A Surgery Issue: Cutting through the Architectural Fabric

Athina Angelopoulou

Introduction

When you throw yourself into the haptic space of encounters, and try to find out what happens when a discipline of spaces meets a discipline of bodies, then a critical moment comes, when you ask yourself: would a trans-architectural theory need to be approached through a theory of the body, or through a theory of space? And if it need not be either, as one *or* the other, then what is the specific quality through which these two disciplines will encounter one another?

Different approaches have been developed around this question. Some lines of thought concentrate their interest on the relation between space and trans-bodies. They investigate more precisely, how, on the one hand, space is re-experienced through trans-bodies and how, on the other hand, trans-bodies are acting agents in the formation of space.[1] However important, these approaches remain within an analytical mindset. According to some other lines of thought, an encounter of queer/trans theory and architecture is to be sought in the concepts of performance and performativity. Yet in architectural discourse these terms mean something different than they do in gender studies. Architects understand performance mostly in terms of efficiency, or effectiveness[2] – even though it does not have a general definition.[3] Performativity, in the architect's view, is by contrast understood as 'the material, organizational and cultural change that occurs as a result of the perpetual feedback and two-way transfer of information' between the building and its context.[4] This specific design approach, which is called performative or performance-based design, is geared towards construction. Its main idea aims at 'evolving a building through performativity and simultaneously testing its effects' in different contextual settings.[5]

As queer theorists like Eve K. Sedgwick or Karen Barad have extensively argued, not every performativity is necessarily a queer one. Performative design does pull architecture away from its long-standing essentialism, bringing it closer to a performativity understood as iterative citationality[6] (i.e. because 'models developed by one research paradigm' have the ability to 'generate, describe and evaluate performances, [but] also cite and recite them').[7] But that does not necessarily bring it closer to queer performativity, which, as Sedgwick has argued, is established rather upon refusals and denials.[8] Hence, more than working through 'iterative citationality', for Barad queer performativity works through 'iterative intra-activity'.[9]

Where are we to find the queer therein? This essay will investigate the possibility of finding it within the architectural through the little-addressed aspect of 'trans-modification'. The recently more known notion of 'transitioning' describes 'a person's process of developing and assuming a gender expression to match their gender identity'.[10] Yet, as a process it varies widely conforming to the needs of

the particular individual. Nevertheless, according to the *Standards of Care for the Health of Transsexual, Transgender, and Gender Nonconforming People,* this process may (or may not) involve behavioural alterations (i.e. changes in gender expression and role, and psychotherapy), external alterations (i.e. surgery), and internal alterations (i.e. hormone therapy).[11] Among these alterations, within an architectural context it is important that we consider transitioning as a 'material' transformation process, to emphasise how *bodily and spatial dimensions here encounter another in their shared quality*. What is more, even though surgeries and hormone therapies may be part of the transitioning of some trans-gender bodies, they are also variously applied to any body. This claim does not express any tendency to reduce the particularity of a transitioning process. But it highlights that, as suggested by gender theorist Eva Hayward, 'we might begin to recognize transsexuality as [being] about more than gender/sex;' rather, it may be 'conceivably about the profusive potential of bodily change'.[12]

In this essay I attempt to contribute to reclaiming a much more material ontology as relevant for the production and transformation of bodies in general, and for architectural bodies in particular. Within this context, I want to focus on a surgical issue, since the processual and performative aspect of surgical procedures make them an interesting case study for a trans-architectural discourse. I will begin with a review of the medical visualisation techniques used by surgeons to help them perform acts of cutting. I will then investigate what the surgical act of cutting through the skin could suggest for the queering of architecture.

Queering Topology: Langer's body plan

In 1861, the anatomist Karl Langer published a body plan. Its lines illustrate the lines of natural skin tension; that is, the basic direction of the collagen fibres of the dermis (the human skin's structural layer). Langer's body plan was a literal plan that could be altered formally or metrically, while staying connective during its transformations. Langer's visualisation was therefore a topological one,[13] since it was based upon relations of continuity, not metric relations.[14] What is particularly interesting about this representation is that instead of being an immaterialised topological description, it was based upon a material fact; namely, the distribution of collagen fibres.

A few decades later, in 1897, the surgeon Emil Kocher proposed that surgeons use Langer's lines as a guide when performing surgical incisions. He argued that incisions orientated parallel to those lines result in thinner scars, while healing becomes the more extensive, the more the direction of the incision diverges from these lines. His proposal was generally accepted and Langer's topological body plan was put into use during surgical procedures. Since Langer's research had been based on cavaders, the lines representing the skin's natural tension lines were in fact not an accurate representation of living individuals. They did not account for dynamic forces.[15] Many attempts were made to re-examine Langer's lines. One critical attempt was made by Albert F. Borges, a surgeon who, in 1984, described a 'simple method to determine the Relaxed Skin Tension Lines (RSTL) by pinching skin and observing the formed furrows and ridges'.[16] Borges's plan of RSTLs – based on living individuals – is still in general use. Yet in most medical textbooks, RSTLs are still referred to as Langer's lines, as a way of acknowledging Langer's work.[17] In the rest of this essay, when we refer to RSTLs, we will be using the term 'Langer's lines' as well. [Fig. 1]

It is worth noting that Kocher's suggestion changed the ontology of Langer's topology in a radical way. Given that Langer was an anatomist and never expected that his lines were to be used for the performance of surgical incisions, Kocher makes, in my opinion, a critical step: by seeing in Langer's

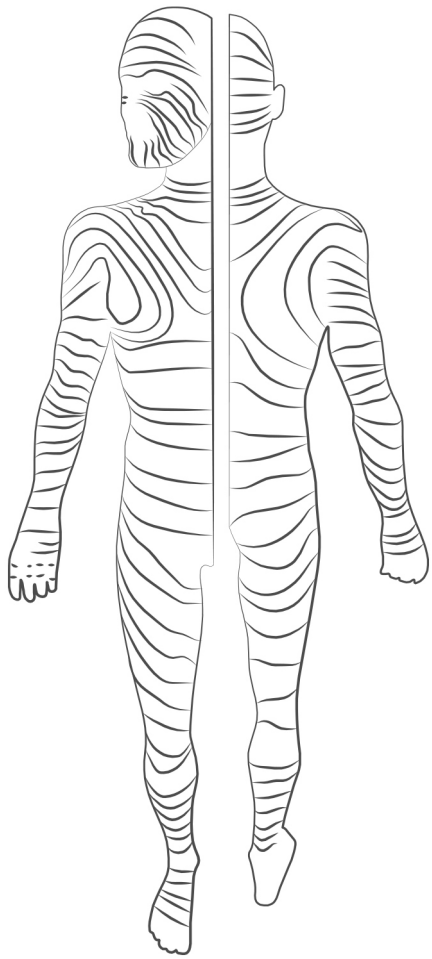

Fig. 1: Langer's lines (RSTLs). Illustration: Author.

representation of matter (i.e. collagen) the measure of our possible action upon bodies, he transforms Langer's representation from a mere topological body plan, to a body plan that, while representing a material continuity, suggests de-structuring acts upon it.[18] I refer to this kind of representation as *amphi-topological*.[19] Amphi-topological representations are incarnating a coexistence of preservation and decay. They thus urge us 1) to cancel the idea of material continuity and give up a part of the process of formal generation to the self-organisational capacity of matter; 2) to preserve topological continuity and thus transform objects by means of continuous deformations; 3) to do both at once. In contrast to the common notion of topological 'plans', amphi-topological representations do not submit a certain behaviour towards transformation; they do not have a predetermined nature. Rather, their nature is defined and redefined every time someone acts through them upon matter. In this sense, such representations are queer to the extent that, on the one hand, they are connected to contradictory states, and on the other hand, their performativity is based upon the possibility of an iterative refusal of established structures.[20] To clarify this position, it may be useful to compare amphi-topology to the concept of classical topology. Topology is concerned with continuous transformations (such as stretching or bending, but not cutting or gluing) and may be a material as well as an immaterial description of forms. Amphi-topology is concerned more with *dis/continuous* transformations, and is thus necessarily a kind of materially embodied and embedded topology. The term 'dis/continuous' is here of particular importance in its two-fold meaning. It designates that an amphi-topological representation may submit both continuous and discontinuous transformations, but not only that. Further, it highlights that in material topologies (amphi-topologies) there cannot be total discontinuity, i.e. anti-relation; only non-connections. Taking the example of skin cuttings, performed through surgery, we may understand that even though the skin is severed and the edges of the cut separated, they are not deprived of their inherent relation. On the contrary, it is this very non-connection that makes them reunite, by activating the skin's wound-healing process through scar formation.

Consequently, Langer's and Kocher's amphi-topological representation, while representing a material continuity (i.e. topology), suggests generational cutting acts upon it, that are dis/continuous acts. In this sense, the qualities of 'amphi-topological' and 'dis/continuous' are capable of queering categorical spatial and architectural binary conceptions of bodies' transformations as either topological *or* non-topological, either continuous *or* discontinuous. Instead, they provide a more inclusive concept for transformational processes.

The cut in queer theory

The act of cutting, introduced in the previous section, is very important for queer theory and transgender studies. It is worth noticing that the term 'queer' itself has its etymological roots in the German 'quer', which indicates a transversal movement; a 'cut' across. It seems though that there is something about this specific act that makes it indivisible from queer nature. That is perhaps why many queer and gender theorists have circled around the subject, while two important figures have addressed it explicitly.

