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CHAPTER 7

Ecologies of Corporeal Space

Katharina D. Martin

In the last two hundred years, medical tools and devices have been a determining factor in establishing the body as a site for the production of new images and new fields of meaning. One crucial aspect is the gaze of the doctor, which is observing, intruding and productive at the same time. This gaze, professionalised with the help of technical instruments, is part of the reciprocal relationship between corporeal space and diverse and changing systems of knowledge. The contingent historical development of symptomatology and medical treatment is correlated to changing technical conditions. This means: the study of symptomatic signs shows its changing modalities in correlation with the historical circumstances created by spaces and tools. As such, it is important to consider technical development and medical practices, as well as knowledge production, in terms of their coeval progression.

In the following chapter I will first present several epistemological aspects of (clinical) medicine and its practice. Next, I introduce an ecological notion of corporeal space, understood as a multi-layered 'milieu'. This is followed by an investigation of the various technical implications within the medical context from the angle of the interconnectivity between the different milieus or environments formed by matter and signs. The (human) body is active but stable; it is an ecological state, or, more specifically, a stasis based on continuous variation. My argument aims to demonstrate that the different medical techniques and instruments function as a membrane, thus as a permeable but selective barrier between various corporeal spaces and their different overlapping milieus. These different fields or milieus are constituted by the combination of signs, which do not yet form a system of knowledge, but rather an arrangement of significant but a-signifying signals.

Surface and Depth

Regarding the historical changes within medical science and in particular the development of the clinic, one has to acknowledge the significance of the epistemological analyses by Michel Foucault in his *The Birth of the Clinic*, first published in French in 1963. For Foucault this publication was not merely about the century of the clinic's 'birth', but also, as stated in its subtitle, about an '*archaeology of medical perception*'.[1] Key aspects of his analysis are space, language, death and the act of seeing.[2] His study presents the development and methods of medical observation in a period of crucial changes. It recalls the history of classical medicine and the rise of the clinic, and presents in detail the techniques of mapping symptoms and anatomical spaces. The chief goal of nosology as part of theoretical medicine in the eighteenth century was a comprehensive classification of all diseases. This motivated medical actors to let a disease unfold in the most free and natural way, after which they could describe the changes of the symptoms in detail and classify the disease. The natural space for being ill was the everyday environment of people's life: the home.[3] In the course of the eighteenth century, however, it became a common practice to take an ill person who lacked a supportive family out of his home and into a publicly financed hospital.[4] The clinic, serving as both a hospital and a place for education, evolved into the preferred and most neutral site for the observation and treatment of people suffering from a disease. This marked a shift towards an understanding of medicine as an objective science and practice.[5]

In classical medicine it was common to observe the patient thoroughly or, put more precisely, medical actors described and categorised medical symptoms. The 'tableau' of classical medicine basically involved a straightforward set of classifications and structured data on families, genera and species. The medical gaze was deployed to observe pathological abnormities, after which they would be arranged, structured and put into a specific 'order' with the help of language.[6]

A tableau, including extensive descriptions and structured information, became part of the interplay between the spoken and perceived. The similarity between a phenomenon and the symptoms classified resulted in a further step, in the essential moment of recognition of the disease in the tableau. Once the particular manifestations of some illness were linked to specific coordinates on the tableau, it took over the space of the body. The information on the outer body and its symptoms made its way into the flat language tableau, after which the disease

became apparent in corporeal space. These acts of classifying involved perceptions led to a productive mode of thinking in terms of particular codes. By connecting the medical gaze and language, a new medical system of knowledge was produced.[7]

In the middle of the eighteenth century, the dissections of dead bodies on a regular basis resulted in a growing amount of anatomical knowledge. Anatomical-pathology developed quickly as a body of knowledge and clinical diagnostics underwent great changes. If in classical medicine the dead body, regarded as the opposite of a healthy body, was believed to be of no further use to medicine, in anatomical-pathology the corpse served as a great source of knowledge for all further diagnostics. Earlier, in nosology, a disease was merely a bundle of characteristics on the surface of the body, but now the body could be horizontally and vertically penetrated to uncover the layered depth of its bulk.[8] The simple gaze of the doctor expanded into a comprehensive anatomical-clinical apparatus, based on the senses of sight, touch and hearing, which allowed one to map the living body.[9] As a result of this exploration of the inner space of the dead body, the living body turned into corporeal space as well. As Foucault states:

> For us, the human body defines, by natural right, the space of origin and of distribution of disease: a space whose lines, volumes, surfaces, and routes are laid down, in accordance with a now familiar geometry, by the anatomical atlas.[10]

A disease was no longer defined as a virtual ideal scheme and theoretical tableau placed on the body. Rather, a disease was now embedded in the flesh and locatable in corporeal space.

