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Anatomical Theatre as Experimental Space

0. Architecture and Philosophy of Science

In recent years, universal claims have been confronted with an emphasis on the locality of scientific practice. The key word locality has mostly pointed to the scientists participating in the experiments, their materials, and their instruments, but the architecture which defines a locality in the first place received remarkably little consideration. It is often simply assumed that there are centres of calculation (laboratories, museums, etc.) in which the cycles of knowledge accumulation are organised through networks.[1]

For research on experimental systems, the architecture appears secondary. Accordingly, the concrete architecture of science is only consulted in explaining how it configures the identity of the scientific fields, how it facilitates, appropriates and presents the work,[2] yet the epistemological contribution of the locations – according to my thesis – goes well beyond facilitation and identity.

In some scientific work, the concept of the public sphere as the intersection of architecture and science has become clear, but it is too often the case that modern science as an open space is contrasted with

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1 Yet it is well known that the aesthetic characteristics of research stage settings must also prove suitable for the presentation and evaluation of factual or theoretical claims. Thus Nicholas Jardine does actually explain how important the architecture is for the philosophy of science, especially if one considers the aesthetics of the "scenes of inquiry," but he contents himself with a discussion of the Callon/Latour "Centers of Calculation." Nicholas Jardine. *The Scenes of Inquiry. On the Reality of Questions in the Sciences*. Oxford: Clarendon, 1991.

2 Peter Galison and Emily Thompson eds. *The Architecture of Science*. Cambridge, Mass.: MIT Press, 1999. Hans-Jörg Rheinberger and Michael Hagner understand the experimental system as the materiality of the research which leads to inscriptions. Hans-Jörg Rheinberger and Michael Hagner, eds. *Die Experimentalisierung des Lebens. Experimentalsysteme in den biologischen Wissenschaften. 1850/1950*. Berlin: Akademie Verlag, 1993.

science in the Middle Ages. Numerous architectonic filters refuse the "general public" access to these spaces.[3] Architectonic, epistemological and social *access* are interwoven in the idea of "openness."

Openness is an exciting, eventful spatial quality developing between the action of the living bodies and the action of the building blocks, and this is what I would now like to illustrate using the anatomic theatre as a case in point. For our concept of science, the public is essential, and especially the anatomic theatre makes a public space possible. The design of this theatre is therefore essential for a definition of what can be understood as revelatory, as openness, and as the public space. Modern science still greatly consists of the mysticism of revelation in the arcanum of power. A theatre can be a place of *revelatio*, it can be a location for the presentation of evidence. Such a theatre can, however, also be a place of dialogue. The fact that the location in the dialogue possesses a voice can be inferred from the key scene in which experimental anatomy distances itself from the old authorities.

1. Anatomic Theatre and what Took Place therein

In January 1540, Andreas Vesalius was performing a dissection before an enthusiastic public of two hundred international students and faculty members in a self-erected temporary theatre at the university of Bologne, while Matthaeus Curtius,[4] seated above their heads in the elevated professorial chair, was formally delivering an anatomy lecture. Although Vesalius' actual task was confined to demonstrating the parts of the body which were discussed in the lecture, a dispute erupted. Cur-

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3 Steven Sharpin has shown in his social history of truth that the "openness" is thoroughly ambivalent: in *Gresham House* it applied to gentlemen, but not for the "general public." Paula Findlen points out that at Ulisse Aldrovandi's, in line with Alberti's idea of the villa and the idealised study cabinets within (according to Mark Wigley the 'first truly private space'), women were not granted admission to the *Wunderkammer*. William Newman has shown that Andreas Libavius's plan for a laboratory, in spite of the uniform niches and the urban location, did not mark the end of alchemy: the alchemic monad is actually the basic design element in the ground plan of Libavius's laboratory. Libavius's laboratory separates off certain areas from the common masses in order to link the symbolic transmutational scheme of alchemy with the selection of the almost perfect.

4 An eyewitness account is given by Baldasar Heseler, a German student, who was present at the demonstrations and lectures. Ruben Eriksson, ed., trans. with intro. and notes. *Andreas Vesalius' First Public Anatomy at Bologna 1540. An Eyewitness Report*. Uppsala: Almquist & Wiksell, 1959.

Fig. 1: Claude Perrault, Frontispiece of his *Histoire des Animaux* (Paris, 1671). The illustration shows a visit of the king to the work rooms of the academy. The human skeleton in the centre is framed by animal skeletons. It stares at the skeletal globe in the foreground. The view through the right window shows the *Observatoire* in a state of construction.

tius emphasised the Galenic anatomy text whilst Vesalius insisted that the result of the dissection, laid plain for all to see, should be believed and not the authority of the text. According to Baldasar Heseler's account, Vesalius replied to Curtius: "even if that is not Galen's opinion, we shall however demonstrate here, that in fact it is so."[5]

The possibility of such a radical change from demonstration to experiment derived from the staging: the transposition of authority and method was performed by the room. A lecture manages with rhetorical, acoustic resources. Vesalius's dissection, on the other hand, is like a "lecture-performance"[6] in which that which is being shown marks the discursive steps which explain and comment upon the lecture. The gaze upon the particular bodily specimen acquires a distinguished status. This status and the gaze, like the anatomist's instruments and the openings and profile of the body, are the product of an architectonic operation. Naturally, the experimental architectonic operations also include the reduction of the theatrical space to the dimension of the drawing, the engraving, and the illustration.[7] The lecture room is consequently a place of experiment in which the realities are tested through presentation.

As a follow up to an execution, as a carnival or a theatrical performance, the anatomic theatres drew hundreds of spectators. The anatomical theatre buildings existing before the playhouses, namely in Montpellier from 1530 on, give evidence to the fact that experimental anatomy had become a cultural institution. The anatomical demonstrations thus served as a performative paradigm for the other experimental sci-

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5 Eriksson. *Andreas Vesalius*. 89.

6 See K. B. Roberts, "The Contexts of Anatomical Illustrations." *The Ingenious Machine of Nature. Four Centuries of Art and Anatomy*. Ed. Mimi Cazort, Monique Kornell, and K. B. Roberts. [Exhibit. cat.] Ottowa: National Gallery of Canada, 1996. 72.

7 Already in the 1960's, William Brockbank judged that anatomical theatre was the foundation site of natural science research and this for the very reason that in the Renaissance it was a point of interception between art and science. "It is closely connected not only with the history of medicine and of teaching, but also with the history of art. The theatre arose out of the stream of ideas which flowed through Italy at the time of the Renaissance. Its purpose was to offer a performance, for […] an anatomical dissection in those days was really more of a theatrical occasion than a lesson. The outstanding personalities and authorities of the town were invited to be present. It was the first laboratory, the first place where scientific research was carried out." William Brockbank. "Old Anatomical Theatres and What Took Place Therein." *Medical History* XII (1968): 371-84.

ences[8] to be reproduced, for instance, in the 18th century in the physics spectacles of Abbé Nollet.

What had begun with Vesalius led in the 17th and 18th century to two further revolutionary steps: firstly, demonstration before an ever larger public; secondly, tactile studies. Pierre Dionis and Joseph Guichard Du Verney set up special rooms in *Jardins de Plantes* from 1680[9] in which students could perform dissections, which, 100 years later, would lead to the *Birth of the Clinic*.

