neighbors by wearing masks and observing social distancing as somehow less than "manly". Might one of the many lessons the coronavirus has in store for us be the following: toxic masculinity and macho posturing are bad for the health – one's own health, but especially those of one's fellow-citizens – while the qualities of empathy, care and concern for others, often manifested more prevalently by women, are much more effective in dealing with such global health crises? One of the reasons for this may be precisely because women – owing in part, perhaps, to their evolutionarily determined neuropharmological makeup – are differentially prone to exemplify and to promote the alchemical transformation of the fear that naturally affects us all in such circumstances, from a paralyzing panic and despair to the kind of inspiring and motivating fear *for*, instead of fear *of*, that was called for so presciently by Jonas?

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restrictions set». Trust, community coherence (i.e., approach and/or affiliative behavior) and a tendency to provide mutual support are all factors promoted by oxytocin.

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