Eva Hayward develops her thoughts upon the act of cutting in her article 'More Lessons from a Starfish: Prefixial Flesh and Transspeciated Selves'.[21] What is interesting about Hayward's work is that, while recognising that sex reassignment surgeries may be a wounding experience for some transgender subjects, it offers an affirmative way of thinking about the cut. By returning to her own experience as a transgender woman, and by speculating upon the mutuality of her becoming with the materialisation of the starfish (who regenerates after cutting), she considers the cut to be an opportunity,

a ‘generative enactment’.[22] Indeed, Hayward thinks of cutting and amputation as a form of becoming; a way to ‘feel the growth of new margins’, as well as an action (to the extent that it is the result of an individual choice).[23]

Queer feminist theorist Karen Barad has broadly written on the notion of the cut as an ethico-onto-epistemological tool developed in the context of her agential realist take on how bodies come to matter. According to Barad’s theory, the universe is comprised of phenomena that are the entanglement, ‘the ontological inseparability of intra-acting “agencies”’.[24] The term ‘intra-action’ is conceived by Barad to contrast the traditional term ‘interaction’, where individuals preexist the relations they enter. Antithetically, the concept of intra-action suggests that individuals exist only through the intra-action in which they come to matter. In Barad’s words, ‘Intra-actions enact “agential separability” – the condition of exteriority – within – phenomena’.[25] That is to say, since in the universe everything is entangled with everything else, any observation therefore depends on a ‘cut’; a provisional ‘local resolution within the phenomena’;[26] ‘a local causal structure’ determining what is going to be considered and what is going to be excluded,[27] so that a certain knowledge upon something may be obtained. Thus, an intra-action is a ‘boundary-drawing practice’[28] that enacts agential cuts.[29]

An agential cut, even though it enacts a local and provisional separability within the phenomena, does not deprive the separated entities from their inherent entanglement. That is why Barad sees agential cuts as a ‘cutting together-apart’.[30] In her view it produces an ‘entangling-differentiating as one move, not [as] sequential acts’.[31] An ethico-onto-epistemological tool, this agential cut may also be important for our previous analysis of amphi-topological representations and dis/continuity of skin cuts, as it suggest that cuts into self-organising fabrics, act as agents of dis/continuity.

The cut in architectural theory and practice

Passing from queer theory and topological dis/continuities to the practice of architecture, the act of cutting continues to hold an equally prominent position. One should only consider the traditional role that cross and planar sections (etymologically related to ‘cutting’) have played in the construction of architectural bodies since the sixteenth century. Raphael claims, in his 1519 letter to the Pope, that the cross section had to be considered as important a drawing as the ground plan and the elevation;[32] forming, from then on, the famous triad of architectural design.[33] Certain academics claim that there is a relation between architectural cross sections and human dissections, even originating in some cases (how queer an origin would be!).[34] The addition of the cross section in the architectural tool-kit established the dialectic relation of surface and depth, signalling a new era for the inner organisation of architectural artifacts. In this sense, architecture has long been producing buildings through intellectual acts of ‘cutting through buildings to come to matter’; that is ‘cutting through buildings’ as part of the process of their very materialisation.

The cutting of a building, however, did not remain a mere matter of intellect within architectural history. In the 1970s a building’s cut passed from the realm of the virtual to the actual world, when the American artist Gordon Matta Clark (who was originally educated as an architect) performed his famous building dissections (building cuttings). Matta Clark was antithetical to architecture as a creation of a building ex nihilo. Rather, he faced it as a piece of information to be put in a feedback process both from human and non-human (ecological) sources, highlighting in this way the performative aspects of place and architecture.[35] Indeed, Matta Clark considered his oeuvre to be a performance, both in terms of his personal working activity and of the changes/acts (simple cuts or series of cuts) made on the buildings.[36] His process involved the selection of the building to act upon, the preparation phase,

and the action phase. Matta Clark chose buildings with a recognisable and established structure (architectural, social, cultural, or other) for reasons of communication effectiveness.[37] Even though he sought typical structures, during the preparation phase he recognised the building's total (semiotic) system, 'not in any idealised form, but by using the actual ingredients of a place'.[38] Thus, he did not reduce buildings to idealised types. This approach led him to actions (cuttings) that emerged in the artist's mind through the buildings' very specificities.

In order to understand Matta Clark's mindset, when performing his cuttings, it is important to consider his previous works, and particularly his Agar pieces, since they are characteristic of his beliefs and attitude towards matter. In the Agar pieces Matta Clark explored 'how changes could be both brought to and brought about by matter'.[39] In these works, matter was literally a living element. It is noteworthy that Matta Clark provided a microscope so that the visitors could inspect in greater detail the life of the agar matter.[40] This take on matter – as a living element capable of bringing about its own changes – continued to accompany the artist throughout his short life, and exercised considerable influence on his building cuttings.

Just as in the case of his agar pieces, Matta Clark considered the buildings to be a form of living being and, as such, an active participant in their transformational process.[41] Artist and building were in an active dialogue during the preparation and the performance of the 'cuts'. The building structure (whether social, architectural, or semiotic) provided the vocabulary for its distortion.[42] The artist responded to the information taken by the building through the performance of his cuts/moves/gestures, and then waited to see what would happen; how the building would respond (receiving and giving feedback). As he said: 'throughout the process, there was a terrific suspense, not really knowing what would hold or shift … I don't feel totally in control of the situation'.[43] This approach was characteristic of Matta Clark's claims concerning architectural bodies. As he used to say, it takes cutting through a building in order to get to know it.[44]

Matta Clark's claims seem to be related to the Spinozist problem of 'what bodies can do'. Benedict de Spinoza said in his *Ethics* that 'the human mind does not know the human body itself, … except through ideas of affections by which the body is affected'.[45] What Spinoza argues here, is that we are conscious of our body only insofar as it is affected by other bodies through movements.[46] Hence the cut (as a transversal movement) is that which passes through the bodies that it happens to cut and is thus a 'passion'.[47] In this sense, cuts, as acting on bodies, are responsive investigations into their self-organising capacity, and it is through them that we may get closer to knowing what bodies can do. This may be exactly the reason why Matta Clark did not consider the cuts to be violent acts, but rather acts that result in 'a sense of heightened awareness' about what a building is.[48]

For Gordon Matta Clark architecture was also an environment, and buildings a structural fabric, so that 'when [one is] living in the city, the whole fabric is architectural'.[49] What Matta Clark did, then, was *cutting through the architectural fabric*, in order to get to know it; to reveal its capacity to re-organise itself and create unexpected and complex spatial results. However, this take on architecture, as a fabric through which one has to cut in order to reveal its ambiguous complexity and create new perspectives, was neither new, nor non-sustainable.

Cutting the fabric: towards a process of smoothing

The idea of material continuity as a fabric reflecting itself in the form of possible modes of discontinuity, and – by extension – possible acts of cutting, was elaborated explicitly by Henri Bergson in the beginning of the twentieth century.

Bergson describes how the totality of matter appears to us as an enormous fabric (*étoffe*) in which we may cut out whatever we want and sew it together however we want; this process can be continued ad in infinitum.[50] He also argues that it is this very ability to consider the material fabric as infinitely divisible that constitutes our idea of abstract space. The continuity of the material fabric of the world is reflected back to us as possible acts of division and recomposition of the fabric, that is, possible acts of cutting and sewing (because, of what surrounds us, we may see only the aspects that we may act upon). When all these virtual acts are projected behind the material world they form space; 'the plan of our possible action on things'.[51]

Furthermore, Bergson does not consider the cutting of the fabric to be only a way to get to know it, but he thinks of it as the only *means to fabrication*. Since fabricating means modifying the material world, and since modifying matter becomes possible when and only when it is perceived as discontinuous and divisible, fabrication becomes inseparable from material cutting.[52] For Bergson, then, one may pass from fabric to fabrication only through acts of cutting. This is how he transforms Spinoza's gnosiological tool of 'cutting the fabric' as *getting to know*, into 'cutting the fabric' as a *fabricating tool*.

Gilles Deleuze and Felix Guattari continued a preoccupation with the spatial aspect of fabrics and, in *Capitalism and Schizophrenia* gave new insights to what a transversal movement (cutting) through that fabric could produce. In elaborating the concept of smooth and striated space, they use woven fabric as a technological model of striated space and contrast it with the nomadic felt as a model for smooth space. On the one hand, the striated fabric is described as being composed by two groups of parallel elements (threads) that intersect perpendicularly. Each group has a specific function within the weaving process (one is fixed and the other mobile), while the whole configuration necessarily has a top and bottom side, since the knots are placed on one side of the fabric. On the other hand, the smooth felt is composed of matted fibres, 'it has neither top nor bottom nor centre' and distributes a continuous variation instead of assigning fixed and mobile elements.[53] Smooth felt is in principle infinite and open, in contrast to fabric that is closed on at least one side. Smooth is good; striated is bad. Smooth is an open space of possibilities and becoming; striated is a space of stability and enclosure.[54]

But as Deleuze and Guattari maintain, smooth and striated exist only in mixture, with either being constantly transformed into the other through processes of smoothing and striation. The sea for example, a smooth space par excellence, was striated through bearings and maps, the latter being exactly the application/projection of an undifferentiated grid upon it (a process of striation). The space of the sea becomes striated, but only provisionally. Its re-smoothing is to be performed by strategic submarines that, serving the purposes of a war machine, *move across all gridding* in order to control striated space (a process of smoothing).[55] Consequently, applying grids is a process of striation, while moving across the lines of the grid (*transversal movement*) is a process of smoothing.

Regarding this smoothing and striation, the French architect and theorist Leopold Lambert argues that a similar smoothing process of striated space, in service of the war machine, has been put in use in cases of urban warfare as well. Lambert provides two examples: the revolutions that emerged in the Parisian urban fabric in the nineteenth century, and the siege of Nablus Palestinian refugee camp in 2002. French revolutionaries and the Israeli army both smoothed the urban fabric by denying the physicality of architecture. They moved across the imposed boundaries by opening holes in the walls, ceilings and floors of the urban fabric.[56] This practice, very similar to Gordon Matta Clark's building cuts, was exactly *cutting through the urban*

fabric as a process of smoothing, creating deep metamorphic scars within the built environment.