Surgical interventions on the living body were not so much motivated by a desire for knowledge, but by the need to act within the corporeal space and treat malfunctions. In the early eighteenth century, most surgical procedures were amputations, which had to be done very quickly to prevent the patient from dying from excessive pain or loss of blood. With the discovery of anaesthetics in about 1845 surgery in the modern sense became possible.[11] A patient under narcosis could be operated without pain, thus time was less of an issue and more complicated surgery became possible. The living body was silenced and the patient became merely a physical object. The living and fleshy organism, suspended in unconsciousness, could now be opened and entered without interferences. In surgery, the patient is cut open wide, wide enough to see, to access, and touch the organs. In combination, anaesthetics and scalpels make it possible for the hands of the surgeon to

enter the corporeal space and operate within it. Drawbacks of this invasive procedure include the damage resulting from the incision, the risk of infections and the time needed for recovery.

When surgery grew into a regular medical practice, anatomy became an irreplaceable part of medical education. To develop necessary skills and good judgement, a practicing physician needed not only to be taught established biological facts but needed also to undergo anatomical training. The recognition of an illness was not just based on cognitive concepts but on hands-on experiences generated by exploring the human body. The recognition of an illness was not just based on cognitive concepts but on hands-on experiences generated by exploring the human body.[12] The combination of cognitive knowledge and experience helps to give form to an illness, a process that Rachel Prentice calls object formation.[13]

When Prentice writes about her experiences as observer during surgery, she describes the process of recognising 'arthritis', which before was merely a linguistic object to her. When seeing the pinkish bone of an opened up knuckle, it was not clear to her what she had seen. Even when the surgeon pointed out that this discolouration was a sign of degraded cartilage, the pinkish bone just took its form as 'arthritis', after she had seen another patient's open knuckle, showing a healthy white bone. For Prentice in this moment the illness became a material object.[14]

Going into the depth of the body enables object formation, which in turn will expand the language-based cognitive concept of an illness. At this juncture lies one important reason for the anatomical training for future surgeons. In anatomical training a profound understanding of the body can be established. The corpse is mapped in three dimensions and the physicians operate with coordinates constituted by different planes and depths.[15]

During her research Prentice engages not only with anatomy within the laboratory. The means of anatomical education are diverse and in the US National Library of Medicine she discovered two fully digitalised cadavers, a woman and a man, created from an image database extracted from two persons.[16]

This Visible Human Project (VHP) is based on a highly complex technique, which makes use of computed tomography, magnetic resonance imaging (MRI) and a photographed cross-section of the frozen corpses.[17] As a result, a very detailed and fully digitalised anatomical map was created. After given public access to these three-dimensional and interactive body replicas, the two-dimensional representations

became outdated. Prentice stresses the fact that the cognitive model of education, characterised by rationalising logic, is moving into medicine to promote quantification, precision and 'efficiency'. Bodies are being translated into 'informatic "body objects," digital and mathematical constructs that can be redistributed, technologized, and capitalized'.[18]

Although she agrees that vision is a significant component of medical work, Prentice claims that its significance can be overstated. She underpins her assertion using the example of an anatomist who states that 'he gauges his progress in opening the spine more by sound than by sight'.[19]

In *Bodies in Formation* Prentice distillates the specific dimension that degraded within medical education: the hands-on-experience, the moment of facing a dead person, cutting into its body as an experience that includes multisensory richness. In the history of medicine, we can account for an important shift by Andreas Vesalius, who put practice before text. In contrast, recent developments show that 'tactile experience is on the verge of being replaced by the visual'.[20]

Although surgery has become a widely established and successful medical discipline today, it is not yet possible to operate and navigate within the living human body without damaging any tissue. Ongoing research concerned with medical techniques has been driven by the aspiration to find enhanced methods that would guarantee secure navigation within the anatomical area, avoiding all unnecessary penetration. One example is the endoscopic technique that already emerged in a primitive form in the nineteenth century.[21]

