Anatomy and Anthropomorphism: Architecture and the Origins of Science

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Abstract

Since the writings of Vitruvius in the first century AD, the use of the human body as a metaphorical and symbolic referent has provided what is perhaps the most prolific trope for architectural theory. The image of 'Vitruvian Man,' with limbs outstretched to touch the circle drawn from its navel, took on particular significance during the Renaissance as architects published their own interpretations of Vitruvius' *Ten Books*. For these writers, the body, as microcosm, was the best available means for representing the order of the cosmos - the world as a whole. Yet, just as the body was being rediscovered as the primary referent for architecture, the understanding of the body was being transformed. Inherited medical texts, namely those of Galen, were being complemented by direct observation of the body through dissection. The published results of anatomical studies were highly influential, giving rise to new conceptions of bodily structure and function. As architects and anatomists exchanged metaphors, methods and images these new understandings of the body came also to affect architecture. The dissection of the body transformed ideas about the constitution of knowledge and about how that knowledge was to be obtained. The methods of anatomical study were fundamental to the then emergent discipline of science, models of cosmic unity were rendered untenable by the practice of partitioning. Moreover, the direct investigation of objects came to replace textual authority in the conception of both anatomy and architecture.

Introduction

The primary model for analogies between bodies and buildings is that of Vitruvian Man, with arms reaching out to touch the circle drawn from its centre.[1] The circle connects the outer parts of the body to the navel, the naturally given trace of its origin. The inherent unity of the circle is seen to reside in the body, with parts of the body combining to make up the whole. Vitruvius observes that this relation between parts and whole should also be observed in architecture, since nature was the model for the architecture of the Ancients.[2]

The correspondence of the parts to the whole is achieved through proportion, a numerical relationship to be observed in architecture.[3] The source of the architectural ideas presented by Vitruvius is no longer available to us but the models of unity inherent in the work reflect those occurring in the writings of Plato and Aristotle.

With Plato's transcendental philosophy the essence of man, the immortal soul, takes up its temporary position in the body and is to be found in the head, the place of reason. There it is complemented by the mortal soul, found within the body. The mortal soul has two distinct parts: one concerned with courage, passion, and love, to be found in the chest; the other being the lower, animal, part of man concerned with the hunger by which the body is sustained. Man is both soul and body together.[4] For Aristotle, the soul is what animated all living things. Man differs from animals in possessing the capacity for reason but both are alive because they are permeated by a soul. The soul is not transcendent but is to be found within; immanent in each and every living being. In its most basic form the soul is nutritive or vegetative, that is, it is able to feed and reproduce itself. The soul of animals is further capable of perception and sensation for which it uses the organs of the (animal) body. The soul is the purpose for which the body exists and since the parts, naturally adapted to their functions, combine to form the whole, their purposes contribute to the expression of the soul through the body. Aristotle applies to the body his own concept of unity as described in Book Eight of the *Poetics*. For Aristotle, the whole is an assembly of parts such that no part can be added nor removed without detracting from the whole. In order to understand the soul Aristotle studied the bodies of animals, taking them apart in order to understand the purpose of each part.[5]

This idea of the whole as a combination of parts that are both necessary and sufficient has proved highly influential. Architecturally, it is in order to achieve such wholeness that buildings should be like bodies. Vitruvius applies this notion of unity, not only to buildings, but also to the range of subjects that must be studied by the architect.[6] One of those subjects is history, which may be necessitated by the use of ornament, about which the architect "ought to render an account to inquirers." It is here that Vitruvius demonstrates a familiarity with the violent origins of architecture. The use of caryatids, for example, originates in the defeat of Caria by the Greeks, who then enslaved its women as a warning.

