

Human Health and Disease as a Complex Adaptive System (CAS)



In the Meikirch model health consists of five components and ten complex interactions. Therefore, health may also be viewed as a complex adaptive systems (CAS). This offers a new dimension for the understanding of health, disease and healing that may be very useful for patient care. It shows e.g. why presumably effective treatments may fail and “ineffective” treatments may succeed.

What is a CAS?

A CAS is an independent and autonomous unit consisting of different cooperating parts, called agents. They are separated from the surroundings by a partially permeable interface and continuously interact among themselves and with the environment. In the case of man there are two types of interfaces corresponding to the two potentials. The biological one is the skin and the mucosal surfaces of the digestive and respiratory tract. The other concerns the difference between the person and its surroundings including all other creatures. The biological given potential offers resources to take up nutrition and energy from the surroundings and uses them to maintain its existence and to do work. Uptake of nutrition and energy occurs by transporters across the interface. Thereafter the material is transformed by the agents of the CAS. The work done by a CAS may be chemical reactions inside the CAS, locomotion of the CAS and uptake or export of substances. The latter may be products of cells or organs, such as saliva or tear drops, urine or bile. Another part of the human CAS deals with immaterial exchanges, i.e. with the perception through our sensory organs and the expression of thoughts and feelings. All of them are essential for survival in given environmental and social settings and for communication with other humans. All these interactions contribute to a continuous dynamic unfolding of the CAS. The totality of the final output of a CAS is called emergence.

A major feature of a human being is its autonomous evolution from conception to death. Humans mature through intrauterine life, childhood, productive life, mother- and fatherhood, and old age up to death. During each period, they must fulfill the corresponding demands of life that are physiological, psychosocial and environmental and vary markedly from phase to phase. Adaptive activities of a CAS occur whenever the internal processes are no longer sufficiently adjusted to respond properly to the environment. In such conditions, the CAS is thought to be in a state of crisis. To meet the ever-new challenges of an evolving life the CAS must give up old and develop new properties. This adaptive process is conceived as a rearrangement of the agents in such a way that the interaction of the CAS with its environment becomes successful again. Such rearrangements are conceptualized as a sum of several small steps within the CAS that proceed with the method of trial and error. Occasionally the specifics of such rearrangements can be observed in children or experienced personally. The success of adaptive processes, however, is not always guaranteed. For this reason, most people go through life with one or several suboptimal arrangements within their CAS. These may be experienced as disturbances occurring because of some specific challenges. In such instances efforts to overcome unsatisfactory experiences unfortunately are not often successful. Well known minor examples are fear of height or of elevators. Unsuccessful rearrangements of the agents of the CAS may, however, also result in

many different disturbances of varying severity including serious conditions such as mental disorders needing psychiatric care.

Health and disease

According to the Meikirch model an individual may be in one of two different states, either in health or disease. Health occurs whenever the two potentials together can satisfy the demands of life. This, however, is not guaranteed throughout life. Human vulnerability results from the fact that fulfillment of the demands of life may at times be threatened. Whenever the two potentials are unable to fully satisfy these demands, by definition, the person is diseased. This implies that the CAS of the individual is in a crisis. Within this context healing means that the CAS has rearranged itself in such a way that the demands of life can again be fulfilled completely, and the crisis is over.

During the life course of a person the surrounding conditions change many times and create abundant opportunities for successful or failed reorganizations of the CAS. Examples are stress at work, burn out, dismissal from work, divorce, death of a relative or friend, etc. On each occasion recovery implies several or many small new steps within the CAS that lead to physical and mental progress of the personality. A hedonistic attitude, anxiety and a bad outlook on life tend to inhibit evolution. In contrast, successful adjustments of a CAS to overcome crises are more likely in humans with a eudemonic attitude who follow a life with a fulfilling purpose.

Human diseases may be classified into three groups:

1. Diseases limited predominantly to the biologically given potential: They can be identified by methods of natural sciences, e.g. physical examination, clinical chemistry, bacteriology, imaging, and biopsy, etc.
2. Diseases predominantly involving the personally acquired potential: They cannot be managed successfully by ordinary medical care. When analyzed by systems theory, there may, however, still be the possibility for a CAS in a crisis to evolve in a productive manner. Most of the time such diseases are not life threatening and in modern medicine often are subjected to benign neglect. Such patients are often treated by physicians in general practice or by psychotherapists. Alternatively, they go to practitioners of complementary medicine or even to quacks. It is self-evident that patients with severe psychic disorders - such as psychotic states, addictions or depressions - need competent psychiatric care.
3. Diseases involving both the biologically given and the personally acquired potentials. For such cases careful evaluation by physicians and psychiatrist may be most appropriate.

What is healing?

Treatment for the first two types of diseases obviously differs. In the first group, the defect of the biologically given potential needs to be corrected as much as possible. Whenever the prior state or a condition close to it cannot be realized the patient will have to live with a defect. This corresponds well with today's practice of medicine. Within this context additional assistance for the CAS to support internal rearrangements generally is omitted. Fortunately, in many cases this is not needed. Treatment for the second type of diseases consists in recognizing a crisis of the CAS and in giving assistance to the patient to restart the evolution of her CAS. How best to accomplish this differs from patient to patient and many methods are available. The third type of diseases requires both, ordinary medical care and help for the evolution of the CAS.