The performativity of spaces results from their being attempts at the production of experience – experiments in Bacon's sense – namely methodically ordered test series which arise through the planned alteration of the conditions of a particular phenomenon. In the spatial experiment, the performativity of the human actors is transferred to the theatrical machinery.[10] Schematically, the following forms can be dif-

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8 In scholastic times and continuing into the Renaissance the word 'experiment' is mostly used synonymously with 'experience' (experientia). Experiments meant in the present day sense are found in other expressions, e.g., *manuum industria* (Petrus Peregrinus de Maricourt). Roger Bacon (already) was extensively concerned with experience gained through instruments and apparatuses which were to give greater certainty than that gained by mere argument. Since this time, the use of the word experiment for experience gained through apparatus and test set-up has gradually taken hold. The weighing-scales most notably gain importance as a measuring and experimental instrument, as shown for example in Roger Bacon's *Scientia ponderum* and Nicolaus von Kues' *De staticis experimentis dialogues*. In this time the practice of experimenting is essentially influenced by techniques developing from alchemy and craft work, but also through new text genres like the dialogue. Francis Bacon then particularly clearly expresses the use of *experimentum* for the experience consciously brought about by human action, the *experiential questa*: "There remains simple experience which, if taken as it comes, is called accident, if sought for, experiment." Francis Bacon. *The New Organon and Related Writings*. Ed. and intro. Fulton H. Anderson. Indianapolis: Bobbs-Merrill, 1960. §82, 79. Bacon's realisation was that only methodologically ordered test series can be the basis of a systematic control of nature. According to Bacon, the principle for test series arise through the planned alteration of the conditions of a particular phenomenon. The performative element is thus transferred from the human actors to the theatrical machinery.

9 In 1691, Verney had a further ampitheatre erected as well as *salles de cours* in the *Jardin des Plantes*: "Grande Salle don't l'intérieur est garni de Bands disposez en amphitheatre." From 1706, there is a program for practical anatomy in *Hôtel Dieu*, a little later a comparable architectural concept is introduced – also for the medical orderlies – in *Hôtel des Invalides*. Cf. Toby Gelfand. "The 'Paris Manner' of Dissection. Student Anatomical Dissection in Early Eighteenth-Century Paris." *Bulletin of the History of Medicine* 46.2 (1972): 99-130.

10 Francis Bacon writes programmatically: "For I am building in the human understanding a true model of the world, such as it is in fact, not such as man's own rea-

ferentiated: (a) the arena form (Padua), (b) the amphitheatre form (Paris), and (c) the confrontational lecture-hall form (Altdorf).[11] Here the seating ascends linearly to one side in five spectator tiers. For most authors the concept of anatomic theatre thus describes a "room with ascending seating to allow the audience a clear view of the procedure being demonstrated."[12] It is said to be the origin of the modern "auditorium." Yet, also numbered among the prominent buildings is (d) the festival hall. Here the action took place on a single plane. The anatomical theatre of the university of Bologna, constructed by Antonio Levanti in 1639, created a space for the demonstrations in the centre of the room, like a dance floor. Benches resembling choir stalls are arranged in a quadrangle around the walls. The lectern for the theoretical lecture is raised up at the front of the room. While in the festival hall certain seats are still raised at the sides, in the (e) salon form, typical for academies, there is only a dissection table in the middle of the room with everyone involved moving freely around it.[13] In contrast to the festival hall, the representative constructions are informal, and the encounters with provisional exhibits intimate.

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son would have it to be; a thing which cannot be done without a very diligent dissection and anatomy of the world." Francis Bacon. *The Works of Francis Bacon*. 1860. 10 vols. Ed. James Spedding, Robert Leslie Ellis, and Douglas Denon Heath. Stuttgart: Frommann-Holzboog, 1989. 110. This anatomy of the world which Olaf Rudbeck was to take all too literally in the anatomic theatre of Uppsala is as a gesture reliant on an ordered space. Bacon's multifaceted description of a repository of knowledge contains a library, a zoological and botanical garden, an experimental laboratory and "a goodly, huge cabinet, wherein whatsoever the hand of man by exquisite art or engine hath made rare in stuff, form or motion; whatsoever singularity, chance, and the shuffle of things hath produced; whatsoever Nature hath wrought in things that want life and may be kept; shall be sorted and included." Francis Bacon. "Gesta Grayorum." [1594]. *Works*. Vol. 8, 335.

11 The Altdorf Academy, raised to the status of university in 1622, possessed a botanical garden, a large library and copious exhibitory collections. In Altdorf physics was studied for the first time experimentally and with a model. Altdorf also possessed the first chemical laboratory. The anatomical theatre is built on the model of the Roman private theatre: the corpse is pushed out from a preparation room to the space in front of the professors demonstration chair. Instrument cupboards, wall charts and skeleton form a flat front wall.

12 Konrad Rückbrod. "Das Anatomische Theater – Archetypus des modernen Hörsaals." *Medizinischer Monatsspiegel MERCK* (1974): 97-114.

13 In each case the respective building forms allow different scientific work. Often they correspond to a different institutional context: medicinal faculties (arena, amphitheatre, confrontational hall, festival hall), art colleges (amphitheatre), academies (festival hall, salon-form, amphitheatre).

In the following, I would like to emphasize the scientific importance of the salon for the history of science. With Descartes and Perrault, I want to learn from the salon form, why, on the one hand, perception is not simply the result of the positioning of motion and bodies, but requires an act of perception[14], and on the other hand, why this act of perception is less linked to bodies and intentions than it is to processes of spatial formation.

14 The concept of the act of perception tries to go beyond the absolutism of the media, which sees perception as a function of apparatuses and cultural patterns of order and beyond the human centred reaction, which clings to the concepts of 'mind' and 'reflection.' In this context a run through the Baroque concepts of theatre and perception seems advisable today. Well into the first half of the 18th century the word theatre is known to refer to more than buildings or the performances; it also refers to areas in the garden ornamented with water games and statues. Theatre in Baroque is a model of perception, which, on the one hand, means a reconstruction, an explanation for the way in which we perceive things as well as it is an idealised gauge according to which we carry out our perception. In this sense "theatre" highlights a piece of adapted nature for perception. The theatrical includes the construction of a space in which an object of display is produced and in which perception is demonstrated as a spatial mode of organisation. At the same time theatre is a "distance-keeping orientational model" in which the public, mediality and artificiality communicate an "awareness of the question of indefinable bodily dimensions of human life-experience." Helmar Schramm. "Theatralität und Öffentlichkeit – Vorstudien zur Begriffsgeschichte von 'Theater.'" *Weimarer Beiträge* 36.2 (1990): 223-39. Theatrical perception is differentiated here from the simple gaze, from seeing, in that it doesn't consider all being (*Daseiende*) as essential and existent, but investigates the actual constitution of the objects according to the circumstances. The theatre is a stage because there the constitution of the subject matter is presented as being generated from the circumstances. If the Greek *Theatron* still described the spectator room, the accent now moves to the stages so that the character of being produced for the spectacle side and for the spectator side the reification element in perception is set in a constellation in the Baroque version where the spectator, the perceived, and mimesis all meet up together. The scene is aligned through imitation with the dimensions of the cosmos. What theatre buildings have in common with books which don't have "theory" but "Theatrum" in the title is not only that they bring something to light and publish it, thereby wishing to justify the material, but at the same time, with this material and its publication, they conceive a symbol of the world. The Baroque meaning of theatre is connected with this theatricality of recognition. If the Renaissance still assumed the similarity of object and sign qua *convenientia* or *aemulatio*, in the 17th century reliance on the appearances as infalliable signs has considerably diminished. This loss of trust derives from experiments which show disparity between the outward appearance accessible to perception and the actual laws underlying the phenomenon. In this sense perception is an action.