Using tools similar to binoculars or telescopes, which were based on the reflection on light from the outside, they entered the natural openings of the body. One way to reach the stomach, for instance, was by passing a straight, static tube through the oesophagus.[22] The technical progress of optics and light were decisive for the further stages of endoscopic tools. Indeed, the invention of the Edison lamp made it possible to bring artificial light into the body that in turn brought a whole new perspective for the medical gaze. The subsequent anatomical and biomedical knowledge production relying on this new invasive visibility is a direct consequence of historically situated, technical capabilities.

It is clear that regardless of whether we are dealing with the outside or the inside of the body, the question of visibility was, and still is, a crucial aspect in diagnostics and treatment within medical practice. The ground-breaking and fascinating discovery of the X-ray technique in 1895 made it possible for the first time to show details of the inside of a living body and also record images of it. For decades the photographs

were exploited in popular culture, and since one of the first bone images showed Bertha Röntgen's hand, the X-ray of the female hand became a fetish object.[23]

It has always been common to apply technical apparatuses in unconventional ways, linked to the world of magic and occultism. The X-ray technique, for instance, has also been used in attempts to capture ghostly apparitions.[24] In this sense it is also possible to interpret media in a wider context than the one proposed by the cybernetic diagram.[25] The model of communication that assumes an information source sending a message to a transmitter, which is subsequently conveyed in an unaltered fashion to the receiver and its destination, is perhaps all too familiar. But, a medium is an agent between different areas of meaning; it submits, produces and/or shows new combinations of signs, which are to be understood as new information. The discussions around concepts of social constructivism and scientific realism entwine around exactly this question of agency and mediation. It was Karan Barad who introduced the phrase 'agential realism', seeking to tie together these epistemological and ontological issues.[26] She bases her arguments on Niels Bohr's interpretation of the discontinuity of quantum mechanics[27] and states that 'measurement is a potent moment in the construction of scientific knowledge – it is an instant where matter and meaning meet in a very literal sense'.[28]

Regardless of the numerous metaphorical interpretations and beliefs that came along with the sudden fact that it was possible to see the most intimate 'inner self', the X-ray technique was soon mainly understood as an objective, diagnostic tool. When in the late 1920s the X-ray technique made its way from the artistic studios of photographers into clinics, technologically produced medical images began to serve as an important tool for diagnosing illnesses at an early stage. If the exploration of the dead body made it possible to establish a map of the living corporeal space, the X-ray produced an additional, new space, separated from the patient's body: patients could now be diagnosed without being present. Increasingly, the personal experience of the patient was rated as subjective and unreliable.[29] As it became possible to show indications of a medical disorder within the corporeal space of the X-ray image, one no longer needed the physical space of an actual patient to be present. When Prentice identifies object formation she clearly differentiates it from the act of objectifying the patient. Illness as an object has different social implications than an ill person as an objectified patient. Within the biomedical realm there are many voices[30] who argue that the physicians are not able to express

adequate motions, that they are distant and show an objectifying behaviour towards the patient. The professional relationship between practitioners and patients often seems characterised by a dehumanising reduction of the patient to a cluster of symptoms.[31] This in turn will create problems because it gives too little agency to the patient to understand and deal with their own pathology. However, so Prentice argues, there is the need for an objectification of the patient's body parts, which does not include objectifying the patient or weakening their authority over their own body. The advantages do also apply to the patients: to objectify the pathological body part as cause for illness makes surgery easier to bear by creating necessary distance to the painful procedures.[32]