The smooth space that emerges here, as well as in Matta Clark's pieces, isn't the same kind of smooth space that architects/architectural conceptions have been trying to realise through the application of topology. It is neither an edgeless space (a space of the surface), nor a space produced through continuous transformations. Rather, it is a space where the revealing of the edge celebrates the emergence of new possibilities, a space created through queer acts of 'cutting across'; cutting through the surface so as to create, from something existing and typical, new organisational logics and spatial relations. It is a space established on denial; the denial of the surface as a limit. Hence, in contrast to the recent emergence of topological takes in architecture, in response to the reception of Deleuze's conception of the smooth, this reading argues that smooth spaces may also be produced through a series of cuts through the material fabric of the world.

SCARchiCAD: queering the architectural tools

Architectural software (deriving from special effects for the film industry), was introduced in architecture in the early nineties at the paperless studios of Columbia University. That was a period when the architectural discourse was heavily dominated by readings of Michel Foucault and Deleuze and Guattari (notably the text on the Rhizome and the concepts of smooth and striated space).[57] Particularly, the ostensible 'goodness' of smooth spaces was a source of inspiration, and at the time, all kinds of architectural concepts and typologies hoping to realise such spaces were developed. What's more, as a result of this architectural movement, certain software packages gained ground over others among architects, by virtue of their relation to Riemannian geometry and topological models, which were connected to the concept of smooth space. Thus, smoothness (translated mostly as edgelessness, and as the process of creating different forms as equivalent expressions of a single organisation) was further embedded, as a quality, in the DNA of architectural production.[58]

The power that the idea of 'smooth' has exercised on the tools through which contemporary architecture is produced, is not to be underestimated. The tool through which a designer elaborates a project is critical for the ontology of the project to be produced. It seems then that one cannot examine what the 'queering of design' could mean without examining the possibility of queering the way it is produced; *queering the design tools* . Since digital environments represent the present, and probably the future, of design, it seems important to investigate how queer creativity, as creating by cutting through the already existing, could find its place within the digital realm. What possibilities could such a design attitude offer?

In order to confront these questions, I have developed SCARchiCAD; a computational tool that takes the skin's wound healing process as a model in order to offer a workflow that postulates the self-organising capacity of bodies as a presupposition of a 'new' structure. There is a dual reason for choosing wound healing (as a process of scar formation) as a model for SCARchiCAD. On the one hand, it is a process activated by queer acts of 'cutting through' the skin. On the other hand, it may well be contextualised in the aforementioned debate around architectural software and its quest for smoothness. This is because uninjured tissue and scar tissue are structured similarly to the fabric/felt model. Indeed, the collagen fibres structuring uninjured skin are organised in layers consisting of fibres arranged in parallel lines; while those structuring scar tissue are much more entangled (even matted in some instances) and deny strict stratification.[59] Cutting through the skin thus appears to be a process of smoothing the striated, like the processes previously described. Furthermore, the model of normal tissue/scar tissue, when compared

to the model of fabric/felt, is characterised by an augmented capacity of its matter (collagen) to be an active/dynamic agent in skin's materialisation. Consequently, the skin healing process seems to provide an anti-paradigm to processes that attempt to create smooth space ex nihilo, or to processes that postulate that 'smoothness' may only be created through topological acts.

Scientific Background

Understanding how SCARchiCAD operates, requires a basic knowledge of the structure of the skin, the different natural processes of scar formation, and the agents of healing. Human skin is composed of two main layers: epidermis and dermis.[60] The epidermis is composed of keratin, generally formed into dead cells flattened in the plane of the surface. The dermis, underneath the epidermis, is the structural layer of the skin, since it is mostly composed of bundles of collagen fibres, which give it its mechanical strength.[61] Since each skin area suffers different forces, the dermal thickness varies accordingly. The collagen bundles are arranged in layers parallel to the epidermis, and the superficial layers have a fibre orientation very close to that of Langer's lines.[62]

Underneath the skin (cutis) there is the so-called subcutaneous layer (superfiscial fascia or hypodermis), and even deeper there is the fascial layer (deep fascia). The subcutaneous layer is so closely related to the dermis that it is regularly presented in literature as the third layer of the skin. It serves mostly functions of mechanical support of the dermis and thermal insulation. Its collagen fibres are organised in such a way as to form easily discernible rims (septa), which may be perpendicular or have a criss-cross orientation to the planes parallel to the epidermis.[63] The fascia is an uninterrupted tissue surrounding and penetrating all structures of our body. Fascial structure varies according to the specific region where it is found; the fascia of the limbs for example consists of three sublayers each one of which has a specific orientation of collagen fibres (parallel), while the angle between the parallel fibre lines of adjacent layers is 78 degrees.[64]

When the skin's continuity is locally destroyed because of a cut, our organisms begin the wound healing mechanism in order to restore lost continuity. During this process, new collagen is produced, re-organised and re-orientated appropriately. There are four main types of scars, each of which stands for a different process of collagen organisation or for a different quantity in collagen production: (1) normal scar, (2) hypertrophic scar, (3) keloid scar, and (4) depressed scar. [Fig. 2]

First, normal scars are flat scars that may not be very apparent. At a microscopic level, the collagen fibres of normal scars re-orientate along Langer's lines if the incision is placed parallel to them. However, there is a declination from complete parallelism. This declination augments even more when the incision is placed perpendicular to Langer's lines. In such a case, one may observe 'many interconnections between the different layers and interdigitations between the fibres of the same layer'.[65] Second, hypertrophic scars are raised scars that do not grow over the boundaries of the original wound. At a microscopic level, their collagen fibres are organised in whorl-like arrangements that progress into distinct nodular forms. However, nodular and whorl-like fibre arrangements may be found to coexist.[66] Third, keloid scars are raised scars that augment their size through time and expand over the boundaries of the original wound following particular growth patterns, that is, following the direction of natural skin tension lines.[67] [Fig. 3] At a microscopic level, keloids consist of 'large bands of fairly uniformly orientated collagen fibres'. In the case of keloid scars produced from incisions perpendicular to Langer's lines, J.A.A. Hunter and J.B. Finlay observe that 'the bands are orientated in every direction except directly across the wound'.[68] Last, depressed or atrophic scars

are scar formations that present as topographical depressions. They are the result of an inadequate production of dermal collagen and connective tissue during the normal healing process.[69]

The activation of a specific process of the healing phenomenon depends generally on (1) the characteristics of the region where the cut is performed, (2) the characteristics of the cut, (3) the age of the patient and (4) genetic predisposition.[70] However, during the development of SCARchiCAD, only factors (1) and (2) were taken under account, by virtue of their geometric translatability.

The characteristics of the region that mainly influence the healing process are (1) the thickness of the dermis on that particular area of the body,[71] (2) the curvature of the area *(*convex areas tend to form depressed scars, while concave areas have a tendency towards raised scars),[72] (3) the existence of bones underneath,[73] and (4) the existence of organs that exercise repetitive cycles of forces, like for example with the movement of the chest wall in the case of abdominal incisions.[74] Yet, for the development of SCARchiCAD, repetitive cycles of forces were not considered, despite their existence in buildings, in order to limit the complexity of the problem (only static forces were considered).

As for the characteristics of the cut that are considered to influence healing, these are (1) its depth, and (2) its orientation in relation to Langer's lines. The deeper the cut, the more layers of the skin are involved in healing, while, generally, deep cuts do not activate normal scar healing.[75] The orientation in relation to Langer's lines influences the healing process, as incisions that are parallel to Langer's lines have a greater potential to develop normal scarring, while those that are perpendicular are much more susceptible to develop keloid or hypertrophic scarring.[76] This is why Emil Kocher suggested at the outset that it is preferable for surgical incisions to be performed parallel to Langer's lines.

SCARchiCAD's operation is based on these basic principles describing the skin's wound healing process and hopes to offer a workflow for the experimentation with queer forms of creativity; which for me is creation as a process of cutting through the existing, instead of creating ex nihilo. The tool was developed through Grasshopper (which may of course be considered an internal contradiction, and thus part of its queer nature).[77] The algorithm starts by asking the user to introduce a surface or a form. The user also has the option of introducing solids (bones) under the surface in order to customise the environment of the digital 'healing'. The algorithm proceeds with the transformation of the input surface/form into a skin-like structure and at a later stage it asks the user to provide the geometry of the cuts to be performed.[78]

More specifically, the input surface is transformed into a structure consisting of four layers (epidermal, structural, subcutaneous, fascial), in accordance to the skin structure described above. [Fig. 4] Initially, the epidermal layer is visualised as a triangulated mesh, because of its composition of flat cells; this form (mesh) is used by other skin simulations as well.[79] The structural layer is visualised as consisting of only five parallel layers; a simplification made necessary for the transformation of a biological structure to a more tectonic one. Each of the parallel layers is formed by isoparametric field curves intrinsic to the input surface. [Fig. 5] These curves stand in the algorithm for the collagen lines of the skin/Langer's lines; (since SCARchiCAD is not a medical simulation, such assumptions were considered permissible).[80] Further, the thickness of the structural layer varies according to local stress concentrations on the input surface, as defined through a structural analysis. Maximum thickness occurs in areas of maximum stress and minimum

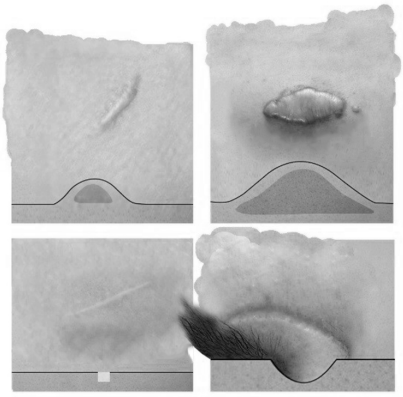

Fig. 2

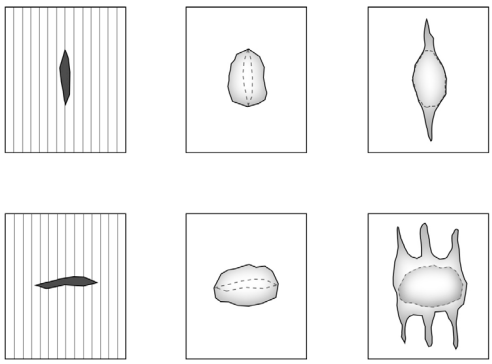

Fig. 3

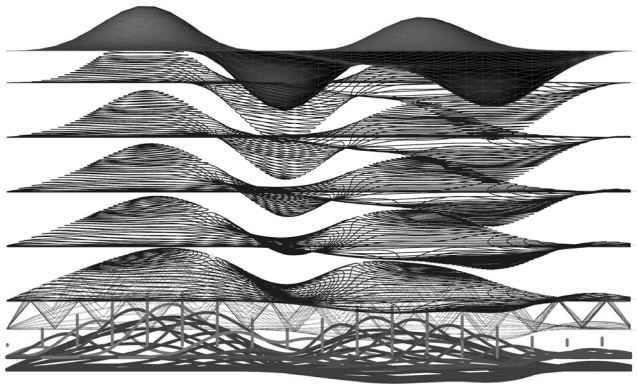

Fig. 4

Fig. 2: Digital collage-painting showing textures and profiles of hypertrophic, keloid, depressed, and normal scars (clockwise from upper left). Illustration: Author.