2. Descartes

As the purpose of anatomy is to contemplate *les belles oeuvres de nature* and to see the inner organs clearly, Charles Estienne, a Parisian doctor who was educated in the humanities and familiar with Vitruv's writings, wrote as early as 1545 that in an anatomic theatre everyone should be able to see and move optimally and in the same way. "In a public spectacle, nothing perfect is ever to be found, if all that belongs to the theatre hasn't been made and disposed as reason commands."[15]

In accordance with this definition of the anatomical theatre, René Descartes' *Discours de la Méthode* (1637) replaces perception with doubt in order to perfect the former through reason. Doubt separates the perception from the impressions. The senses deliver only the simple impression of the outside world onto the various sections of our nervous system. This nervous system for Descartes is the interior furnishing, so to speak, of doubt.[16] Through experiment, the descriptive reason distances itself from the outer appearances. Descartes counters Kepler in this field, declaring that the soul does not calculate its distance from objects according to a "natural geometry," but rather places the angles of perception in relation to the rotation of the eyes, like a blind person with a stick who translates bodily movement into an intelligible sign.[17]

Dürer's idea, according to which perspective reveals the hidden order of the universe, does not convince Descartes either: he claims, the mechanical function of the eyes provokes in us the sensation of distance and depth, and the virtuality of depth can easily be proven by

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15 "Tout ainsi qu'en un spectacle publique iamais riê ne se trouve parfaict, si tout ce qui appartient au theatre n'est ainsi faict & disposé côme la raison le veult." Charles Estienne. "La dissection des parties du corps humain divisée en 3 livres […]." [1546] *L'Oeuvre de Charles Estienne et l'école anatomique Parisienne.* Ed. Pierre Huard and Mirko Drazen Grmek. Paris: Cercle du livre précieux, 1965. 373.

16 Description is a movement of association. There are no chains of similarity any more, but rather "chacun se persuade communément." René Descartes. "Le Monde." *Oeuvres complètes*. Vol. 13. Ed. Charles Adam and Paul Tannery. Paris: Vrin, 1999. 3.

17 Descartes compares the brain here with a church organ. It doesn't depend on the outward appearance, but on the distribution of air. Thus the visible parts which the anatomists distinguished in the brain substance could not explain the functioning of the brain. René Descartes. "L'Homme." *Oeuvres complètes*. Vol. 11, 161. Similarly he does not wish to derive the aesthetic feeling in music from a translation of the harmony of things, but speaks rather of arbitrary habits.

illusion in perspective.[18] For Descartes, space is then created only when there are sticks and lines and alignments.

At the same time, it is impossible to understand exactly what another person is expressing, even if we are completely acquainted with all their personal facial expressions. As Descartes says, everyone enters the theatre of the world masked.[19] The people walking by on the street could be disguised automata. Consequently, there is no external intention or truth preceding the mind's power of creation.[20] The intuition regulates doubt and fabrication.[21] If according to this intuition, only that which I clearly and distinctly register is true, then, in the physical world, the extended body can only be clearly and distinctly known if it is understood in its inner construction. Its shape is a function of the limits of its extension and of the alteration in situation, (substance, duration, and quantity), while colour, sound, smell, taste and touch qualities are blurred and obfuscated and possibly ideas of "non-things." The *Perceptio clara et distincta* is consequently a construction, always related to the contrast with the exposed illusion.[22] For such games of illusion, Descartes' imagination constantly produces rooms, apartments with mirrors, complete cities in an almost surreal manner. For Descartes, architecture as automation is the core of the world comedy.[23] The *Dis-*

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18 Descartes. "L'Homme." 161.

19 "Ut comoedi, montiti ne in fronte appareat pudor, personam induunt: sic ego, hoc mundi theatrum conscensurus, in quo hactenus spectator extiti, larvatus prodeo." René Descartes. "Cogitationes privatae." *Oeuvres complètes*. Vol. 10, 213. My translation.

20 We can understand that the automata both reveal to us that life is soley a mechanism (animals are only machines), and that these mechanisms are based on artificial invention. In applying our efforts to the basic rules of understanding, our affective interpretation meets with the mechanical invention, (autonomy and happiness). René Descartes. "Discours de la méthode." *Oeuvres complètes*. Vol. 6, 19.

21 Intuition for Descartes is not the passing evidence of the senses and the deceptive judgement which relies on the muddled images of the sensory perception (*imagination*), but rather such a simple and distinct apprehension by the pure and attentive mind that there can no longer be any doubt about what is thus recognised. René Descartes. "Regulae ad directionem ingenii." *Oeuvres complètes*. Vol. 10, 366-68. As an example of such a lofty apprehension Descartes presents the intuition that the sphere has one single surface. But how do I know this?

22 His theatrical metaphor implies that the mind remains an observer of the motion which is created in the world of extensions and that the limitedness of the physical bodies and their interrelatedness is an object of creation, the latter however incite interpretational observation. Still these bodies create the passions which affect the soul so that this can be directed by the surprise, admiration, certain blood circulation etc. caused by the objects. Cf. Descartes. *Oeuvres complètes*. Vol. 11, 420.

23 René Descartes. *Oeuvres complètes*. Vol. 7, 563.

cours de la méthode explains how one can only comprehend the world as a game of mere appearances and fictive truths when one becomes an observer rather than an actor.[24] In order to see the world as a comedy, one must withdraw from it and understand it as architecture. Thinking is the performance of the world as architecture.

Consequently, on the 10th of November, 1619, Descartes finds himself in a closed room and there he creates the theatre of his mind. In this founding scene of scientific individualism, Descartes compares himself with an architect who sketches "*places regulières*" (geometrical architectural landscapes) on a vacant plain in his fantasy. He counterposes the beautifully ordered works of the architect with the scholastic towns thrown collectively together.[25]

The architect does not imitate anyone when he traces geometrical architectural landscapes on a plain in his fantasy. He produces a space. The architect's drawing, through his creativity, is capable of lending beauty, clarity, and perfection to his objects. Following Claudia Brodsky Lacour, we can see Descartes' thought excursions as the origin of modern philosophy. Brodsky Lacour leaves no room for doubting that the famous *cogito* describes an architectonic action.[26]

The building of foundations as a self-projection of reason does not describe a private structure, but rather an entrance.[27] Descartes' method imitates the singular performance of architecture for the very reason that this does not imitate anything, but rather lays foundations. Later in the *Meditationes*, Descartes sums up his efforts to find a "solid ground" upon which he could construct the "foundations" of his philosophy as the attempt running through all his work to imitate the architects:

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24 "Taschant d'y être spectateur plutost qu'acteur en toutes les Comèdies qui s`y iouent." Descartes. *Oeuvres complètes*. Vol. 6, 28.

25 Descartes. *Oeuvres complètes*. Vol. 6, 11.

26 "The image of a single architect drawing a comprehensive plan on a 'vacant plain' is the 'thought' Descartes opposes both to travel and to reading, the terms of the pseudo-opposition between the figurative book of the world and literal book learning." Claudia Brodsky Lacour. *Lines of Thought, Discourse, Architectonics, and the Origin of Modern Philosophy*. Durham: Duke University Press, 1996. 33.

27 The architecture of the self is at the same time a masking corresponding to the geometric costumes of the Baroque through which the self removed itself from body's decline. The costumes enhance the importance of appearance and completely hide the actual condition. The human appearance is staged as an artificial splendid ornament composed of geometrical figures. As the perfect expression of the significant immortal I, the baroque costume balances the carefully trained posture, gestures and gait with the geometrically designed landscaped spaces surrounding the castles, gardens and parks in the ceremonies, processions, ballets, and festivals.