With the advent of the abovementioned medical technologies 'the doctor's subjective sensorial impressions' has increasingly been replaced by '*supposedly* objective visual evidence'.[33] As van Dijk states: 'X-ray pictures, like other mechanical reproductions, always yield mediated perspectives, as their meanings are always shaped by the knowledge and feelings of their interpreters'.[34] With the help of a machine and based on the patient's body a new corporeal space had been produced. These new kinds of images correlate directly with the production of knowledge since they 'mold as well as reflect visual reality'.[35] The medical system of knowledge is pervaded by power, and to this day it is difficult to gain access to this system. Whoever has had the experience of having his body X-rayed will remember the 'moment of truth', when the doctor puts up the X-ray photo, looks at it and formulates a diagnosis. Even if the physician explains the image, or even if there is a clear fracture of a bone that is easy to spot, it is still obscure to see this encrypted image of one's own internal organic structures. One has to agree that these pictures are less transparent than they may seem to be. They need to be carefully interpreted by trained specialists before becoming a reliable source for medical diagnostics. Similar to the tableau with its tables, X-ray is 'a representative technology creating an *illusion* of unmediated, objective reality'.[36] At this point in medical history, the question of mediation began to present itself much more clearly. As indicated, to *mediate* means not merely to transmit, but to convert through diverse channels, and between different milieus. The media are always reshaping signs and reformulate information, even if one does not recognise the impact of the media's productive force. In this respect it is hardly surprising that the doctor who looks and listens has to give way to the specialist qualified to handle the technology and read their images. Despite the fact that a technical image of the body

such as an X-ray is strongly mediated, it is commonly seen to be superior to any subjective form of perception.

Parallel to the rise of this kind of technologically mediated diagnostics, the endoscopic procedure swiftly developed as well. By having more sophisticated optical equipment, a safe and reliable internal light source and a flexible cable that could be passed between organs, the technique would prove to be more than just an extension of the eye of the doctor: it became also an extension of the hand of the surgeon. To have to make an incision to be able to enter the body with an instrument was a highly intrusive step. Anaesthesia was needed as well, which is why the procedure did not become common before the twentieth century. At that same time the former seeing device became a real instrument that functioned as an extension of the hand of the surgeon. Nowadays the technique is in many ways applied as a routine procedure. The entrance hole for the surgical device is small, and the instrument is even able to show video images. As of the 1980s the recorded images of the internal body proliferated not only within the medical world; they also made their way into study curriculums of architecture and design schools, into art exhibitions, private homes and on the Internet.[37] During the actual surgical procedure the camera feed is shown on a monitor. To work with these displaced images requires great skill and a lot of concentration on the part of the surgeon, since this additional source of visual information has to be observed and interpreted to then being transferred and practically applied onto the patient's body.[38]

The general map of the physical space of the human body is no secret anymore, and with the evolved technical media, highly detailed information can be gathered. Each measuring machine produces its own characteristic image and particular encryption. This in turn has prompted a need for specialists with diverse technical and visual skills. Digitally augmented reality is a recently developed technique of interactive training exercises and image-guided surgery. Due to a high image quality and interactivity, training software can be of great benefit to students. Besides that, it can be an advantage to be led by a 'virtual' body during surgery. Throughout endoscopic operations, the gaze of the surgeon is directed away from the body because the camera feed is shown on a monitor. This cognitive performance demands great discipline and extensive training. The projections of the augmented reality on the other hand make it possible to merge this additional information and help to reduce the workload or even shorten the time of narcosis. Already before the surgical procedure, data about the patient's physical condition has been processed and can be used. Computer tomography

images or X-ray images are visually prepared and then projected directly on to the relevant body part. Tracking devices attached to the skin are connected to a wireless mouse, and they allow one to switch between different visualisations of the internal corporeal space.[39] This visualisation technique was only recently improved by a method to produce an overlaying image with transparency and spatial presentation. The *Edge Overlay* visualisation aims to provide depth cues when viewing sealed objects.[40] When showing occluded objects, it was very effective to preserve the context of occluding structures by rendering just the edges. A perception of depth is achieved through including a 'window' without determined frames: in a certain area around the central image, the 'tissue' becomes more transparent and therefore produces a spatial appearance. Thus, very little of the occluded object is obscured by the thin edges, but there are enough visual cues to give a compelling sense of depth. In other words: the clinical information is processed and prepared in order to be turned into a new projected image, making it possible to perceive a three-dimensional space. This field of the optical dimension is a field of mixed realties, and functions as membrane between the internal corporeal space and its cognitive and digital correlation. Based on the physical body of the patient, a seemingly decrypted internal image appeals to the gaze 'immediately' and instantly.