Fig. 3: Keloid growth. Keloids tend to grow, following natural skin tension lines, developing interesting patterns. Illustration: Author.

Fig. 4: The skin-like structure. Epidermal, structural, subcutaneous and fascial layers. Illustration: Author.

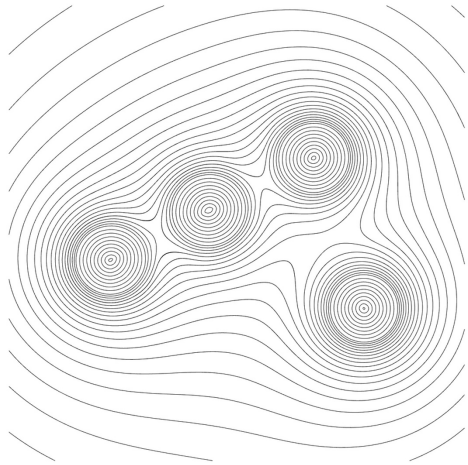

Fig. 5

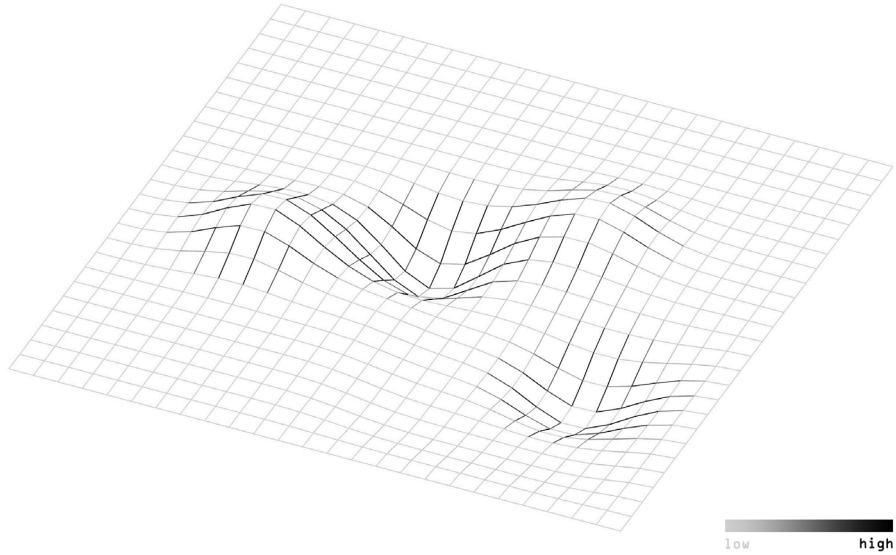

Fig. 6

Fig. 5: Isoparametric field curves, intrinsic to the input surface. These curves stand in the algorithm for the collagen lines of the skin (Langer's lines). Illustration: Author.

Fig. 6: Structural analysis of the input surface. Illustration: Author.

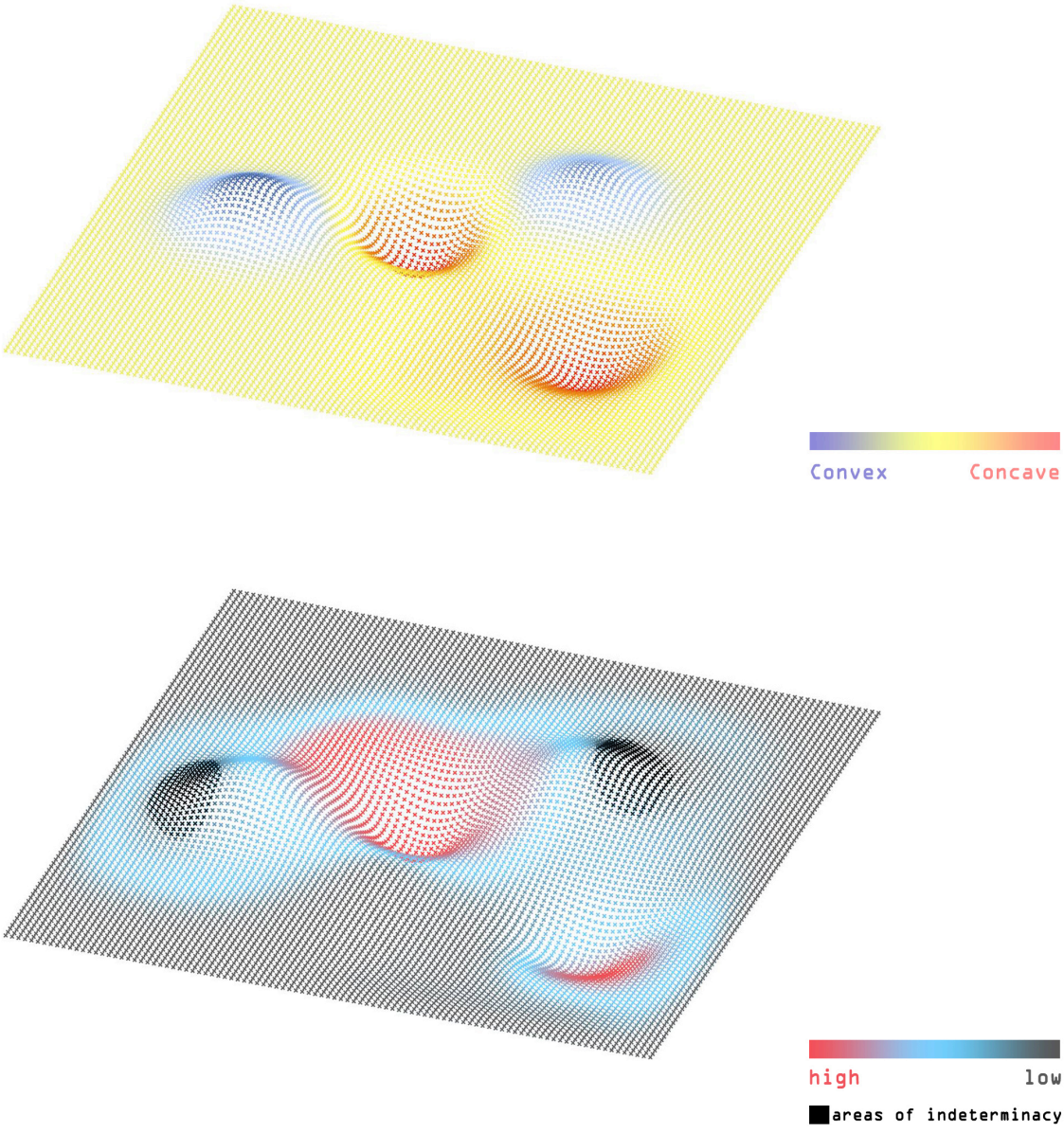

Fig. 7: Concavity/convexity analysis of the epidermal layer and thickness analysis of the structural layer. Contradictory results of these two analyses produce areas of indeterminacy. Illustration: Author.

thickness in areas of minimum stress. [Fig. 6] Since the structural layer is the only layer whose thickness influences the healing process in an important way, it is also the only one that is calculated and visualised with a variant thickness. Next, the subcutaneous layer is translated into a space frame structure (because of the similarity of this structure to the actual organisation of fibres of the hypodermis into rims/septa perpendicular and criss-cross to the plane of the epidermis). Lastly, the fascial layer consists of three parallel sub-layers, the lines of each being parallel, while the angle between the lines of adjacent layers is 78 degrees, following the structure of the deep fascia of the limbs.

The agency of the skin-like structure in the healing phenomenon is calculated by the algorithm through a concavity/convexity analysis of the epidermal layer and through a thickness analysis of the structural layer. [Fig. 7] On the one hand, through concavity/convexity analysis, convex, concave, and planar areas are related to a tendency towards depressed, raised, and normal healing processes respectively, following the tendencies that those areas have in nature. On the other hand, thickness analysis matches areas of high, moderate, and low thickness to high, moderate and low susceptibility to the keloid healing process, following scientific results suggesting such a relation.

From their very definitions, these two analyses are expected to present some areas of contradictory results; areas of indeterminacy. This is because convex surfaces that tend towards a depressed healing process generally have a high thickness due to high tension, as determined by the structural analysis, and thus tend to raised healing processes as well. This indeterminacy is the ‘queer’ bit of the algorithm, since it oscillates between contradictory states, and it is to be resolved based on local relations (tendencies of neighbouring areas).

If the user has introduced a solid (‘bone’ component) under the skin structure, the healing process will be influenced by its presence in the case of a deep cut. In this case, the algorithm is interested only in the existence or non-existence of the solid and thus the bone is represented by a boolean variable (true/false) in different positions of the surface.