"Testatus sum ubique in meis scriptis, me Architectos in eo imitari, quòd, ut solida aedificia construant, in locis ubi faxum, vel argilla, vel aliud quodcunque firmum solum arenosâ superficie contectum est, fossas primum excavent […], ut deinde in solo firmo ponant fundamenta. Sic enim ego dubia omnia, instar arenae, primum rejeci." ("Throughout my writings I have made it clear that my method imitates that of the architect. When an architect wants to build a house which is stable on ground where there is sandy topsoil over underlying rock, or clay or some other firm base, he begins by digging out a set of trenches from which he removes the sand […] so that he can lay his foundations on firm soil. In the same way I began by taking everything that was doubtful and throwing it out, like sand").[28]

The act of the architectural – i.e. foundational – drawing is the image of a non-representative plan which at the same time is its execution. The plan is executed in the discursive realm. This plan-performance relation of the drawing combines reason ("qu'un ingénieur") with imaginative freedom ("trace à sa fantaisie"). This relation intervenes on a plain ("dans une pleine") where there is otherwise nothing.[29] But the plain is an external requirement. The order of the "places régulieres," it is true, are free from historical and physical limitations. But the plain, the image, is materially bound. In order for the surface to be freed, it must be mathematically redefined.[30] The Cartesian *Géométrie* is in this

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28 Descartes. *Oeuvres complètes*. Vol. 7, 536. Translation from: René Descartes. "Meditations on First Philosophy." *The Philosophical Writings of Descartes*. Vol. 2. Trans. John Cottingham, Robert Stoothoff, and Dugald Murdoch. Cambridge: Cambridge University Press, 1991. 366. Cf. Daniel Payot. *Le philosophe et l'architecte. Sur quelques déterminations philosophiques de l'idée d'architecture*. Paris: Aubier Montaigne, 1982. 116. Payot says Descartes imitates architects in that they self-generating (*auto-géniteurs*) don't imitate anything.

29 All quotations: Descartes. *Oeuvres complètes*. Vol. 6, 11-12.

30 In conceiving of the 'squares' and 'cubes' as not being two or three dimensional figures, but rather as multiplications of the lines with themselves, Descartes breaks with the restriction of polynomial equations (to an order of three). If one now understands orders as a representation of extensions in one dimension only, they can be described for each value so that the other dimensions are free to represent variables. If Descartes remains interested in the reality of physical space defined as dimension and magnitude, his reinterpretation of the orders as magnitudes opens a new approach to dimension as a graphical resource. His conceiving anew the orders of equations made multivariable equations clearly and distinctly visible by linking the variables to geometrical dimensions. Descartes' geometry was able to make complex and more complicated equations graphically visible by translating geometric figures into equations without being limited by the linear incommensurability. This conversion possibility was based on a technical adjustment in the notation which consisted in an altered perception of the relationship between

sense the counterpart to the narrative passages of the *Discourse*, as it casts the bridge from the plan to its discursive execution. With Cartesian geometry, figures previously unimaginable in two dimensions can be drawn. In simultaneously developing a new technique to speak about these figures – equations with two unknowns – Descartes was able to refer the algebraic notation to the knowledge of the physical world. The combination of conceptual and technical transformation described the outer world as the result of an act of perception (namely as forms which could be sketched with the help of a ruler and a compass given an arbitrarily determined line segment unit, two unknowns and their disposition along the coordinating axis) which corresponds to the *places régulières* of the fictitious architects.[31]

The problem of the materiality of the surface doesn't first appear on the architect's paper but exists already in his brain. In the fifth chapter of the *Discours* Descartes gets down to explaining the nature of material objects and does this through the same architectonic thought experiment: in order to speak of light, of the heavens' vaults, of earthly bodies and finally of the human being who contemplates all these things, while at the same time evading the scholarly battles, Descartes decides once again to leave things in obscurity [*ombrager un peu toutes ces choses*] and to simply focus on "what would happen in a new world."[32]

If there were physical bodies in this imaginary new world, without souls, but in all other ways just like our own, then, according to the natural laws of mechanics, these would demonstrate the same functions. Even if we were to equip a machine so that it aped us, uttered words, and cried out that it was being hurt, this machine, even if it were to do some things better than we can, would act solely according to the disposition of its organs. Man, says Descartes, is not a machine because he possesses a universal instrument.[33] Reason, in its withdrawn cham-

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number and space. By combining the architectonic geometric form with the discursive, algebraic notation, Descartes expanded both conceptual modalities well beyond their previous restrictions.

31 The increased power of mathematics to describe external natural phenomena (through the coordination of algebra and geometry) increased for Descartes the power of thinking. "Cartesian notation saves time for the mind." Brodsky Lacour. *Lines of Thought*. 67.

32 Descartes. *Oeuvres complètes*. Vol. 6, 42. This imaginary world would only have to contain material, movement and natural laws and it would inevitably order itself according to the form which could appear similar to our cosmos ("pûst paroitre tout semblable").

33 "Car, au lieu que la raison est un instrument universel, qui peut servir en toutes

ber (the famous *glande pinéale*), is capable of overcoming limitations through projection, but it remains, like the fantasy of the architects, dependent on the material elements of its performance. So the mind, concludes Descartes, is so dependent on temperament and the physical disposition that in order to make people wiser and more mentally agile, medicinal remedies must be contemplated.[34]

On the other hand, in the sixth chapter of the *Discours*, architecture proves to be a link between geometry and medicine. Here Descartes calls upon those of his readers not versed in any way in anatomy to have the heart of a large animal dissected before them before reading any further.[35] Only the sight of the organs of the non-rational animal functioning in the same way as our own shows to what measure our bodies are also ruled by solely mechanical laws – however, only if one actually sees in this organ what Descartes' text describes. This is only achieved through interpreting the sight-organ in a geometrical fashion. The section through the eye allows the sight to be manipulated as in an architectonic scenography. In two dimensions sight only responds to lines; movements become vectors. The scenography reduces the world to the distinguishing characteristics of membranes, nerves, glass and water, brightness and refraction, i.e. to lines.

With the aid of the drawings, Descartes focuses on the role of the optic nerves to explain the sense of sight. Herein lies the anatomic innovation of his approach. This allows him to cast doubt upon all similarities between the cerebral image and the object. Thus the disposition of the organ determines what can be perceived,[36] but not the execution

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sortes de rencontres, ces organs ont besoin de quelque particuliere disposition pour chaque action particuliere." Descartes. *Oeuvres complètes*. Vol. 6, 57.

34 "car mesme l'esprit depend si fort du temperament, & de la disposition des organes du cors, que s'il est possible de trouuer quelque moyen, qui rende communement les hommes plus sages & plus habiles qu'ils n'ont esté jusqu'icy ie croy que c'est dans la Medecine qu'on doit le chercher." Descartes. *Oeuvres complètes*. Vol. 6, 62.

35 "car il est en tous assez semblable a celuy de l'homme." Descartes. *Oeuvres complètes*. Vol. 6, 47.

36 "Ie desire, dis ie, que vous consideriez que ces fonction suiuent toutes naturellement, en cette Machine, de la seule disposition de ses organs " Descartes. *Oeuvres complètes*. Vol. 11. 202. The investigation of nerves and irritability in particular becomes a test for the situation of liveliness and of consciousness. The ideal must reflect itself in the brain and in the nerves. Advances in brain physiology and psychology in the 18th century are not thinkable without Descartes' initial contributions. Schiller for instance contemplates how physique conditions the development of ideas (*Über den Zusammenhang der tierischen Natur des Menschen mit seiner geisigen* (1780)). The ideal physique must prove to be the human one.

of the perception, which is a matter for the subject. For Descartes it follows from anatomy that for humans, body and mind are inseparably unified.[37] The mind depends upon the body's mechanics: "c'est l'ame qui voit & non pas l'oeil, & qu'elle ne voit immediatement que par l'entremise du cerueau." ("First, it is the soul which sees, and not the eye; and it does not see directly, but only by means of the brain."[38])

The brain is, so to speak, the inner projection plane for the motions – the camera obscura of the mind, since although the soul sees, it reacts in its external acts of perception to the configuration of the brain and the nerves. The perfecting of the sight through lenses, filter etc. is the result of an architectonic experiment in which the susceptibility of the senses to deception is overcome by the use of geometry. As in the camera obscura and the telescope, the necessary contrasts for clear and distinct perception must be constructed.[39] By showing how much knowledge of "external things" can be improved through a change in the "situation," the transparencies, or the disposition of the body, he also demonstrates the dignity of the universal machine, reason.