Homeostasis and Allostasis

To analyse the specificity of the entanglement between medical practice, its media and corporeal space, I will introduce the notion of 'milieu' as methodological instrument. Claude Bernard, the founder of modern physiology, scorned classic nosology and wanted to establish an 'experimental medicine'. His research of animal physiology was based on vivisection, surgery on living organisms conducted for experimental purposes. Bernard's work has been recognised primarily for his concept of the constancy of the 'internal environment'. This *milieu intérieur* is geared to stabilising and maintaining the uniformity of the organism's conditions, so that it can pursue a free and autonomous life.[41] For instance, the *milieu intérieur* ensures a steady body temperature, and helps the body to adjust to the oscillating climate changes of the external environment, the *milieu cosmique*.[42] This process, also called homeostasis, describes the sufficient regulation of the physiological adaptations necessary for internal stasis. The control of temperature, pH, glucose, protein, oxygen, sodium and calcium are important examples of these regulatory responses to the systemic

physiological requirements. As argued in recent research in the field of neuroscience, however, Bernard misjudged the environmental context and overrated the separation of the internal milieu from the external world.[43] Suggesting that the concept of homeostasis was defined too narrowly, it proved impossible to explain all the observed adaptations by the organism. Today's research emphasises that a viable stasis cannot be accounted for by physiological adjustments only, as behavioural ones are equally relevant. The concept of 'rheostasis', for instance, includes a wider range of biological systems, taking into account variations tied to context, season and surroundings. Considering reactive and predictive homeostasis, it does include physiological and behavioural regulations, giving rise to a notion of 'physiology of change'.[44] An alternative neuro-scientific concept, 'allostasis', was introduced to acknowledge the change of state as a prerequisite for viability. Allostasis comprises both the behavioural and physiological processes that maintain internal parameters for the essential requirements for life. The concept acknowledges the impact of an external (social) space, and it is considered a plausible hypothesis for connecting events that may seem to be unrelated at first glance.[45]

If we want to follow up on the notion of a connected internal and external milieu, we should turn to Jacob von Uexküll and his concept of *Umwelt* (environment). In his theoretical biology (*Theoretische Biologie*)[46] and theory of meaning (*Bedeutungslehre*),[47] Uexküll emphasises the importance of a subject-oriented epistemology, which he based on his biological research.[48] A significant aspect is the reciprocal relationship between an autonomous organism and its geographical environment, on which each unique milieu is based. He interrogates the specific living arrangements in and around an oak tree, and establishes his idea of many different environments that cross-cut one another. A subject has its own milieu (*Umwelt*) and is simultaneously an object in several foreign milieus.[49] Especially well known is Uexküll's example of the tick, which was enthusiastically taken up and propagated by Gilles Deleuze and Félix Guattari.[50] The tick reacts on the perceptive signs produced by the hunted animal. The prey's smell, its skin temperature, as well as the resistance of its hair, are the few relevant signs that compose the tick's *Umwelt*. A unique composition of perceptive (noticed) and effective (produced) signs constitute a particular *Umwelt*, and the reciprocal connection between different organisms form a functional cycle and overlapping milieus.[51] Based on many different examples, Uexküll demonstrates that the functional cycle is as meaningful relation, organised by perceptive and effective signs.[52] The main point is that the organism

does not respond merely to causal impulses, but to perceptual signs or meaningful signals.[53] Each subject's *Umwelt* includes carriers of meaning,[54] and together they maintain a reciprocal relationship and a shared field of meaning. Surrounded by these vital counterpoints the subjects 'internal front' does entail imprinted images of them.[55] Uexküll elaborates this aspect when he describes the spider's web. The fly, never seen before by the spider, is present as a primal image. This *Urbild* is the form on which the spider is able to build the perfect web for the hunt.[56] The web is a well-made mould of the fly, so to speak, and it would not exist in this way without the fly's concrete characteristics. Every subject is considered a carrier of meaning, who produces 'formative melodies'[57] and corresponding properties.[58] A subject is formed into a 'recipient of meaning'[59] and foreign motifs are taken on. These different formative melodies mutually influence one another. Deleuze and Guattari admire Uexküll's theory of transcoding based on music: nature as music, which includes possible passage and bridging based on rhythm and melodies, and that always produces a surplus value. This rhythmic plane does not exist in its pure form; in reality it always shows itself mixed.[60] For Deleuze and Guattari a subject's *milieu* has to be established by organising a limited space and keeping the 'forces of chaos' outside. Within the chaos the milieu is a stabilising centre; it is a home and a field of certainties.[61] In this context it may be helpful to note that milieu or environment should not be confused with a fixed geographical space that can be easily determined. Although the 'milieu' is part of the space, it is defined by an assembled, multi-layered realm of matter, signs and meaning. The cycles of meaning (constituted by perceptive and effective signs) each have a certain mode or style and their own particular semiosis.[62] But there are additional elements that help to grasp the moment of ecological change with respect to processes of exchange. In the analyses of Francis Bacon's paintings, Gilles Deleuze identifies three core elements: structure, figure and contour.