When the surface/form, introduced by the user, has been transformed into a skin-like structure, the algorithm asks the user to digitally perform the cuts. [Fig. 8] Each digital cut is represented in the algorithm by two variables: (a) its index number, and (b) its depth. The index number is a remapping of the cut’s directionality in relation to the fibre lines (isoparametric field curves), where 0 represents parallelism and 1 perpendicularity. [Fig. 9] The reason for this, as explained earlier, is that the depth and the declination of the cut’s orientation from Langer’s lines are the two basic characteristics of its geometry, influencing the healing.

It is important to understand that the healing process to be activated is a result of the intra-activity of all three components of the healing phenomenon (surface, solids, and cuts). [Fig. 10] In Figure 11, I show a map of the general healing propensities emerging through the intra-activity of the different components, for a particular surface. The variables of the cut intra-act with those of the input surface and solids, so as to produce a map of the collective behavioural tendencies of the phenomenon ‘surface-solids-cut’ towards particular generative/healing processes. One may notice in the visualisation how the propensities of the surface change in relation to the depth of the cut. Furthermore, one may notice that the healing result of two cuts performed on the same region with exactly the same depth, may vary considerably, if the cuts have a different orientation, since the index number of a cut is also an agent of the phenomenon. That is why cuts of a particular depth performed on the

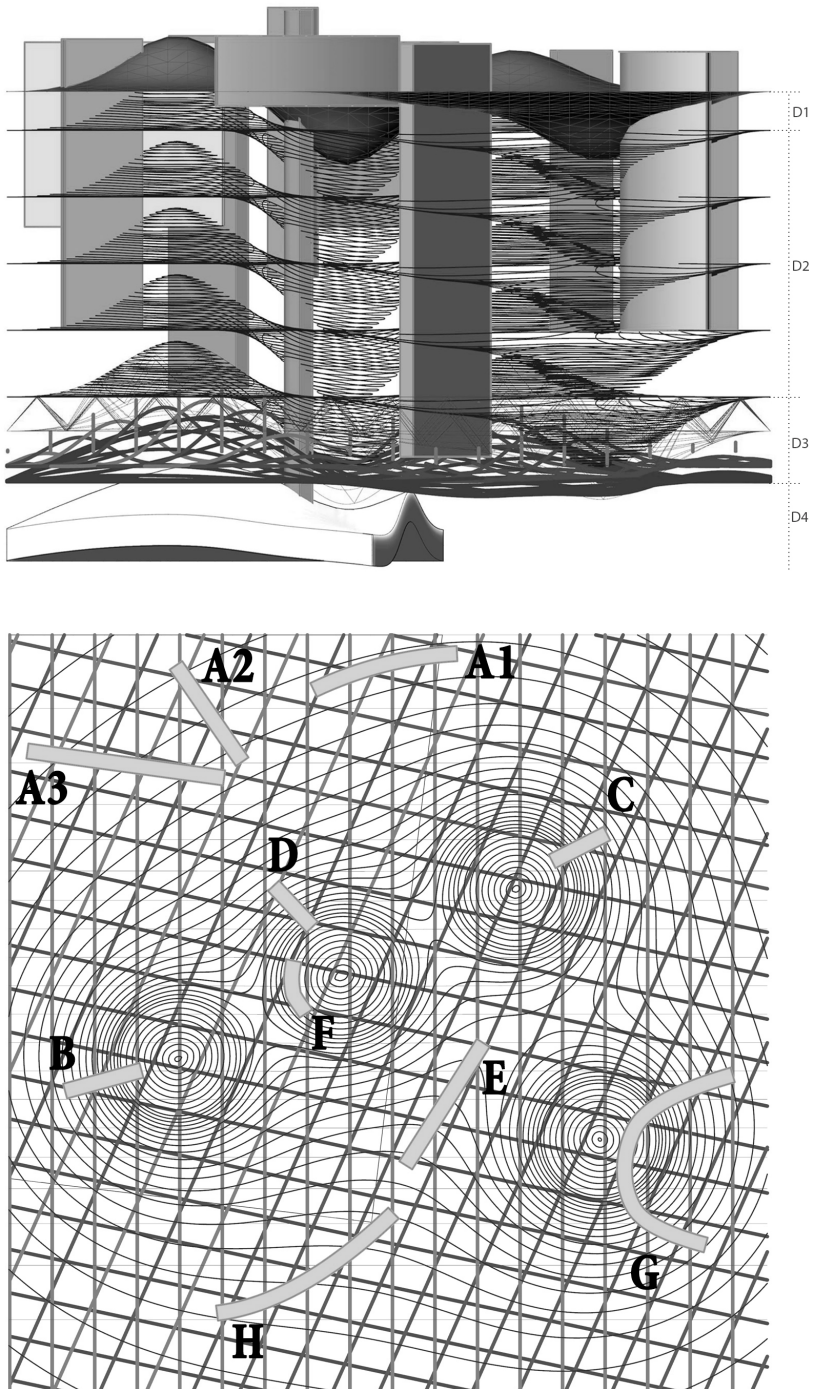

Fig. 8: The cuts (elevation and plan). Author

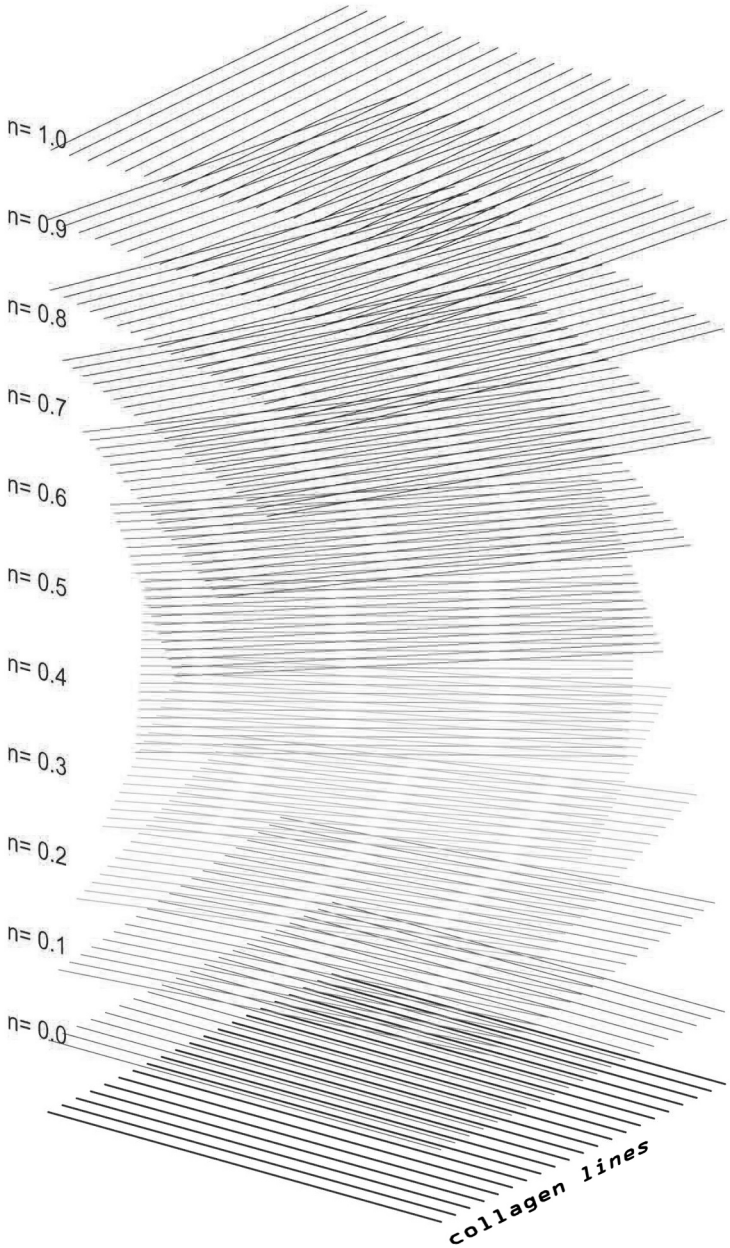

Fig. 9: Index numbers according to the cuts' directionality in relation to fibre lines. Illustration: Author.

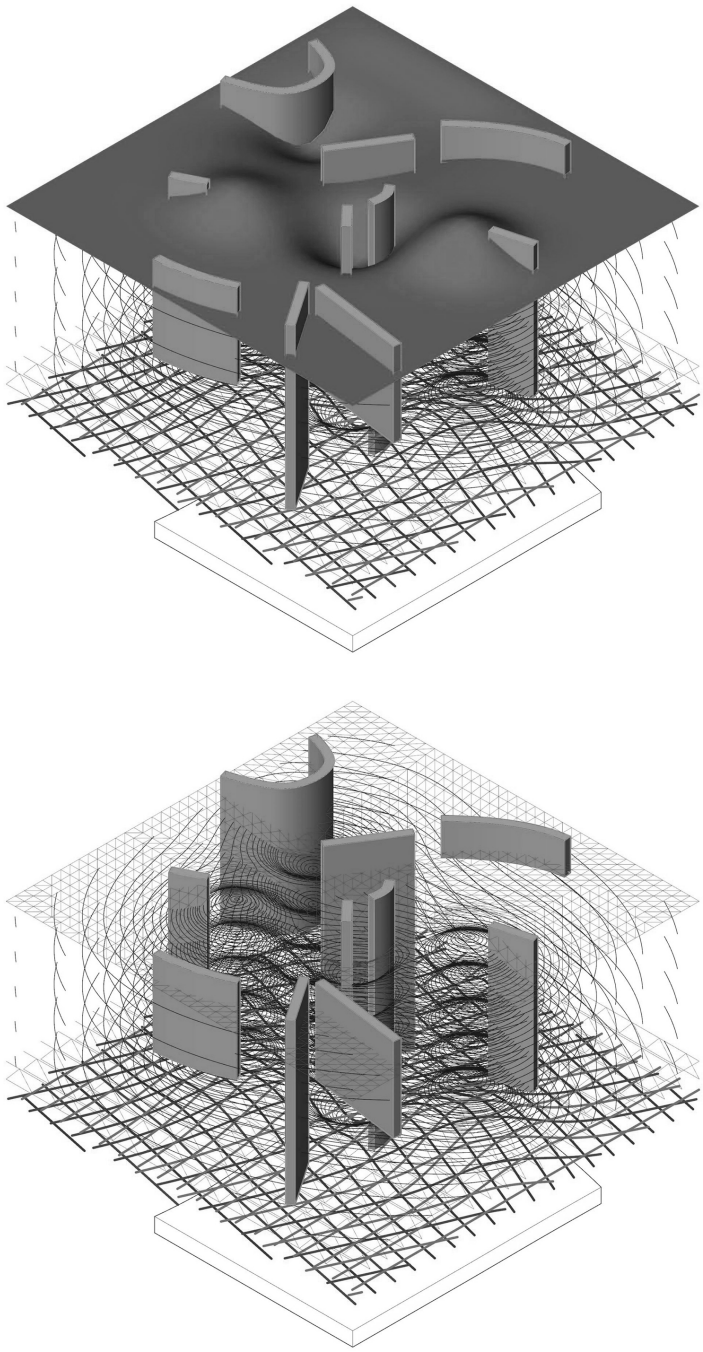

Fig. 10: The components of the healing phenomenon (skin-like structure, cuts, bone). Illustration: Author.

same surface region are shown to tend towards two healing processes, even contradictory to each other.

