

The serotonin model of suicidal propensities¹

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In all civilisations of the world, there are people who kill themselves. It would seem that the social systems which generate the greatest number of suicides are the industrial societies developed in Europe (capitalist or communist). Only Sri Lanka and Surinam present suicide rates as high as those observed in Europe. Switzerland does not escape that trend, as it was, in 1987, classed 9th by the World Health Association in terms of world suicide rate. Furthermore, in our societies, the suicide rate tends to increase dramatically since 1965. During the 19th century (Durkheim 1930), the suicide rate increased with age. The new increase corresponds quasi exclusively to an increase of suicides among males from 15 to 24 years of age. Suicide attempts yield much higher numbers. In 1976, 427 persons out of 100 000 (a total of 431 174 cases) in the U.E. made a suicide attempt (Diekstra 1989.)

In 1971 the Geneva statistics mention 58 suicides in the year (Service cantonal de statistique de Genève 1971). Today, in the same town, the number is approximately a 100 a year. As a culture, we are clearly addressed by such figures. It is our responsibility to study the factors – clearly social or psychological via education – which support more and more often the citizen's death wishes. It is also well known that these official figures are probably inferior to reality, as an unknown number of accidents are probably masked suicides or suicide attempts.

In our culture, it is usually medical institutions that are asked to judge the state of persons who attempt suicide. Furthermore, it has often been observed that many suicides consulted for medical help a few months before their death (Yessler and al. 1961, Brown & Sheran 1972, Nielsen, B., Wang, A.G. & Bille-Brahe, U. 1990). In

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the more recent structures, it is observed that from 30 to 64 per cent of suicides had a recent contact with psychiatric institutions (Wolk-Wasserman, D. 1987). Niels, Wang & Bille-Brahe and (1990) report that in the Denmark of 1987, psychiatric institutions have seen 10 000 suicidal patients.

Given this state of affairs, many studies have attempted not only to understand the mechanisms that lead to suicide, but also methods of finding the suicide risk for an individual. All models and methods found until today, although helpful, are notoriously insufficient. Recently, having mentioned a general agreement 'that the estimation of (suicide) risk is important, complex, and difficult to quantify'. Motto (1991) summarises the present situation by stressing that 'the absence of generally accepted instruments to accompany the task attests to the elusiveness of a unitary solution to the problem.'

Understanding suicide

Suicide has been approached through many angles, ranging from sociological models to physiological ones. The literature can be summarised as oscillating between two extreme positions:

a) A literature which stresses the variety of causes, motives, and type of persons who commit suicide. Starting with Durkheim's (1930) classical study, this literature shows that suicide rates are influenced by social factors such as religion, geography, and marital status independently from psychopathology.

b) Although convincing, these data are of little help for the clinician. It has indeed been confirmed that a northern protestant bachelor living in town has more chances than a Mediterranean catholic married in a village to suicide. But the figures we are speaking of are too small for a sociologist, for it is obvious that many northern protestant bachelors living in town do not suicide. Running away from the sociologist's defence of diversity, some clinicians hoped that a form of suicidal predisposition could be detected in individuals. This has led to concepts of a 'suicidal syndrome' (Ringel 1976), or 'suicidal profile' (Nielsen, B., Wang, A.G. & Bille-Brahe, U. 1990, Motto, J.A 1991).

Current research seems to move between these two polarities. For example, Freud's proposition that depression may be a major factor in suicide not only supported intra-psychic explanations, but

influenced sociological research to focus on depressing social factors such as delinquency, broken home, unemployment, place of residence, unemployment, job loss, school and professional failure (Brown & Sheran 1972, Rourke, Young, Leenars 1989)... which is not what sociologists had in mind. This cognitive loop, induced by the preoccupation of medical institutions, has a certain wisdom, as it reflects problems indeed encountered by a probably important part of the suicidal population which consult for medical support: people who have impulsive suicidal impulses which they are not able to contain them, and may thus act without having really made the choice of dying. These people are the main preoccupation of clinicians, as it is in a certain sense only in those cases that medical support is really required and ethically essential. But one must not forget numerous cases which raise moral and/or ethical issues more than purely medical ones.

The prevalent medical position relating suicidal intentions to psychopathology does not consider people who primarily want to avoid being transformed in plumbing factories by hospitals, people attempting to avoid speaking under torture, or people killing themselves under the influence of social rituals such as hara-kiri in Japan. But even opposing 'moral' suicides to those related to psychopathology is arguable, as:

- a) some people do not speak under torture
- b) people with a clear psychopathology seldom suicide.