But in order to improve the mind of humanity as a whole, philosophy must pass into medicine. In order to liberate his method from the limitations of his own body, Descartes must publish it. Publication is the first step for the formation of experiential collectives.[40] When the causes of the most common experiences have been explained, he says,

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37 "Ame et corps […] sont jointes et unies." Descartes. *Oeuvres complètes*. Vol. 11, 120.

38 Descartes. *Oeuvres complètes*. Vol. 6, 141. Cf. 109. Translation from: Descartes. "Discourse on Method." *Philosophical Writings*. Vol. I, 172.

39 Thus Descartes calls for the arrangement of comparative bodies, in order to be able to perceive external bodies sufficiently separate from one another. For accessible bodies, the set-up should shift the object to be judged into the centre of a group, for the inaccessible a machine should fix the eye's movement: "qu'on aperçoiue le plus d'obiets qu'il est possible en mesme temps. […] afin de sçavoir vers quel costé il faudra, par aprés, tourner ses yeux pour regarer celuy d'entre eux qu'on voudra mieux considerer. […] Mais il est aysé si les obiets sont plus distinctement au trauers de la lunete ; & s'ils sont inaccessibles, de mettre la lunete sur une machine, qui serue a la tourner facilement vers tel endroit deerminè qu'on voudra." Descartes. *Oeuvres complètes*. Vol. 6, 163-64.

40 "[…] ie iugeois qu'il n'y auoit point de meilleur remede contre ces deux empeschemens, que de communiquer fidellement au public tout le peu que l'aurois trouué, & de conuier les bons esprits a tascher de passer plus outre, en contribuant, chascun selon son inclination & son pouuoir, aux experiences qu'il faudroit faire, & communiquant aussy au public toutes les choses qu'ils apprendroient, affin que les derniers commençant où les precedens auroient acheué, & ainsi ioignant les vies & les trauaux de plusiers, nous allassions tous ensemble beaucoup plus loin, que chascun en particulier ne sçauroit faire."

then communal efforts could also be made to explain the "circumstances" of the rare experiences. We can see from this comment that although in principle Descartes defines space only as extension, in the end he also attributes to it the other characteristics of the physical, so that a knowledge of the 'external things' becomes possible through collective experiments with the 'circumstances' on which the situation and the disposition of the bodies depend. Colours, tones, smells, taste, and tactile qualities are the 'plain' of the collective space. The publication of the method creates a space in which people are differentiated from automata through their observations.

At this point, it seems to me that Cartesian ideas on space as extended matter, on the body as a perceptual dispositive, on architecture and anatomy coincide: Descartes' method creates an internal space of imaginary contrast to the physical. Descartes devises his 'anatomical theatre, as script, as a path from geometry to the living body, whereby the very publication of this method as discourse turns to the architectonic fantasy through which people are able to liberate themselves from their circumstances.

3. Perrault

3.1 Cartesianism and Architectural Theory

Claude Perrault transposes Descartes' foundational movement to the realms of architectural theory and of physiology.[41] In each of these

41 It is true that Leonardo da Vinci had already thought about the similarities of the "sections" of bodies and buildings and influenced Bramante with knowledge gained through architectural and anatomic studies on the connection between section and structure, but Perrault's call to recognise the supporting role of reason in the empirical sciences also led to new kinds of insights which actually gave particular emphasis to the artificial. As a professed Cartesian, Perrault doubted that knowledge was derived primarily from the senses: "car bienque la connoissance du corps humain dépende principalement de son inspection […], la Raison fournit aussi des lumières pour s'y conduire qui ne servent pas seulement à s'éclairer sur l'usage des parties que l'on a trouvées, mais mesme sur la nécessité ou la probabilité de celles que l'on espère de découvrir […]. Il est nécessaire de joindre toujours les observations avec le Raisonnement." Claude Perrault. *Essais de Physique*. Paris, 1680-88. 325-27. His physiology lectures of the year 1651/2 comprise the starting point of his scientific career. "During these hectic times, Perrault went every day to the Rue de la Bûcherie where, in the new amphitheatre, he explained to the students the functions of the human body." Wolfgang Herrmann. *The Theory of Claude Perrault*. London: Zwemmer, 1973. 3.

fields Perrault grants the subject a supporting role in both the observation as well as in the representation – in order to free the imagination from false external dependencies in favour of a smooth plain. In the traditional architectural theory, such a dependency consisted above all in an intrinsic similarity between the macrocosm and the microcosm of buildings and body. According to this idea, our sense of beauty owes precisely to the presence of cosmic proportions. Perrault revolutionizes this basic assumption of classic aesthetics with a nominalist gesture in asserting that the proportional relations are arbitrary creations. No natural authority determines what pleases the eye. Perrault opens up beauty and proportion for innovation as they are based on nothing less than *fantaisie* – the Cartesian term for the free drawing of orders from the mind.[42] Consequently, the evidence of that which pleases relies on methodical planning if one wants to avoid the fixation on generally accepted harmonies. What the eye 'knows,' as opposed to what it sees, is a pattern which it has learned to recognize. Thus the training of the organ becomes relevant. While everyone can recognize 'positive beauty,' the perception of 'arbitrary beauty' requires the development of taste, a structuring of aesthetical judgment which is directly comparable to the scientific method which Descartes seeks to establish with his 'plan' (dessein). Once freed from the restrictions of resemblance and general perceptions, the aesthetic theory can describe the mechanisms through which arbitrary beauty becomes an acquired taste. Perrault defines two axes of pleasure in architectural form: habit (acoutûmance) and closeness (compagnie). In the first case, the taste is reinforced through repetition over time. In the second case, it is transferred by spatial association: the mind links two different things in transferring familiar values between adjacent objects. Like Descartes, Perrault also takes the 'average' as a starting point.[43] This arbitrary measure doesn't correspond to any external order, but it determines precisely the relations composing a concrete whole.[44] Perrault defines

42 Claude Perrault. *Les dix livres d'architecture de Vitruve*. Paris, 1684. 120.

43 The rejection of the architectural innovation as a departure from the imitation of the ancients is based on the false supposition that non-imitative works must necessarily be bizarre and capricious. Digressing from Vitruv and tradition, Perrault proposes one third of the columns diameter as a measuring unit in order that the proportional relations could be represented by the simplest means, namely by whole numbers.

44 Like the proportional relations represented by mathematical orders in the new notation of Descartes' equations, the proportions in Perrault's theory of architecture are also primarily arbitrary intellectual constructions and secondarily linear configurations. In fact Perrault refused to 'correct' these relations for the senses

architecture as an act which, in the drawing, combines the practice of executing the plan and the theory of appropriate proportions. In activating an arbitrary system retained by simple *mémorisation* (integration), the hand produces certain lines determined exclusively by the mind. These lines locate the exterior of the object in the interior of the gaze. Architecture is thus transposed to the mind in the way Descartes imagined it: it becomes the line of reasoning of thought. The execution of the plan is a development of the interior.[45] Thus modern architecture, according to Perrault, does not represent, but rather invents and produces the mind.

3.2. The Observatory

The planned execution of the interior is the basis of scientific acts. Although the observatory built by Claude Perrault from 1667 onward was primarily intended as an astrological observatory, it was in fact to serve the whole academy as a work station.[46] In defiance of specialization, the building defines the academy through its collective acts of testifying and controlling as a "community of people who have eyes for such things […] and hands to find them."[47]

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and so contradicts, in the best Cartesian sense, the entire visual tradition which considers that architecture must include a correction for the natural optical deformations experienced by the viewing body. The idea that the proportions themselves must be deformed to generate the sensory impression of regularity doesn't make sense to a Cartesian who knows that the seeing takes place in the mind. The "correction" was much more a learning and memory process. Perrault opposes time-wasting learning and recalling with rapid recognition which frees the mind from the strictures of apparent matter, whether it be a line segment or a building.