Finally, if the depth of the cut is larger than the thickness of the epidermal layer, a certain healing process is activated by the algorithm as a result of the intra-activity of the different components. The healing processes, to be activated, tend towards four procedural poles, in accordance with the healing processes of the natural phenomenon: (a) the normal scar process, (b) the keloid scar process, (c) the hypertrophic scar process, and (d) the depressed scar process. The normal scar process modifies the orientation of the fibres in the planes parallel and perpendicular to the input surface. The keloid process produces an augmented number of virtual fibres and modifies both their orientation and curvature, so as to simulate the raised appearance of keloid scars and their fibres' augmented density and entanglement (the curvature of the virtual fibre lines is modified so as to result in convex fibre configurations). The keloid process evolves through time following the growth logics visualised previously in Figure 3. The hypertrophic process modifies the orientation and curvature in a similar way, but also creates nodular and whorl-like fibre arrangements that, in accordance to the natural process, tend to repulse the fibres around them. Last, the depressed scar process modifies the orientation, but especially the curvature of the fibres so as to result in concave configurations simulating the formal result of topographical depressions. In all four processes, the randomness of the fibres gets higher when the index number of the cut increases. [Fig. 12]

Some thoughts

SCARchiCAD remains a work in progress. Apart from its internal contradictions, it has helped me to navigate through queer creativity and explore the possibilities that design, as cutting through existing structures, may offer. As far as the macroscopic characteristics of the resulting materiality are concerned, the cutting through the surface leads to the emergence of areas with altered material properties. More precisely, the augmented density of fibres, as in the case of materialisations generated through processes with a tendency to the keloid procedural pole, result in augmented regional stiffness. Other than that, materialisations that resulted from cuts with a high index number (perpendicular to Langer's lines) result in high degrees of randomness in the modification of curvature and orientation. As a consequence, regional isotropic areas emerge out of the destruction of anisotropic ones. An interesting direction for future research would be to investigate whether the opposite may also occur; that is whether anisotropic areas may emerge through the regional cutting of isotropic ones.

Other than that, it became apparent how, when the continuity of an amphi-topology is regionally destroyed, new organisational logics emerge and hierarchical relations among different layers are transgressed; [Figs. 13–14] that is, in contrast to topological transformations that rest at a formal level, without any alterations to the organisational logic of the new form. When cutting through a material form, the new connections between the different layers, as well as among the lines of the same layer, result in more complex and entangled regional relations.

Last but not least, SCARchiCAD created a thought that could bridge queer creativity and creation ex nihilo. Since digital architecture is notoriously bad at dividing buildings and constructions into parts that would allow assembly, it is possible that this approach of *cutting through a design or virtual building* might enable one to think and design the seams in a building differently, making queer creativity a part of every creative process that aims at fabrication through the assembly of parts.

Conclusions

This essay has suggested that creativity, and design

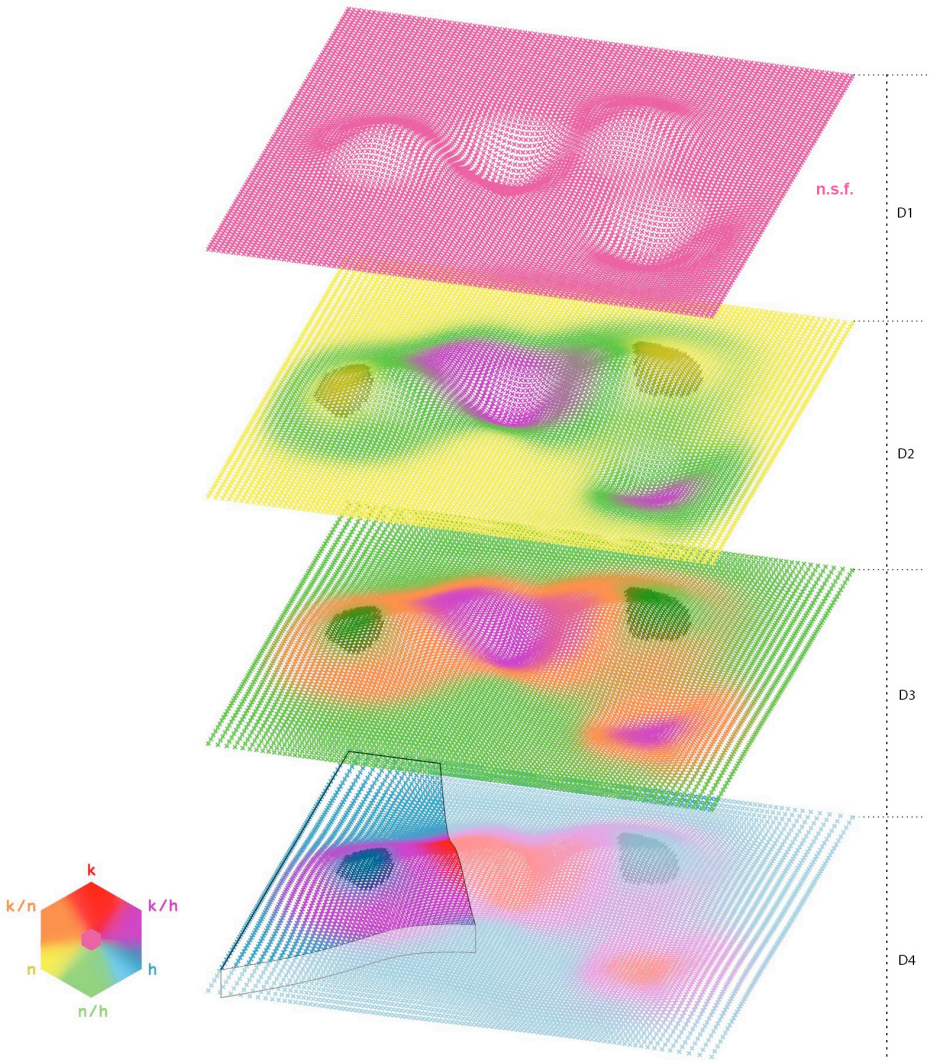

Fig. 11: Collective behavioural tendencies towards particular healing processes. The propensities of the surface change in relation to the depth of the cut. (D1: the depth of the cut is smaller than the thickness of the epidermal layer. D2: the depth of the cut reaches the structural layer. D3: the depth of the cut reaches the subcutaneous or the fascial layer. D4: the depth of the cut reaches the bone. k: keloid, h: hypertrophic, n: normal, n. s. f.: no scar formation when the cut does not surpass the epidermal layer). Darker colour variation represents areas of indeterminacy shown in Figure 7. Illustration: Author.