The serotonin hypothesis

An important issue raised by psychiatry, often mentioned by justice institutions and media, is that of predicting who will commit an overtly aggressive act against others or self under what appears to be a 'mad impulse'. People just released from a psychiatric institution who attack a whole village, or the children of a region, are particularly dramatic examples. Suicides are more current, although less overtly embarrassing, cases.

Today this problem is approached around a central theme: the relations between serotonin and impulsivity. Several studies have shown serotonin levels to be lower among people with impulsive (auto) aggressive acts than among current depressives, who themselves have a lower serotonin level than a 'normal' population. In the last five years, research has provided an important number of studies confirming this study (Iraskman-Bendz L., Asberg M., Nordstrom P., Stanley M. 1989, Montgomery S.-A. 1987, Moss H.B., Yao J.K. & Panzak G. L. 1990, Ricci L.-C., Wellman M.-M. 1990), and one study in which this finding was not replicated

(Roy A., Lamparski D., de Jong J.-A., Adinoff B. & al. 1990)² Although a serotonin explanation of impulsivity will probably soon prove too simplistic, it is for the moment the hypothesis which groups a maximum of data.

A first way of dealing with the serotonin findings is to consider them as a blunt correlation, which would require other correlations to be related to more general mechanisms. We prefer to spell why the serotonin model is appealing as a finding fitting in a whole other series of other experimental and clinical findings, which for the moment have not been connected with the serotonin findings empirically. And then to consider how those relations could be tested experimentally.

The ethological perspective

Social status in schools

"Difference of social status, from an ethological perspective, is often associated with dominance. (...) Generally dominance is defined in function of three dimensions: (i) access to resources and sexual partners, (ii) who wins fights and (iii) behaviours stating the others' submissive behaviour, who looks at who, presentation of genitals, etc.). In fact, a given primate cannot always be classified in the same way in relation to these three dimensions: a person can be very dominant in relation to sex (i), and much less dominant in relation to social status (iii), etc."(Feyereisen & De Lannoy 1985: 33-34, 210-211, my translation).

Ethologists have extended their approach of dominance to the study of human groups such as school classes. From this perspective, status display has been related to ways of asserting territorial rights, such as putting a foot or leg on a desk drawer, desktop or chair, touching or leaning against property, distributing personal articles to mark territory, crowding what is ostensibly someone else's space or property as in another's office' (Henley 1977:127). This approach of leadership has been applied by Montagner (1978) in a study of the behaviour of schoolboys, which suggested the following distinction:

« Les leaders expriment des actes de lien et d'apaisement beaucoup plus souvent que les dominants-agressifs. Les leaders provoquent ainsi chez les autres enfants l'approche et l'offrande, sans qu'il soit possible de conclure qu'ils ont exprimé de telles attitudes dans l'intention d'attirer et d'entraîner les autres. L'enfant de 2-3 ans est d'autant plus attirant, imité et suivi que la fréquence de ses séquences d'apaisement est plus élevée et celle de ses agressions plus faible » (p.161).

²On the other hand, relations between suicide and catecholamines or the dexamethasone suppression test does not seem to be confirmed.

The attitudes used to describe a status are defined as corresponding to established bodily patterns (listed in pages 34 — 37) such as caress, kiss, touching another's hand, putting one's hand on another's neck, to lean one's head laterally...(pp. 90-94, my translation).

Nadel-Brulfert, Baudonnière, & Fontaine (1983) show that Montagner's patterns are only observed when many children are confronted with a small number of toys. In situations where three children are put in a room with three samples of each toy, 'monkey dominance behaviours' are not observed. This experiment suggests that such dominant behaviours as those observed by ethologists among humans, can often be related to situational phenomena (socio-psychological) rather than more sociological ones.

The Nadel-Brulfert study thus suggests that 'apish' dominance behaviours tend to intrude in the dynamics of a group when its members have to fight to find what they need.

This literature constantly distinguishes a 'leader' and an 'impulsive' character. The impulsive character is often aggressive in an inefficient way, which associates him with what family therapists call a 'symptom child', and which psychoanalytical literature associates with a 'weak ego' structures (e.g. borderline and narcissistic). These character structures can be highly aggressive, but they do not necessarily manage their aggressivity in the same way:

- The leader character is described as someone who prefers to display appeasing gestures, and only displays aggressivity when both personal and situational needs require it. When these needs are frustrated, the leader character can find other efficient ways of destroying his enemies. (Laborit 1979: 116)
- The impulsive character, on the other hand, is described as using appeasing behaviour in a less efficient way, and as displaying highly aggressive gestures impulsively, even when it does not seem to be required for his personal or situational benefits. Furthermore, he is described as someone who is less strong than a leader, as he often loses fights against him. (Montagner 1978)

It can therefore be postulated that the leader has an efficient capacity to master and regulate his aggressivity, while the 'weak aggressive' has a poor capacity of regulating it. Leadership, in ethological literature, mostly considers a form of natural leadership character, which does not have to include such human phenomena as Napoleon or Hitler.