45 Brodsky Lacour. *Lines of Thought*. 132-33.

46 Although in Perrault's lifetime most dissections were performed in the *Bibliothèque du Roi* or in the *Jardin des Plantes*, it is clearly established that the academy's activities were to move later to the Observatoire.

47 It is beyond doubt that Perrault, Jean Pecquet and Adrien Auzout actively participated in these experiments. The academy had made it their rule that the control of an experiment was a collective act. No publications were authorised of "Mémoires qui ne contiennent pas de faits qui n'aient été vérifiés par toute une Compagnie, composée de gens qui ont des yeux pour ces sortes de choses." Claude Perrault. *Mémoires pour servir à l'histoire des animaux*. Paris, 1733. Part I. 8. Followed by: "après avoir fait les dissections ensemble, les membres de la Compagnie entendaient chaque mercredi la lecture des descriptions anatomiques auxquelles Perrault ajoutait souvent ses propres réflections." Archives de l'Académie des Sciences. *Registres manuscrits*. 1676 (11 mars), F78. Scientific work at home was not unusual. Dissection and vivisection experiments were per-

Like the later Parisian *Collège Royal*, the Oxford *Ashmolean Museum* or the Petersburger Kunstkammer (cabinet of curiosities),[48] the *Observatoire* is simultaneously a machine of observation, a stage of representation and a symbolic space in which the various sciences are brought to cooperate according to an architectonic of knowledge.[49]

Perrault's outline corresponds to the organization of knowledge which Descartes develops in his *Discours* where he deals with the question of the nature of things, starting with a theory of light, passing through the heavens' vaults to the earthly bodies and finishing up with the human being. According to Descartes, it is a human peculiarity to observe the nature of things. Thus it follows that humans exist only within an observatory.

Perrault's first drafts say virtually nothing about the use of the three floors: what is clear is that the actual astronomic instruments should rise up from the flat roof; beneath this, in the second floor of this building oriented along the meridian, sophisticated openings for light

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formed at Montmor's by Pecquet, at Melchisédech Thévenot's by Nicolaus Sténon, at Pierre Michon Bourdelot's and at Denis'. However, it was most notable in the *Jardin du Roi* that anatomy and botany found exceptionally good working conditions. Cf. Joseph Schiller. "Les laboratories d'anatomie et de botanique à l'Académie des Sciences au XVII siècle." *Revue d'Histoire des Sciences* 42 (1964): 105.

48 Also worth mentioning are the academy buildings in Berlin and Vienna. The *Ashmolean Museum* (1679-1683) was as much influenced by Giulio Camillo's memory theatre as by Samuel Quiccheberg: in the basement there were chemistry laboratories, on the ground floor a school for natural history, on the first floor the museum, above this the library. The highlight of the royal collections was the Kunstkammer and library of Peter the Great in Saint Petersburg, with the adjacent academy of sciences (1718-34). A three-storey library and the museum were annexed to the other side of the elliptical anatomic theatres with spectator galleries in the upper stories. The tower accommodated an immense globe and no less than three observatories. Vertical communication was possible within the tower, but also via two lateral staircases, so that the access to the centre always led through the library or museum rooms. Both had galleries. Peter the Great had already planned to add a further academy of art and architecture to the physics laboratories, instrument collections and lecture halls, but this only came to pass after his death in 1725. Thomas A. Markus. *Buildings & Power, Freedom and Control in the Origin of Modern Building Types*. London: Routledge, 1993. 190.

49 In Perrault's time anatomical experiments on plants and animals were also performed in the *Observatoire*. Schiller. *Les laboratories d'anatomie*. 97, 114. Michael Petzet. *Claude Perrault und die Architektur des Sonnenkönigs. Der Louvre König Ludwigs XIV und das Werk Claude Perraults*. Munich: Deutscher Kunstverlag, 2000. 371.

were constructed, incorporating sun clocks and a planetary calender.[50] The library and the machine collection were situated on the top floor. On one of these machines Perrault once explained the anatomy of the tongue movement of the green woodpecker. The large salons were intended as assembly halls and laboratories.[51] The basement rooms were designed for chemical and physical experiments. The academy's *Procès Verbaux* from the 27th of August, 1690, report on the visit of the English king to whom the academy demonstrated all their activities. The demonstration of knowledge served a political if not a military purpose: according to Colbert, this citadel of sciences is the pendant of the triumphal arch which glorifies the earthly conquests of the armies of Louis XIV: "Arc de triomphe pour les conquests de terre – Observatoire pour les cieux," notes Colbert in 1669.[52] The conquest of the heavens by the sun king was to take its departure point here in observation. This concept of observation can be shown to derive from Descartes himself if the observatory is compared with its architectural model, Tycho Brahe's Uranienburg. Perrault does not simply want to create a building from which one can observe the heavens, but rather one which, as perfect spatial order, is the mind's foundation for clear and distinct observation.[53] To perfect the mind, the inner construction of the perceptive body must itself be an experiment in the Cartesian sense; Descartes with his "*ombrager les choses*" approach built the bridge from astronomy to anatomy. Perrault now moves this architecture of shadows from the realm of experiment of thought to an accessible landscape, basing it on the public exchange of experience, an aspect not considered in Tycho Brahe's princely island.

The observatory is the anatomy of the heavens. Thus the learned republic can correct mistakes by advancing from the form of appearance to the exact description of the inner structure. Perraults idea of an inner

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50 The centre of the building was denoted by the shaft of a winding staircase. This shaft was intended to indicate the zenith without the help of any further instruments.

51 Antoin Picon. *Claude Perrault ou la curiosité d'un classique*. Paris: Picard, 1988. 78, 202.

52 Pierre Clément. *Lettres, instructions et mémoirs de Colbert.* Paris, 1861-1873. 288. Petzet. *Claude Perrault.* 369. Even for contemporaries the observatory, containing no ornamentation whatsoever, appeared as a model of military architecture.

53 Picon reports with astonishment that Perrault seems to have anticipated Picard's instruments which were only devised in 1668, whilst John Flamsteed and Christopher Wren another eight years later built an observatory in Greenwich which use Brahesian instruments. Picon. *Claude Perrault*. 212.

structure takes its orientation from the Cartesian equivalent of body and space. The description of the size, form and situation of the body parts is at the centre of Perrault's physiology when he opposes the old conception, according to which the human is the measure of all things: it cannot by any means be claimed that mankind is better proportioned than the most deformed beast, claims Perrault, since the perfection of each thing depends upon the way it relates to the purpose for which it was made.[54] Thus Perrault made possible the transition from the cosmological idea to the morphological analysis of comparative anatomy. The comparative studies and the exact collective verification must construe a relationship between proportion and aim.[55]

Now I don't want to claim that the observatory is a Cartesian citadel. Perrault deviates from Descartes in some important points. Precisely because he does not proceed on the assumption of the existence of God, but rather takes as his departure point the diversity of the empirical, the point which then renders Descartes vulnerable, namely the interlocking of the human intellect with its organs, leads Perrault to a different conception.[56] While Descartes' mechanics ascribed only a force of inertia to the body, Perrault's theory of the body contains, in addition, at least toughness (*dureté*) and vigor (*ressort*). The configuration of elementary corpuscles characterizes each material differently: the finer and the flatter, the stronger the cohesion of corpuscles and the more spherical,

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54 "La perfection de chaque chose dépend du rapport qu'elle a à la fin pour laquelle elle a été faite […]. Il a fallu convenir d'une mesure et d'un module, de même que l'on fait en architecture: et considérant tout l'univers comme un grand et superbe édifice, qui a plusiers appartements d'une structure différente, on a choisi les proportions du plus noble pour régler tous les autres." Perrault. *Mémoires*. Preface. Cf. Picon. *Claude Perrault*. 61.