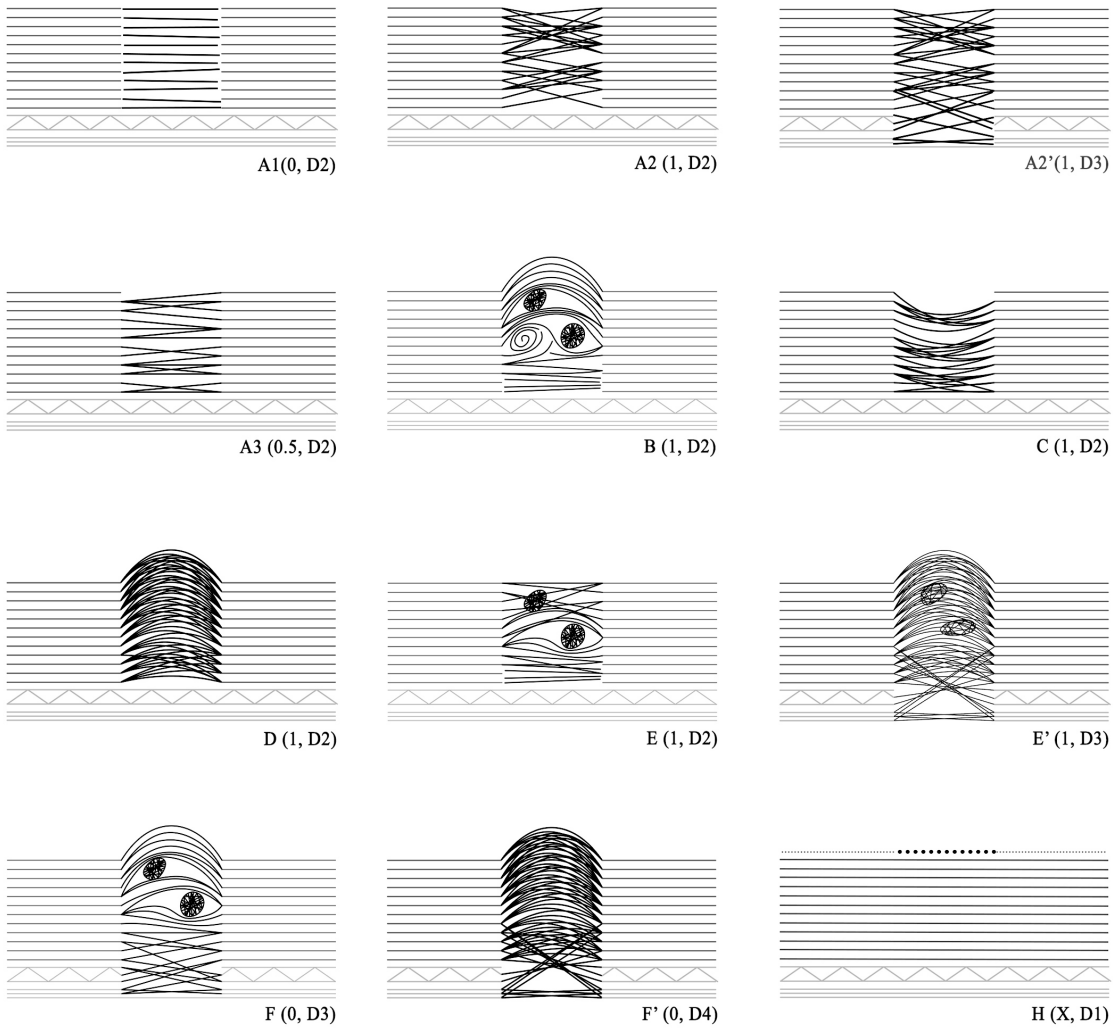

Fig. 12: Diagrammatic sections of the resulting scars. Cut (index number, depth). A1, A2, A2´, A3: organisations produced through variations of the normal scar process. B, F: organisations produced through variations of the hypertrophic process. D, F´: organisations produced through variations of the keloid process. C: organisation produced through the depressed scar process, H: no scar formation. E, E´: hybrid organisations. Illustration: Author.

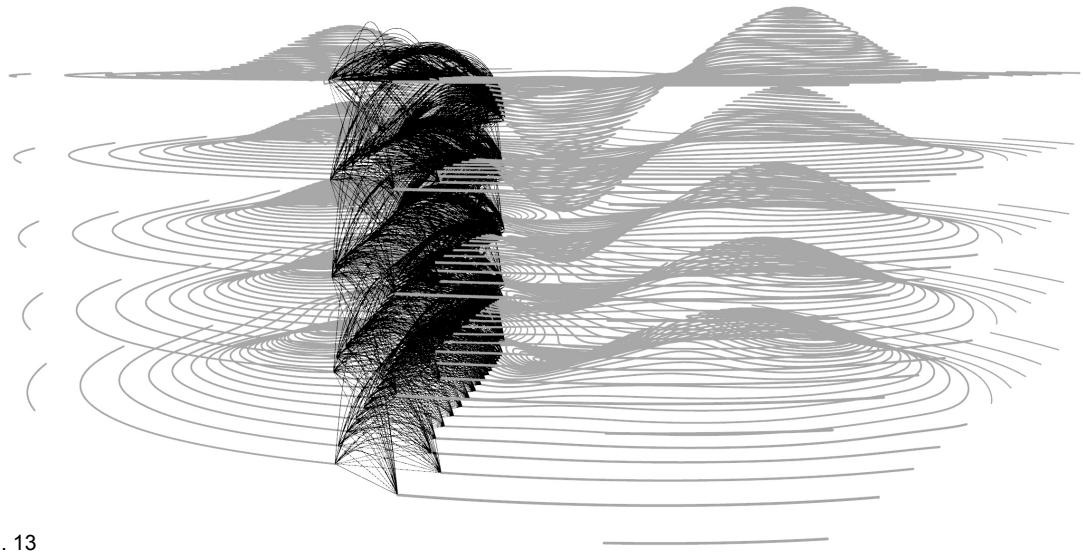

Fig. 13

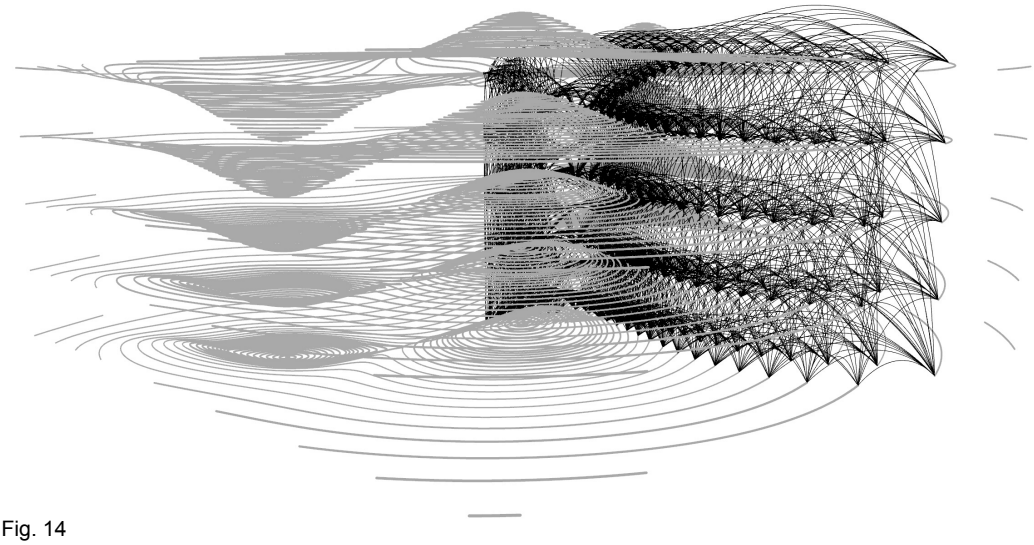

Fig. 14

Fig. 13 & 14: Perspective view of the healing result after the cut. New organisational logics. Illustration: Author.

creativity in particular, may be seen as a mechanism of thought and action, which does not make forms ex nihilo (with the designer as demiurge), but activates appropriately the material fabric of the world – affects it in order to provoke its capacity of form generation and autopoiesis (designer as an 'affecting body'). Certainly, there are many ways to affect matter. Yet, cutting through it (refusing the given relation and continuities) is the most destabilising and, in this sense, the queerest of all, as long as it is established upon a denial. I argue, thus, that *queering* in architecture and design should be interpreted as cutting through structures and processes; as an iterative return to the moment of denial of the existing structures. But this denial is not an ultimate one, like for example the demolition of the Pruitt-Igoe modernist housing project. Instead, it is a partial destruction, like the one realised through the building cuts of Gordon Matta Clark. The act of refusal, which is at stake here, does not deny the material reality per se, but tries first of all to understand it, showing responsibility towards the process that is materialised through the 'body' to be modified. This kind of responsibility is important, because it makes the very difference between a violent act of cutting and a generative one.

In this way, the tradition of discontinuity, as anti-relation, is changed towards more affirmative interpretations. Dis/continuity, I argue, is the quality that permits the emergence of a (smooth) space of future reworkings and possibilities. Dis/continuous acts, projected behind amphi-topological representations, become, then, important 'tools' for the materialisation of buildings through the queer performativity of architecture (iterative intra-activity). As a boundary-drawing practice, architecture produces buildings by enacting a series of virtual (intellectual) or actual 'agential cuts' through the material fabric of the world: cuts that open up bodies towards unknown reworkings of their own. Promising becomings to come.

Notes

I would like to deeply thank Eftihis Efthimiou who helped me to translate SCARchiCAD's algorithm into a Grasshopper definition. I would also like to thank George Parmenidis, since our conversations helped me to clarify many ideas presented here, and Stylianos Giamarelos for reviewing early drafts of this essay.

1. Eva Hayward, 'Spider City Sex', *Women & Performance: a Journal of Feminist Theory* (2010): 225–251.
2. Rivka Oxman, Roey Hammer, and Shoham Ben Ari, 'Performative Design in Architecture' in *Predicting the Future: 25th eCAADe Conference Proceedings* (Frankfurt/Main: Faculty of Architecture and Civil Engineering, FH Wiesbaden, 2007), 227–234.
3. Branko Kolarevic and Ali M. Malkawi, *Performative Architecture Beyond Instrumentality* (London: Spon Press, 2004), 179.
4. Ibid., 179.
5. Ibid., 186.
6. Judith Butler, *Bodies that Matter: On the Discursive Limits of 'Sex'* (London: Routledge, 1993). In Butler's approach to performativity, citationality is integral. She defines performativity initially through speech acts, and then adds gestural/bodily components to this. She gives the example of the performativity of the judge, whose decision gains its binding and conferring power from the citation of the law, whose authority is thereby established.
7. Kolarevic and Malkawi, *Performative Architecture*, 179.
8. Eve K. Sedgwick, 'Queer performativity: Henry James's the Art of the Novel', *GLQ: A Journal of Lesbian and Gay Studies* 1 (1993): 1–16.
9. Karen Barad, 'Nature's Queer Performativity', *Kvinder, Køn & Forskning* 1–2 (2012): 25–53. While in Butler performance is created through the repetition and thus normalisation of acts, Barad foregrounds the ways in which in these material-discursive practices, bodily matter actively 'kicks back'.
10. Trans Student Educational Resources. 'LGBTQ+Definitions'. Transstudent.org. http://www.transstudent.org

[accessed, 13 August 2017].