Serotonin and dominance

Buck (1988: 213) describes an experiment of McGuire, Raleigh, and Brammer demonstrating "an interesting similarity in the levels of serotonin in dominant male monkeys and dominant male humans. They found that the level of serotonin in the blood of

dominant male rhesus monkeys is twice as high as the level of other male members of the group. When the dominant male is removed from the group, his level of serotonin falls to normal, whereas the level of serotonin in the newly dominant male rises. According to the evidence, the rise in the leader's serotonin level is induced by the submissive behaviour he receives from the followers. A similar phenomenon was found in the blood serotonin levels of members of a fraternity at the University of California at Los Angeles: the fraternity officers had higher levels than other members. Whether shifts in leadership status affect the serotonin levels of male humans remains to be investigated. It is noteworthy that McGuire and his colleagues found dominance to be associated with *high* levels of serotonin, for impulsive violence seems to be associated with *low* levels of the same substance. The crucial difference here may be between confident dominance and "bad-tempered" hostility."

If one considers the initial functions of serotonin, this result is indeed an astonishing one. Serotonin was initially perceived as an inhibitor of behaviour, 'inhibitory and restorative of general bodily resources. Serotonin is related with the control of the parasympathetic nervous system.' Inhibition of serotonin causes insomnia, whereas increased amounts of serotonin appear to increase slow-wave sleep. A decrease in serotonin correlates with an increase of motivated behaviour; an increase of serotonin may be related to an increase of introversion. (Buck 1988, p. 137, 139, 145ss, 549ss)

Laborit (1990, p. 118ss) points out that the serotonin effect must be perceived as balancing other psycho-biological effects if one wants to understand it, and shows how complex a system present knowledge already points to. For example (p. 123), among monkeys, leaders tend to use the adrenal medullar system when involved in social interactions, while subordinate males who are less active tend to respond with the hypothalamus-pituitary-adrenal cortex axis... known to be involved in stress responses. Serotonin has the effect of diminishing action. As such it can counterbalance a propension to move, activated by other systems such as those influenced by catecholamines. Leaders from this perspective, are described as (a) having a high charge, and (b) as having the means (enough serotonin is available) to put strong breaks on that charge.

I have not found literature showing that leader and impulsive characters have a different aggressive potential. What mainly differentiates them seems to be a capacity to inhibit impulsive aggressive behaviour. This is stressed by the observations that changing certain biological variables allows different monkeys to become leader, as shown not only in this experiment, but already in the classical experiment of Plotnik, Mir, and Delgado (1971),

where monkeys could themselves stimulate electrodes planted in certain nervous centres.

Another aspect of the above-mentioned research is that serotonin level and the ability for leadership is regulated – among monkeys – by submissive behaviour. This presupposes a regulative system between 'leadership behaviour' and 'submissive behaviour'. In a certain way, one could say that a leader needs to eat the other's serotonin. This is accomplished by behaving in such a way that others offer submissive behaviour. Thus the serotonin model supposes that one of the variables influencing serotonin concentration in an organism is the interaction between behaviour on a very specific axis: dominance – submissive. Becoming the centre of gratifying displays in a population creates in me the bio-psychological possibility of becoming a leader of this population (thus one can become the leader of a family which has adored one, and not a leader in another population – such as a professional one – where we did not manage to receive gratifying displays. In more general terms dominance capacities in a population seems to be regulated by the distribution of gratifying displays; and an incapacity of eliciting such displays would create a negative loop on someone's capacity to dominate. (Buck 1988, p. 213)

The psychoanalytical perspective

Ego strength and impulsivity

In 1917 already, Freud (1953: 252) had noticed intense "murderous impulses against others" "turned back" on oneself as being characteristic of depression. But he also observed that aggressivity directed to oneself was not a sufficient cause "to explain what interplay of forces can carry such a purpose thought to execution". Sociology had already shown that there is a much bigger number of people who can be classed in suicide risk populations than the number of people who actually suicide. Freud confirms at a psychological level that there are many more people with high auto-aggressive and suicidal impulses than the number of people who carry out a suicidal intention³.