55 In order to correct the mistakes of the ancients and their Renaissance commentators, some strange experiments came to pass in the Académie des Sciences: because Plinius had claimed that the chameleon explodes with pure rage as soon as it happens upon a fig branch, "on fit monter le camèlèon sur un figuier savage poir voir si cela le renadait furieux […], mais il demaura aussi doux et aussi paisible qu'auparavant." Archives de l'Académie des Sciences. *Procès-Verbaux*. 1668. Vol. 4, fol. 233v.

56 This should also be seen in the context of the loner Lamy's theory about the bodily parts with no function. In his *Discours anatomique* Guillaume Lamy comes to the conclusion that nature tries out every possible combination of organs and simply allows the non-adapted species to waste away. In the end Lamy rejects any functionality ascribed to bodily structure. Guillaume Lamy. *Discours anatomiques* […] *avec des Réflexions sur les objections qu'on luy a faites contre sa manière de raisonner de la nature de l'homme et de l'usage des parties qui le composent*. Rouen, 1675.

the sooner they fall apart. According to Perrault, the main reason is the air-pressure and in this he follows Otto von Guericke's experiment on the vacuum. Thus Perrault replaces Descartes kinetic approach with a theory of momentum arising from the oppositional arrangements of the bodily parts.[57] The control system is not situated in the pineal gland, but rather in every part of the body. If the bodily machine resembles an organ[58] then the music originates not in the intention, but rather in the interplay. Perrault counters Descartes man-made machine with the infinite interconnection of mechanisms: "Tous les corps qui composent l'univers sont tellement serrés et presses les uns contre les autres, que pour attirer un corps, il n'y a qu'à lui faire une place, dans laquelle il est nécessairement poussé par les autres." ("All parts the universe is composed of are tightened and pressed against one another in such a way that in order to attach a new part one merely needs to clear a place for it in which it shall necessarily be compressed by the other parts.")[59] Thus in order to observe the details in nature, one only needs to clear an empty space corresponding to one of these singularities. So the experimental clearing of a space corresponds to the probability of an explanation. Perrault's leaving the individual rooms in the observatory largely undefined may be due to this intention. Temporary structures can create an appropriate place for the object of investigation in the midst of educated eyes. An elephant requires a different space than an otter.[60] In this way Perrault draws more radical consequences than Descartes from the role of the architectonic imagination, since he claims that there is always a multitude of possible models of explanation for physical experiments. The likelihood of the model depends upon the space which it renders to the specific configuration of matter, so that its observation and manipulation can be possible. Thus Perrault integrates precisely the diversity of the senses and their function in the experiment: the task of architecture is to bring the eye and the hand into

57 Whilst Descartes had also explained movement as a consequence of the muscle-contracting action of subtle mind-bodies (esprits animaux), for Perrault the activity of the nerves effects the opposite, namely relaxation. Perrault. *Essais de Physique*. 162. Picon. *Claude Perrault*. 73.

58 Additionally, quite consistently with the aforementioned, he grants the animals a soul. Perrault. *Mémoires*. Paris, 1733.

59 Perrault. *Essais de physique*. 138.

60 In 1681 the group around Claude Perrault had the elephant of Versailles dissected in *Jardin du Roi* in the presence of the king. A theatre is built for this purpose. Similar special contraptions befitting the object of investigation are designed for the *Bibliothèque du Roi*.

play in different ways – Perrault's anatomic salon facilitates 'seeing through' and understanding.

4. Experimental Spaces: Architecture, Action, Science

In conclusion, I would like to generalize my historic example. In order for something to be an observable, geometrically representable fact, it must correspond to a structure. The structure elevates the object from circumstances or its course. The object must then fit into a schema which presents it as a part of the world. This configuration of structure and schema is by no means obvious. It posits both an ordering as well as its circumvention.

Space structures the object by defining its profile even if this structure can neither be clearly reduced to the characteristics of a thing nor to the situational constellation of spatial qualities. In this sense perceived structural qualities are neither distinguishing characteristics of an object nor characteristics of a carrier which they further qualify. If, say, black represents a quality in this sense, then the ontological position of black is not given through that 'relational' moment where black is the characteristic of a wound, but black is rather more a quality in space without any further relation to a wound that has black as a distinguishing characteristic. The room's intervention is essentially subtraction, liberation, disclosure. The ability of space to act in this way does not rely in the first instance on the scalpel or the microscope, but is rather determined beforehand in the embodiment of perception. The dimensions of the exact conception and presentation are dependent on the experimental configuration of space.

If the body as a thinking instrument is the spatial reference point for Descartes as well as for Immanuel Kant in his orientational thinking, with Emmanuel Levinas and Foucault it becomes clear that the suffering and pleasure-taking body, more so than the doubting body, can be seen as the condition of existence. The staging of the body determines its possibilities of development. The gaze determines the body. The clinical glance turns the body into a piece of treatable information. According to whether the body is seen as being the origin or the manifestation of this information, individuality is the biography of the illness or its disciplination. Foucault sees the clinical organic body as a three dimensional space in which the toing and froing of the gaze between the visible sign of the illness and its residence in the organ tissue creates a demarcated volume. The gaze is in the body. Anatomy is a read-

ing through the forms which reduces the organic volumes to the area of the skin tissue and through this gaze approximates at the surface the organs to the mathematical model. The tissue surfaces are the perceptive correlate of the surface gaze. In so far as the surface is no longer the structure of the observer, but rather the figure of the observed, the gaze is imprinted into the tissue. With the creation of volume through the tactile gaze, new spaces open up with opaque masses. The principle of this gazing exercise is repetition which construes the individuality of the case from the observational process. Thereby the clinical project gives up the idea of the 'ideal observer,' which was inherent in the old medicine and replaces this ideality with the unlimited experience of the multitude of observers and cases. With the conception of the location of an illness, clinical empiricism becomes constituted by a different politics of location. According to Foucault, the hermeneutical practice in relation to the definite text surface corresponds to this medical empiricism.[61] This pre-clinical certainty, on the other hand, prefigures today's genetic concept of the body which reduces the bodily organization to sequence programming. Thus the gaze slinks out of the body and returns to the classic interpretation of essences. On the other hand the computerizing and genetic cartography reduces the organic body to a registration space.

The experimental space demarcates body, perception, and processes from one another in such a way that the differentiation between a thing and its circumstances is possible from a particular perspective. The situatedness of the gaze, e.g. the perspective, is transposed to the object as a mode of presentation. Thus the conditions of observation pass certain contingencies on to the object so that the perceived can be disputed. The disputation presupposes a certain space which not only demonstrates the diverse aspects of corporeality, but also presents the

61 "Ce qui est modifié donnant lieu à la médecine anatomo-clinique, ce n'est donc pas la simple surface de contact entre le sujet connaissant et l'objet connu; c'est la disposition plus générale du savoir qui détermine les positions réciproques et le jeu mutuel de celui qui doit connaître et de ce qui est à connaître. L'accès du regard médical à l'intérieur du corps malade n'est pas la continuation d'un mouvement d'approche qui se serait développé plus ou moins régulièrement depuis le jour où le regard, à peine savant, du premier médecin s'est porté de loin sur le corps du premier patient ; c'est le résultat d'une refonte au niveau du savoir lui-même, et non pas au niveau des connaissances, accumulées, affinées, approfondies, ajustées. […] Il ne s'agit pas du même jeu […]. L'expérience médicale va substituer, à l'enregistrement des fréquences, le repérage du point fixe […]. La notion de siège est substitué à celle de classe." Michel Foucault. *Naissance de la clinique. Une archéologie du regard médical.* Paris: PUF, 1963. 139-42.

fact of this diversity as an inner structure. Thus it defines the materiality of the disputation. The mode of presentation thereby both eliminates and articulates at the same time the physicality of the subject. In this sense the architecture of science is performative. Without anatomic theatres, the phenomenon of 'human bodies' as the structural equivalent of a three dimensional object turned inside out would not exist. Its mode of appearance would not be testable. There would be no collective of perception. Science differs from other forms of knowledge in its specific architecture which transforms contingency into necessity, in equating the surfaces of the object's structure with the surfaces of the anatomic mapping. This observational standardization results from modifications of the contrast. Once the results embody the experimental spatial order,[62] architecture has succeeded in automating the perceived and perception.