> This contour, as a 'place,' is in fact the place of an exchange in two directions: between the material structure and the Figure, and between Figure and the field. The contour is like a membrane through which this double exchange flows.[63]

Deleuze does not talk about a fixed system with respect to form, with boundaries that stabilise a self-preserving and organised system against a hostile and fluctuating environment. His concept contradicts system theories, which rely on the differences between a complex environment and an operated superior order.[64] The contour is a permeable boundary enabling processes of exchange between the different layers. The

three aspects identified by Deleuze – form, structure and contour – are ecological components of a milieu. As Deleuze and Guattari write: 'the living thing has an exterior milieu of materials, an interior milieu of composing elements and composed substances, an intermediary milieu of membranes and limits, and an annexed milieu of energy sources and actions-perceptions'.[65] To conceive not only the human body as a milieu, a corporeal space that is changing its reciprocal relations, but also give heed to its counterparts as formative motifs and carrier of meaning, implies a shift in the angle of this investigation. We can now look at the inflections concerning corporeal space, medical practice and the involved media.

Symptomatology

I will attempt to apply the ecological concept of milieu and revaluate the examples of medical techniques discussed above. In medical practice we deal with differently coded fields and one can recognise that the ecologies of corporeal space concern the gaze and the language of the doctor, the intruding scalpel and hands of the surgeon, as well as the mediated images of the body. In each case one finds a certain kind of porosity between diverse fields of meaning. Next to the act of cutting the skin and touching the organs, there are many other intersections between surface, internal space and environment. Tableaus, X-ray photographs, brain scan images or even the printed curve of an electrocardiography are highly induced new arrangements of signs correlating between the physical body and the particular abilities of the measuring instrument. In each case one finds the corporeal space expanded into different milieus.

First, there was the directed gaze of the doctor, near to the body, mapping the outside space and its symptomatic signs, followed by the crucial step of converting the body's code, customising its signs and translating it. By translating symptoms into language these are introduced into a different field of meaning, thus into a new milieu. During this process, certain recognisable collections of symptoms are identified and named. In so doing, diseases are configured, and a new knowledge system, including a particular concept of illness, is produced. It is indeed fascinating that until today one finds a reciprocal dimension within this kind of diagnostic processes. Identification of a set of symptoms of a patient gives rise to a diagnosis. From there on the patient has a disease, which becomes evident in his corporeal space. The body, besides having its fleshy milieu with its own symptomatic signs, is now

also part of a differently coded field of signs: the system of illnesses. Just as the fly is the counterpart for moulding the spider's web, the patient's body is 'framed' by the system of medical knowledge. In most cases the subjective symptoms of the patient and the correlated technically induced images are counterparts. The X-ray photo, for instance, offers a two-dimensional image of the three-dimensional body. The photos are made with the help of non-visible radiation. The radiation actually has to cross the body to shape the image. In that sense, the body functions as a counterpart par excellence. But it is the machine and its particular technical functioning that is responsible for the characteristic shape of the image. There is a reciprocal relationship at work between the patient's body and the X-ray machine and the X-ray image shows its own productivity due to the conditions of the technical device. As a result, one has a correlating technically induced body image, which is indeed geographically separated from the physical space of the patient's body, but nevertheless showing clear indications for shared milieus.