To explain which people among those with suicidal fantasies might finally carry them out, psychoanalytical 'characterology' also distinguishes between weak and strong ego. One of the functions

³ I have not found a study showing that at least most suicides occur in those populations with a high risk

of the ego is the regulation of our instinctual and emotional life from at least three points of view:

- a) A *delay* system: expressing an emotion or satisfying an instinctual urge must often be delayed until we find ourselves in a suitable situation. This delay system must at least allow for regulations within a day.
- b) A *cooling* system: the delay system can only function if our emotional psyche can be somewhat cooled for a moment so that for example we can concentrate on our work until lunchtime even if an attack of hunger intrudes in our mind at eleven o'clock.
- c) A *recycling* process: when an emotion cannot be adequately expressed within a matter of days, the organism has the possibility of expressing an urge through less appropriate channels. For example, sometimes it may be more appropriate to use express anger by overworking than by shouting at one's boss and losing one's job.

To types of psychopathologies can be derived from this model:

- a) people who only have some of these means available, and therefore over-use them (neurotic pole)
- b) people for whom all these means are insufficiently developed (psychotic pole)

When the ego is too weak for one or more of these functions people tend to rely on a more voluntary form of control: will power, generating what one often calls 'superego' pathologies. The term 'will power' itself shows the limits of such a mode of self-regulation: it is strongly dependent on the amount of 'inner power' available at each moment in us. Thus during moments of inner weakness, the 'wilful person' finds himself incapable of regulating his behaviour in a coherent way, and may act upon impulses. Acting on impulses may mean doing things parts of myself wish to do, but which other parts of myself might not want to do. Thus, reacting to a beautiful but depressing film I might kill myself, while more deeply I might wish to live. It is to be noticed that in this model one can find impulsive aggressive acts among most character structures (as all have at least one weak function), but that it becomes more likely as one comes nearer to the psychotic pole. This suicide distribution corresponds to what is generally observed.

Following such a line of thought, Rainer Krause, who helped us to put up our experiments since 1987, had suggested that a likely area to find behavioural traits related to suicide would be in the direction of impulsive acts.

Serotonin and psychopathology

Psychiatric studies have confirmed a relation between quantity of available serotonin, structures considered as having a weak ego by psychoanalysts, and impulsive (auto) aggressive acts. This trend of research tends to favour a relation between suicide and low serotonin rather than a relation between suicide and

depression. Edman, Asberg, Levander & Schalling (1986) clearly specify "the association (of serotonin levels) with suicide, however, is not confined to melancholia, as suicide attempters who do not satisfy research criteria for depression have lower CSF 5-HIAAA levels⁽⁴⁾ than control subjects. Furthermore, subjects with personality disorders and borderline conditions who have attempted suicide had lower CSF 5-HIAAA levels than those who had not." Moss, Yao, & Panzak (1990) stress that "alterations in serotonergic neurotransmission have been implicated in disorders characterised by impulsivity, aggression, low mood, and substance abuse". They found low serotonin concentration among antisocial personality disorders (A.S.P.) as well.

The relationship between CSF 5-HIAA and suicidal behaviour appears to be the most clear-cut for suicidal acts, in particular when violent methods have been used. Thus, when suicidal ideation was rated or a rating scale was used that combines ideation and acts, the association was weaker or nonexistent (Edman, Asberg, Levander & Schalling, 1986).

Brown and Goodwin (1986: 144-145) stress that low serotonin levels are associated, first of all, with violent acts, and then with suicide; with impulsiveness and inability to "delay gratification". It would therefore seem that an impulsive violent act requires (a) a tendency for violence, and (b) a low serotonin level. In other words, it would appear as if serotonin could be related to the cooling function of the psychoanalyst's ego, and that further research on this model could help psychiatrists to detect people who could end up committing a violent act.

Serotonin findings are probably part of a more general mechanism. For prevention and therapeutic purposes, it could be helpful to find other elements of this general mechanism. The literature provides us with clinical observations which a) could fit with the model we already constructed around the serotonin findings, b) are considered helpful in dealing with depressive patients, and c) add new elements to an eventual model of the suicidal population which could benefit from psychotherapeutic and psychiatric help: those for who may commit suicide on the basis of a whim, rather than as a voluntary and responsible decision.

Suicide and significant others

The more sociologically oriented studies (Brown & Sheran 1972) suggest that "suicide is probably best understood as a multidimensional malaise", through which biological, sociocultural, interpersonal, psychological, and personal/existential

⁴. 5-hydroxyndoleacetic (a substance close to serotonin) acid concentration in the cerebrospinal fluid.

aspects are coordinated (Rouke, Young, & Leenars 1989). It has been noticed that this coordination of levels involves at least:

a) Depressing situations such as unemployment, job loss, school and professional failure...

b) inability to cope or solve problems in general

c) marked interpersonal conflict and especially a feeling of rejection.