In order to guarantee reproducibility and consistency, the stage-setting creates a place of normality free of distortion; like the baroque drama, scientific architecture attempts to universalize this normal place, i.e. to impress everyone, if possible, with an undistorted gaze. Something internal appears in this as a medium sized body contrasted with a repertoire of profiles.

The possibility of a structure in space is indebted to a space in-between which is always part of perception (depending on certain curvatures and transparencies). The intermediary space as presentation of a difference between spatial view (internal) and corporeal view (external) causes the evidential experience.

The architectonic experiment consists of the planned alteration of modes of presentation. In the presentation the object takes on qualitative nuances in space which it lacks in an abstract reconstruction. Seen abstractly an object can be uniformly coloured, but presented in the light it will always appear with other colours, shadows, etc.

In addition, the variants in the amphitheatre forms suggest a particular political orientation of the observation, i.e. in the situation and organization of the collective observation. The observational apparatus determines the organisational form and the power to dispose of knowledge.

Buildings are thus only one side of the architectonic of space and body. Consequently, we should not only see buildings as aesthetic,

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62 At least six spatial sectors are thereby configured by the scientific architecture: 1. manipulation space (process, records), 2. observational space, 3. comparison space 4. application space, 5. social space (disputation), 6. literary space.

technical or investment objects, but primarily as social forms. As forms they produce power in at least three ways: a) The form of a building produces a powerful experience (monumental, sublime: churches).[63] (b) The form of the building organizes the actors by producing or structuring their relations – school and prison or strangers, visitors and inhabitants. Power arises through the asymmetries of access, control and appearance.[64] (c) The form embodies knowledge (*Observatoire*).

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63 Three component forms can be derived from Paul Frankl. *Entwicklungsphasen der Neueren Baukunst*. Leipzig: Teubner, 1914. 1. Spatial composition – the geometry of space. Its medium is the plan. 2. Mass and surface, the concrete material which forms the space. Frankl's term is '*Körperlichkeit*' (corporeality). 3. The effect of light, colour and other optical phenomena which produce alternating images with each focal point which fuse into one sensation in the mind. Only with the combination of these three components in architecture is meaning lent to the world.

64 In Charles Estienne's (1545) semi-circular form of the anatomic theatre (Vitruvian model with a proscenium and even a tarpaulin roof) three classes of spectators were separated in the public area through specified outer stairways: professors of medicine were closest to the dissection table, in the second row were the examination candidates, above this with no differentiation were the medical students, surgeons and the general public interested in natural science. The octagonal vaulted theatre from the end of the 17th Century built by the royal *Académie de la Chirurgie* in the Parisian *Rue des Cordeliers* preserved an astonishingly formal approach: the main entrance to the theatre led through a distinctive fissure in the seating tiers directly to the dissection table, while the public had to find their way to their seats through two narrow side entrances. In these circumstances the anatomist made a ceremonial entrance. The steeply ascending tiers of the anatomical theatre following the Paduan model avoided obstructions and gave the audience an almost horizontal view of the action, a maximal view of the cadaver. In flatter or in completely flat lecture halls as are common in schools, maximum eye contact between teacher and pupil is demanded. The movement from the fully circular theatre to the horse-shoe to the semi-circular lecture hall corresponds to an increasing asymmetry of power. The complete circular form totally embeds the teacher in the experience shared by the public, since for each participant the centrally directed gaze takes in those sitting opposite. As soon as the audience are sitting in a quadrangle arrangement and the entrance of the teacher is connected with a private laboratory or preparatory room which remains hidden from the public, an asymmetrical power abyss emerges between the teacher, sitting at the front, and the audience who are not present to one another whether they be sitting in a reduced semi-circle or in straight rows. This spatial arrangement ressembled the liturgical lay-out where the events in the choir and at the altar were hidden by a screen, most clearly in the orthodox iconostasis which completely shielded the sanctum. Markus. *Buildings & Power*. 232, 240. The growth of the scientific presentation through the proliferation of the theatre and its increasing size transformed the 'upper class theatre' into a public spectacle which is manifest in Gondoins anatomy theatre built to accommodate 1400 spectators. So far two types of power mechanisms have been recognised in the knowledge-producing buildings. In the anatomy theatre, the relation speaker/listeners only required a segregation

The spaces determine the scientific nature of the experiment through social and epistemic dimensions (possibility of universalism). On the other hand, it is the experiment which first constitutes with these spaces (the anatomy as) experimental science (possibility of concretizing). If the anatomical theatres of the Middle Ages and the Renaissance are compared with the achievements since the anatomic theatres of the *Académie Royale des Sciences* in Paris, then it can be seen that scientific paradigms change in accordance with their locations, but also in accordance with the recognition which may be generated by this change. It is only with the staging of experimental anatomy, with its access to experimental facts, that a cultural scheme is created which increases the probability of these facts.[65] Anatomic theatres have the

on the basis of a temporary status – no class relations, as generally speaking after the lecture the students were to be the lecturer's equals. By contrast, the institutions of infotainment and public instruction fixed a status differential, often further accentuated through class differences when connections between financing, selection and profiling were concerned. Whereas the general public, once granted admission, were to be amused in the anatomic theatres, special spaces, and preferential seating existed there for the professorial colleagues. In a third type, however, the teacher/listener relationship changes when the scientific and social space is divided, because the ideas, theories, and experiments are being discussed amongst equals. In the prestige laden societies, academies, and institutes, members present their ideas to equally eminent colleagues in a room which is simultaneously a meeting and a lecture space. Speakers and listeners were on an equal footing, close to one another, on the same level. At the same time the presidents had a supervisory function, but this did not automatically mean he had more authority, The mutually shared knowledge is not open for dispute, and access is withheld from others which can be read from the seating arrangements squashed up against the walls for assistants and helpers; these latter tucked away in the academy niches often seemed to belong to the furniture. The essence of social spaces is imprinted in the lecture halls. In order to increase the power of these halls through impenetrable control and demonstration, it is necessary that the visitors, the spectators, catch only a glimpse at a time of a body of control-knowledge. The fragment is presented in a dramatic spectacle. The interrelation of stage architecture and presentation provokes the experimental form. The functioning of prisons does not depend upon whether or not the inmates comprehend and acknowledge their meaning. These spaces classify and punish. In exactly the same way the scientific setups do not produce knowledge through cultural meanings, but rather through social configurations and by performing experimental programs.

65 There still exist posters that invite everyone to the anatomical theatre, who is interested to learn about the 'structure of man': "c'est le cas des cours d'anatomie dont certains sont publics et sont annoncés par voie d'affiche; d'autres sont ouverts à toute personne 'désirant s'instruire sur la structure de l'homme' (Affiche placardée le 18 avril 1747 par le Collège de chirurgie d'Orléans)." Charles Bedel and Pierre Huard. *Médecine et pharmacie au XVIIIe siècle*. Paris: Hermann, 1986. 203.

monopoly on the inner structure of the body (arbitrary). This they impart in exchange for the schema of general perception. At the same time, the architectonic definition of perception, corporeality and process define what counts as an experiment and also that it is the experiment which counts.

Translation: Shivaun Conroy

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