The actual cutting of the skin to open the body may be the most obvious act of crossing between milieus. We know that a certain stasis is necessary to keep the organism alive. This securing state, however, seems to be based on constant changes and adjustments. A living organism has to deal with diverse environmental situations, caused by changing seasons with many weather and climate variations. Furthermore, there is a strong influence by changing social and physical interactions with other organisms. Each situation is balanced by a combination of different means dependent on each unique subject's abilities. During and after an open surgery, the body reacts strongly but very often it is also able to cope with the situation and restore a 'healthy' stasis. Still, it is an understandable desire to want to enter the internal milieu of the organism without opening the skin (contour or membrane). In fictions one can find fantastic stories of travelling through the body. The internal milieu is turned into 'space', which can be entered for an adventurous trip. These kinds of narratives are usually about a crew and a ship shrunken to a microscopic size, which enters the body through a natural opening. The travellers will follow the blood circulation system through the organs and may later use a tear to exit the body again.[66] The internal organic space is presented as the unexplored and infinite outer space. This genre of fictions reflects on the scientific challenge of visiting the internal space of the body unnoticed. The endoscopic technique in fact comes quite close to this ideal. If an incision is needed, it tends to be very small, while the instrument is sterile and flexible. To place the view of the doctor inside the body appears almost like an

unnoticed visit. The secret and technical gaze inside is nevertheless a productive one, reflected in the parallel video feed on a monitor. The surgeon's gaze is not directed towards the patient's body; he or she is guiding the endoscopic instrument with the help of the image displayed on the monitor. In that sense the surgeon operates within the corporeal space of the video feed. Based on the camera's mediation, the patient's body manifests itself in an additional geographical place, and becomes part of a different system of signs.

Today's endoscopic surgery replaces images not only geographically; it also translates them into digital form. Thus, the patient's corporeal space does not only exist in its fleshy form, but also as technical physicality in a video feed or a digital illustration. In the case of these new graphical images, all visual information is based on the digital system as a particular way of computation. The digital form is without further expression or flexible relationships and always formatted. It should be stressed that it is possible to directly address a particular pixel without having to traverse the precursor. The pixels, due to their continuous addressability, are more text than image and the computer graphics are therefore quite easy to manipulate.[67] In fact, it is not just possible to manipulate images, but also to produce entirely new images. Of course, these new images are an integral part of reality, and shall not be dismissed as somehow 'virtual' and therefore a less relevant part of the world. But there are particular complications between the digital and analogue domains that reveal themselves in the area of the optical and the sensory realm.[68] In the Visual Human Project the corpses have been literally scanned slice by slice, to be turned into a high-quality simulation. The virtual anatomy instruction is mainly visual, and van Dijk coins the term 'eyes-on-experience' since no further senses are involved. However, she emphasises that the digital cadavers and their virtual dissection offer a 'new body of knowledge'.[69] Within the VHP a seamless cross-over between three-dimensional images of organs, tissue and bones is possible. The perspective can be changed by mouse movements, and images can be rotated and manipulated. The interactive and virtual bodies are not merely represented but rather simulated and the VHP claims to constitute 'unmediated inscriptions'[70] of cadavers. The medical education with help of the VHP may not equate with a hand-on-experience, but it does appear perfectly suited for contemporary medical practice, in which physicians depend every day on representational technologies.[71] Furthermore, van Dijk concludes that the digital cadavers 'constitute a distinct continuation of age-old anatomical practices'.[72] One should give attention to the image as part of a mixed reality. Since the optical field

as part of the sensory realm is a place where transcoding proceeds, one should acknowledge the image as an element of mixed realities. Body simulations and augmented reality behave like a membrane between digital code and human perception. Even if the computer graphics are entirely based on digital code, by generating an image that can be seen and spatially perceived, the digital information provides analogue stimuli. The digital realm based on code produces actual corporeal spaces while at the same time maintaining their milieu constituted by digital structures.

The world of medical practice, with its intruding instruments and diagnostic visualisation machines, is marked by an array of intersections between different milieus. There are many examples of the organic body pervading its corporeal space into the technical milieu. One should be wary to claim completeness when investigating these ongoing ecological processes. To grasp the multiplicity and the infinite character we do not need to pursue exhaustive historical research, but merely point to observable intersections. I would like to refer once more to Uexküll, who acknowledges that the incredibly large number of different milieus must lead to confusion, and that focusing on one set of arrangements is the methodologically correct response.[73] This chapter is a speculative but nevertheless practical and realistic approach towards an ecological understanding of the body. The ecology of corporeal space does not end with its own organic area and symptomatic signs. Next to the signs of the flesh, there is an array of symptoms that is based on medical instruments and media, systems of language and the rhythm of the digital code. The body as an ecological form is able to expand its range from a collection of subjective signs into the encrypted field of medical knowledge and digital formations.