These observations already set a scene that is not gratifying for one's self-esteem in terms of dominance. Observations on the relations between suicidal patients and the 'significant others' they live with tends to increase the feeling of persons where feedback can be perceived as negative.

Fawcett, Leff & Bunney 1969 quote clinical observations showing that 'suicidal behaviour occurs in a symbiotic relationship of mutual dependence and masochism'. Wolk-Wasserman (1986) observed that family members manifested extremely strong hostility and expressed death wishes against the patient. He suggests that suicide occurs with people who have to deal with strong displays of aggression around them. Wolk-Wasserman (1987) also summarises observations by Richman who "stated that the suicidal family is characterised by its closed nature and broken links with social institutions, as with friends and acquaintances. Family members were therefore reduced to seeking help within the closed family circle. If this support failed, there was a risk of suicidal action".

A suicidal person would then be (a) over-dependent on a 'tribe' which provides an aggressive and dismal feedback, and (b) a person who is aggressive against herself and has a dismal view of what can be lived in this world. It is in such a population one observes the highest suicide rate.

Suicidal syndrome

Ringel (1976), influenced by psychoanalysis, attempts to describe a sort of 'suicidal character'. The core feature would be what Ringel calls dynamic constriction. Constriction is an impression of being constricted. Dynamic constriction also has the following properties:

"A compulsive urge into one direction, that is, in the direction of ultimate suicide. (...) In the outward appearance of the individual, dynamic constriction is frequently manifested by a loss of spontaneity, by inhibition and passive behavior. (...)The patient feels that the situation or the condition will never change and thus he falls prey to his own mood."

There is a general depreciation of self and others. Ringel also observes a strong superego pathology, full of aggression against the self. He also stresses that suicide is independent from specific pathologies.

Motto (1991) finishes this portrait by noticing the difficulty of such people with pain: "Suicide occurs when a person's limit of psychic pain tolerance is exceeded by the level of pain that is either

experienced or anticipated with a degree of subjective certainty. Thus the process of estimating the risk of suicide at a given moment is essentially determining how close the actual or anticipated pain is to the person's tolerance threshold at that time."

Discussion

Testing serotonin levels is today a tedious task, which is difficult to carry out on such people as suicidal patients who come for help and support after an attempt. Nevertheless, these studies have helped us to group a certain number of isolated observations, and propose the skeleton of a model we wish to test in the future.

What we have tried to convey is a model involving processes going from the biochemical to the social, and from the social to the biochemical. All of the literature seems to agree on this, yet little has been done on this matter in terms of close observation. The importance of going with research based on such premises is more and more often stressed in the literature on emotional life and emotional difficulties (Buck 1988, Haynal 1990).

We do not have the means to carry out a research strategy that would allow us to study the coordination of these levels simultaneously, although we do think that such a strategy would be required.

As a compromise solution, we have asked ourselves if there was an aspect of this model which has been particularly left aside. And we noticed that one such aspect is nonverbal communication.

The McGuire experiment, and the systemic approaches, both show the difficulty impulsive people have in establishing an efficient relation with others in terms of their self-esteem. These patients seem to have a behaviour that leads them to a dead end. Therapeutically this means that giving serotonin to such patients only, without the support of gratifying relationships would be inefficient; and vice versa.

Wolk-Wasserman (1987) has made an observation on the relation between five prepsychotic/psychotic suicidal patients and psychiatric services which go in the same direction:

"On the day preceding the suicide attempt, all five patients conveyed their suicidal intentions by indirect, non-verbal communication. This suicidal communication could be expressed by the patient – although in regular contact with the therapist – suddenly arriving at, or repeatedly ringing, the psychiatric department, driven by a need to see the therapist and make sure the contact would continue. This uncertainty regarding the continued contact, and the suicidal thoughts arising in this connection, were often caused by a misapprehension, or misinterpretation of the therapist's remarks about concluding the contact.

In all the cases when the patients arrived unannounced, they were received by the personnel on duty who, failing to understand the indirect,

nonverbal suicidal communication and seriousness of the situation, referred to ordinary consultation hours or regulations in force. ... The therapist, after receiving the messages from the personnel on duty, like the relatives, understood the indirect, non-verbal suicidal communication and the seriousness of the situation, were upon they immediately contacted the patients, and also arranged the hospital care."

From such reports, one can only assume that a detailed explicit knowledge of the non-verbal communicative strategies of patients with suicidal risk could be very helpful.

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