11. E. Coleman et al. 'Standards of Care for the Health of Transsexual, Transgender, and Gender Nonconforming People, Version 7', *International Journal of Transgenderism*, 13, no. 4 (2012): 171.
12. Hayward, 'Spider City Sex', 227.
13. 'In topology, we no longer distinguish between two figures, two spaces, if you can pass from one to the other by means of a continuous deformation – with neither leap nor cut'. Jean-Michel Kantor, 'A Tale of Bridges: Topology and Architecture', *Nexus Network Journal* 7, no. 2 (2005): 13–21.
14. Pierre Agache, 'Langer's Lines' in *Agache's Measuring the Skin,* ed. Philippe Humbert, Ferial Fanian, Howard Maibach, and Pierre Agache (Springer International Publishing, 2017).
15. James C. Waldorf, Galen Perdikis, Sarvam P. Terkonda , 'Planning Incisions', *Operative Techniques in General Surgery* 4, no.3 (2002), 199–206.
16. Albert F. Borges, 'Relaxed skin tension lines (RSTL) versus other skin lines', *Plastic and Reconstructive Surgery* 73 (1984): 144–150; Ali AlHamdi, 'Facial Skin Lines', *Iraqi Journal of Medical Sciences* 13, no. 2 (2015): 103–107.
17. Waldorf, Perdikis, and Terkonda, 'Planning incisions', 206.
18. Ibid., 199.
19. The prefix 'amphi- 'has the meaning of 'both', or 'on both sides' (in contrast to the prefix anti- which suggest a dualism – either the one, or the other). Thus, 'amphi- 'suggests a certain kind of oscillation or incarnation of contradictory states.
20. Karen Barad, in her article 'Nature's queer performativity', uses the term queer to characterise entities with internal contradictions.
21. Eva Hayward, 'More Lessons from a Starfish: Prefixial Flesh and Transspeciated Selves', *Women's Studies Quarterly* 36, no.3 (2008):64–85.
22. Ibid., 71.
23. Ibid., 72.
24. Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (Durham and London: Duke University Press, 2007), 333.
25. Karen Barad, 'Intra-actions', *Interview by Adam Kleinman, Mousse* 34, no. 81 (2012): 76–81.
26. Karen Barad, 'Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter', *Signs* 28, no.3 (2003): 815.
27. Ibid.
28. Barad, *Meeting the Universe Halfway,* 204, 206 and 208.
29. Barad, 'Intra-actions', 80.
30. Ibid.
31. Ibid.
32. The plan had a material aspect, since it was the foot-print of a building on the ground before the construction and in this sense is different from the section.
33. Wolfgang Lotz, *Studies in Italian Renaissance Architecture* (Cambridge, MA: MIT Press, 1977), 20–21.
34. Barbara M. Stafford, *Body Criticism: Imagining the Unseen in Enlightenment Art and Medicine* (Cambridge, MA: MIT Press, 1991); Jacques Guillerme and Hélène Vérin, 'The Archaeology of Section', *Perspecta 25* (1989): 226–257.
35. Gloria Moure (ed.), *Gordon Matta-Clark: Work and Collected Writings* (Barcelona: Poligrafa, 2006), 55.
36. Ibid., 66.
37. Ibid., 61, 132.
38. Ibid., 68.
39. Stephen Walker, 'Gordon Matta-Clark: Matter, Materiality, Entropy, Alchemy' in *Material Matters: Architecture and Material Practice,* ed. Katie L. Thomas (New York: Routledge, 2007), 46.
40. Ibid., 47.
41. Moure, *Gordon Matta-Clark*, 326.
42. Ibid., 177.
43. Ibid., 175, 265.
44. Ibid., 175. 'It seemed to take cutting through it [the building] with a chain saw to get to know it'.
45. Benedict de Spinoza, *Ethics*, ed. and trans. Edwin Curley (London: Penguin Books, 1996), 47 (IIP19).
46. In Spinoza's *Ethics* bodies are considered to affect one another through the communication of motion.
47. Ibid., 70 (IIID3).

48. Moure, *Gordon Matta-Clark*, 253.
49. Ibid., 166.
50. Henri Bergson, *L'évolution créatrice* (Paris: Presses Universitaires de France, 1991), 157. (catalogue.bnf.fr/ark:/12148/cb372376370).
51. Ibid., 158. For the translation I consulted Henri Bergson, *Creative Evolution*, trans. Arthur Mitchell (New York: Modern Library, 1944).
52. Ibid., 157.
53. Gilles Deleuze, and Félix Guattari, *A Thousand Plateaus,* trans. Brian Massumi (Minneapolis: University of Minnesota Press, 1987), 476.
54. Ibid., 475–477.
55. Ibid., 479–480.
56. Leopold Lambert, 'Processes of Smoothing and Striation of Space in Urban Warfare', *the funambulist. net*. https://thefunambulist.net [accessed, 10 August 2017].
57. Deleuze and Guattari, *A Thousand Plateaus*, 3–25.
58. Lars Spuybroek, *The Architecture of Continuity: Essays and Conversations* (Rotterdam: V2_Publishing, 2008), 209.
59. J.A.A. Hunter and J.B. Finlay, 'Scanning electron microscopy of normal human scar tissue and keloids', *British Journal Surgery* 63, no. 10 (1976): 826–830.
60. Thomas J. Krizek et al., 'Biology of Tissue Injury and Repair', in *Plastic, Maxillofacial and Reconstructive Surgery,* ed. G. S. Gregoriade, R. Riefkohl and S. L. Levin (Philadelphia: Williams & Wilkins, 1997), 3–4.
61. Steven D. Pieper, 'More than Skin Deep: Physical Modelling of Facial Tissue' (Master's Thesis, MIT, 1989), 10.
62. Hunter and Finlay, 'Scanning electron microscopy of scars', 826–830.
63. F. Nurnberger, and G. Muller, 'So-Called Cellulite: An Invented Disease', *Dermatological Surgery* 4, no.3 (1978), 221–229; and Bernard Querleux, Céline Cornillon, Odile Jolivet, and Jacques Bittoun, 'Anatomy and physiology of subcutaneous adipose tissue by in vivo magnetic resonance imaging and spectroscopy: Relationships with sex and presence of cellulite', *Skin Research and Technology* 8 (2002), 118–124.
64. Luigino Benetazzo, Andrea Bizzego, Raffaele De Caro, Guglielmo Frigo, Diego Guidolin, Carla Stecco, '3D reconstruction of the crural and thoracolumbar fasciae', *Surgical and Radiologic Anatomy* 33 (2011): 855.
65. Hunter and Finlay, 'Scanning electron microscopy of scars', 828.
66. H.A. Linares, C.W. Kischer, M. Dobrkovsky, D.L. Larson, 'The Histiotypic Organization of the Hypertrophic Scar in Humans', *Journal of Investigative Dermatology* 59, no.4 (1972), 323–331.
67. Rei Ogawa, and Dennis P. Orgill, 'Mechanobiology of Cutaneous Wound Healing and Scarring' in *Bioengineering Research of Chronic Wounds. Studies in Mechanobiology, Tissue Engineering and Biomaterials, vol 1*, ed. Amit Gefen(Berlin: Springer, 2009): 37.
68. Hunter and Finlay, 'Scanning electron microscopy of scars'.
69. Elliot T. Weiss, et al., 'Successful Treatment of Atrophic Postoperative and Traumatic Scarring With Carbon Dioxide Ablative Fractional Resurfacing', *Archives of Dermatol*ogy 146, no.2 (2010), 133–140.
    In the algorithm, the 'depressed scar process' is considered to be a procedural pole separate from the 'normal scar process', because of their difference in the quantity of produced collagen and formal results.
70. D. M. Davies, 'Scars, Hypertrophic Scars, and Keloids', *British Medical Journal* (1985): 1056-1058, and D.J. Crockett, 'Scars', *The British Medical Journal* (1974): 648–651.
71. Bilsev Ince, Mehmet Dadaci, Pembe Oltulu, Zeynep Altuntas, and Fatma Bilgen, 'Effects of Dermal Thickness on Scars in Women with Type III–IV Fitzpatrick Skin', *Aesthetic Plastic Surgery* 39, no.3 (2015): 318-324.
72. Alicia Pérez-Bustillo, et al., 'Surgical principles for achieving a functional and cosmetically acceptable scar', *Actas Dermo-Sifiliográficas* 104, no. 1 (2013): 17–28; Crockett, 'Scars'.
73. Satoshi Akaishi, Masataka Akimoto, Rei Ogawa, and Hiko Hyakusoku, 'The relationship between keloid growth pattern and stretching tension: visual analysis using the finite element method', *Annals of plastic*

surgery 60, no. 4 (2008): 451.

74. Hunter and Finlay, 'Scanning electron microscopy of scars'.
75. John A. Zitelli, 'Secondary Intention Healing: An Alternative to Surgical Repair', *Clinics in Dermatology*, vol. 2, issue 3 (1984): 92–106
76. H. Peter Lorenz, and Michael T. Longaker, 'Wounds: Pathology and Management', in *Essential Practice of Surgey,* ed. Jeffrey Norton et al. (New York: Springer Verlag, 2003), 84
77. Grasshopper is a visual programming language and environment, primarily used for generative algorithms and parametric modelling.
78. In the term 'skin-like structure', the 'skin' is used in a broad sense, meaning both the skin (epidermis and dermis) and its sublayers (hypodermis and deep fascia). Skin collaborates importantly with its sublayers, while the latter are highly implicated in the healing phenomenon, especially in the case of deep cuts.
79. Pieper, 'More than Skin Deep', 79.
80. The thought behind this correspondence was to use a set of lines intrinsic to the surface in a similar way that collagen lines (representing collagen concentrations) are intrinsic to our skin. In addition, the similarity of the organisation of the isoparametric field curves to the organisation of collagen lines made the translation of the relations between skin cutting features and formal generation feasible.

Biography

Athina Angelopoulou is a licensed architect and a post-graduate student of Theory of Knowledge in Architecture at National Technical University of Athens. Her research focuses on design methodologies, and on the design of lived bodies. Athina's most recent works on the design of monstrous bodies and on queering perspectives in architecture, have been presented in conferences at the University of Texas, Queen's University, and National Technical University of Athens. She is currently interested in design reasoning, cuts, catastrophes, accidents, and errors, and investigates how these may become part of an architectural thinking that embraces dis/continuity and destruction.