Notes

This chapter is a revised and extended version of the paper 'Ecologies of Corporeal Space', in Radman and Kousoulas, eds, *3C: International Conference Proceedings*, pp. 39–50.

1. Foucault, *Birth of the Clinic.*
2. Ibid. p. ix.
3. Ibid. pp. 39, 40.
4. Ibid. p. 40.
5. Ibid. pp. 109ff.
6. Ibid. pp. 60ff.
7. Ibid. p. xviii

8. Ibid. pp. 135ff.
9. Ibid. p. 164.
10. Ibid. p. 3.
11. Brandt, *Illustrierte Geschichte der Anästhesie*.
12. Prentice, *Bodies in Formation*, p. 5.
13. Ibid. pp. 16ff.
14. Ibid. pp. 16f.
15. Ibid. p. 22.
16. Ibid. p. 21.
17. Van Dijck, *Transparent Body*, p. 119.
18. Prentice, *Bodies in Formation*, p. 20.
19. Ibid. p. 14.
20. Van Dijck, *Transparent Body*, p. 123.
21. Ibid. p. 66.
22. Ibid. p. 66f.
23. Ibid. pp. 84, 89.
24. Ibid. p. 94; Thacker, 'Vermittlung Und Antivermittlung'.
25. Ibid. p. 306. See the communication model by Claude Shannon and Warren Weavers.
26. Barad, 'Meeting the Universe Halfway', p. 167.
27. Ibid.
28. Ibid. p. 166.
29. Van Dijck, *Transparent Body*, pp. 84, 87, 89.
30. Prentice, *Bodies in Formation*, pp. 17ff.
31. Ibid. p. 17.
32. Ibid.
33. Van Dijck, *Transparent Body*, p. 86 (my italics).
34. Ibid. p. 99.
35. Ibid. p. 98.
36. Ibid. p. 98 (my italics).
37. Ibid. p. 71.
38. Tönnis, *Augmented Reality*, pp. 132–40.
39. Ibid.
40. Ibid. p. 133.
41. Bernard, *Leçons sur les phénomènes de la vie*, pp. 112ff.
42. Ibid. p. 117.
43. Schulkin, *Rethinking Homeostasis*, p. 2, n. 1.
44. Ibid. p. 16.
45. Ibid. p. 21.
46. Uexküll, *Theoretische Biologie*.
47. Uexküll, *Foray into the Worlds of Animals and Humans*, pp. 136ff.
48. Rüting, 'History and Significance of Jakob von Uexküll', p. 49; see also Buchanan, *Onto-Ethologies*.
49. Uexküll, *Foray into the Worlds of Animals and Humans*, pp. 128ff.

50. Ibid. pp. 44ff.; Deleuze and Guattari, *Thousand Plateaus*, p. 51.
51. Uexküll, *Foray into the Worlds of Animals and Humans*, p. 145.
52. Ibid. p. 150.
53. Ibid. p. 164; Bains, *Primacy of Semiosis*.
54. Uexküll, *Foray into the Worlds of Animals and Humans*, pp. 139ff.
55. Ibid. pp. 159, 164, 189, 202.
56. Ibid. pp. 158ff.
57. Ibid. p. 198.
58. Ibid. p. 202.
59. Ibid. p. 198.
60. Deleuze and Guattari, *Thousand Plateaus*, p. 314.
61. Ibid. p. 311.
62. Paul Bains speaks in the case of a whole functional cycle of 'a semiosis'. Bains, *Primacy of Semiosis*, p. 63.
63. Deleuze, *Francis Bacon*, p. 12.
64. Balke, 'Auf dem Rundgang Bilder des Lebens'.
65. Deleuze and Guattari, *Thousand Plateaus*, p. 313.
66. Van Dijck, *Transparent Body*, pp. 65f.
67. Kittler, 'Computergraphik'.
68. Colebrook, *Blake, Deleuzian Aesthetics, and the Digital*, pp. vii–xxxvi.
69. Van Dijck, *Transparent Body*, pp. 119, 125.
70. Ibid. p. 125.
71. Ibid. p. 124.
72. Ibid. p. 120.
73. Uexküll, *A Foray into the Worlds of Animals and Humans*, p. 133.

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