Crises of the CAS have some general features that justify a discussion of possible treatments. In most cases manipulative procedures are counterproductive. The general approach to assist a CAS for its evolution requires that several conditions are to be realized. Initially the person must accept that it may be possible to stimulate a blocked evolutionary process of the past to restart to evolve again to a state that is better compatible with the present surroundings. Such a process may have healing properties. Therefore, the question arises, how a blocked evolution may be reactivated. Obviously in this field much is not sufficiently clarified by clinical investigation. Yet, from the point of view of the suffering person trust appears to be central. For therapeutic purposes three features of trust were found to be critical:

1. Trustworthiness of the personal relationship with a therapist as *viewed by the suffering person*: Trust specifically in the relevant person, friend or therapist.
2. Trust in the expertise *as viewed by the suffering person*: Trust specifically in the personal and professional qualities of the person, friend or therapist.
3. Credibility of or trust in the chosen procedure *as viewed by the suffering person*.

Evolution of a CAS is not a continuous process. It often occurs at specific moments in time, when a new internal rearrangement happens to take place within the system. Therefore, a personal therapeutic relationship often must last for some time until an evolution occurs. Occasionally much patience is needed. In general, evolutionary steps are supported by positive expectations and inhibited by anxiety and a bad outlook on life. The experience of trust in other humans may encourage patients to reduce their anxiety and to render their anticipation more positive. The direction of these evolutionary steps is open and there are many degrees of freedom. Opportunities for evolution must occur in a protected atmosphere and ideally with a clear purpose in life. Role models may be helpful. Support of an individual is a non-linear, confidence building, interactive process. Often it is initiated within a doctor patient relationship, but can occur wherever trusting human relationships are cultivated. The patient's self-confidence grows in an atmosphere of confidence. Choosing a specific and valuable goal or a purpose in life also helps a CAS to evolve further. Typical examples to prepare for this type of treatment are the so called Balint groups, where physicians deliberate among themselves about how best to help a specific patient. (Dr. Michael Balint, 1896-1970, was psychiatrist and taught psychotherapy to groups of practicing physicians.)

Another important contribution to healing has been offered by Antonovsky. He postulated a sense of coherence composed of three elements:

1. Understandability: The person needs to understand his problem and his situation in detail.
2. Manageability: The person needs to be able to manage whatever is needed.
3. Purpose: A purpose in life motivates for a high level of self-care.

When this sense of coherence is high, a person has many more opportunities to help herself. A good example is diabetes mellitus. The person must understand how blood sugar and insulin function. She must be able to handle her diet, to measure her blood sugar and to inject insulin. Finally, she should feel that good care of her diabetes makes sense. This general concept applies to all sorts of health problems and diseases.

So far practicing physicians have cultivated supportive human relationships with their patients. Also, practitioners of complementary medicine have received the necessary confidence by many patients. Representatives of scientific medicine, however, looked down upon complementary medicine, because they doubted its scientific validity. Unfortunately, this conflict between believers and doubters could not be solved by a scientific discourse. In Switzerland, however, it took an interesting turn. It resulted

in a popular initiative at the federal level. A positive popular vote led to the introduction of complementary medicine into the Swiss constitution. As a result, anthroposophical medicine, traditional Chinese medicine, homeopathy and phytotherapy practiced by physicians are now paid by the compulsory health insurances. This is an example of a long lasting scientific dispute that could not be solved by research and scientific evidence, but eventually by a popular vote. Apparently, the experience by the people was so convincing to them that they expressed it in a political process. Yet, considering that these complementary medical procedures may induce the CAS of a patient to evolve further, a scientifically valid theory may now be offered. At least the three conditions for reorganization of the CAS enumerated above seem to be fulfilled: Trust in the personal relationship between patient and therapist, trust in the treatment method and trust in the chosen procedures, everything interpreted from the point of view of the patient.

The field of healing obviously is not limited to the four methods accepted in Switzerland. When opening Google for “healing”, there are 350 million results and for “healer” 51 million. Consequently, the field of healing still is wide open and much of it is practiced beyond science. Although it will remain uncertain, which of these methods truly have positive effects on health, they may in some individuals inspire the three forms of trust and thereby autonomously stimulate a CAS for internal rearrangements and evolution. Nevertheless, many of these methods remain controversial and it may be wise not to trust them blindly but follow-up the effects in individual patients and investigate the results in people by appropriate health systems research. This is particularly warranted for methods that involve unsolicited activities to manipulate the patient.

Recently mindfulness meditation was found to reduce inner tension and to support positivity. The emotional freedom technique (EFT) functions with a similar purpose and has produced evidence of efficacy. There is a good chance that these techniques may help a CAS to evolve further. It is hoped that more procedures will receive attention by investigators to demonstrate that they assist CASs of patients to develop. For each patient, it would be very helpful to know which method is best.

Conclusions

To look at human health with the Meikirch model leads to a new understanding of health as a CAS that evolves throughout the whole life time. This offers a new thinking about mechanisms that support resilience, lead to diseases or contribute to recovery. Much more clinical research is needed to adequately understand how a CAS contributes to health and disease and how a CAS can be influenced therapeutically.