> And so the architects of that time designed for public buildings figures of matrons placed to carry burdens; in order that the punishment of the sin of the Cariatid women might be known to posterity and historically recorded.[7]

Similarly, after the Spartans defeated the Persians a colonnade was erected.[8] George Hersey argues that the violence implicit in these commemorations is typical of classical ornament.[9] In particular, he argues that ornament, rather than simply a remnant of obsolete construction techniques, is a trope of *sacrifice*. They originate in practices of war where tropes, in the form of trophies, were

erected on the battlefield.[10] This practice echoes the symbolic reassembly of parts of the animal during hunting, both as penance and to guarantee a future source of food by preventing the complete destruction of the animal. In a similar manner, the ornamentation of temples is seen to constitute a reassembly of the parts of sacrificial victims, enabling their bodies to endure in the details. These ornaments arose initially from the transformations of body parts, with teeth, bones, and skins becoming dentils, triglyphs, and tympana. They also arose from the decorations associated with sacrifice - Torus mouldings at the base of columns evolved from ropes used to bind feet and capitals were derived from ceremonial headdresses. Ornament served to immortalise the victims of sacrifice and of war. The purpose served is not purely memorial, but of committing to stone a record of the outcome, as confirmation of the propriety of suffering.[11]

The Body Reborn

With the spread of Christianity throughout Europe after the fall of the Roman Empire the dissection of human bodies was forbidden. Augustine denounced dissection, along with vivisection, as barbaric.[12] In academies where medicine was taught, such as Salerno in the eleventh and twelfth centuries, the bodies of pigs were used for anatomical demonstrations. However, in the early thirteenth century the practice of Natural Philosophy emerged, intended to counter the Cathar 'heresy' that all matter was evil.[13] Natural Philosophers strove to demonstrate that all of Nature's objects were part of God's creation and were, thus, imbued with the presence of God. Aristotle's ideas of design and teleology merged with the Platonic idea of the body as microcosm revealing the body of man, created in God's own image, as the end or goal of the process of creation. Although the body was liable to tempt the soul with earthly desires, it was nonetheless an expression of that soul in the world. As a consequence of this view the proscription against anatomising the human body was relaxed, for nowhere else could the full perfection of God's creation be seen. Thus, in the fourteenth century human bodies began to be used in anatomical demonstrations, such as those performed by Mundinus at the academy at Bologna. The anatomy lecture was a demonstration, both medical and philosophical, presented to students studying the two fields concurrently. Aristotle's work formed the foundation for philosophical instruction while the source of anatomical knowledge was the texts of Galen (a Roman physician from the Second Century AD). Galen's writings were the only surviving works on human anatomy available for this purpose. The combination of the two fields reveals the central importance of the anatomy lecture: to show the *body*, elaborated through Galen's text, as the place of the *soul*, explained through the writings of Aristotle. The format of the lecture involved the professor reading aloud from a text derived largely from Galen's originals. This was accompanied, or even followed, by the dissection of the body performed by a surgeon over a period of three days. In this

format, the professor did not need to engage with the corpse; it was merely there to confirm what appeared in the text. It was the text that was authoritative; there was nothing to be learnt from the body that did not already appear in writing. This method, followed for over 200 years, meant that Galen's writings were to form the foundation of anatomical practice during the Renaissance.

The sequence of dissection worked from the outside in, starting with those areas most liable to decomposition. However, this contrasts with Galen's suggestion that anatomy should be learnt by starting with the bones. Galen's text presents a decidedly structural model of the body, explained through the metaphor of body as building, no doubt instilled in him during education by his father.[14] Galen's father, Nicon of Pergamun, was connected with the building trade in the temple area of a town famous for its sanctuary of the healing god Asclepius.[15] Galen was clearly influenced by his surroundings in his choice of career but, as the following passage shows, he was also influenced by his father's profession.

> The nature of all the bones, as I said, is to be thoroughly learnt either from man, from the body of the ape, or better from both. Then one should move on to the anatomy of the muscles. For these two parts of the body underlie all the others, like the foundations of a building.[16]

Although Galen was interested in human anatomy much of his work was derived from the bodies of apes and other animals since the dissection of human bodies was not permitted in the Rome of his day. What knowledge of human anatomy he gained came from skeletal remains and from his appointment as physician to the gladiators.[17] Galen's writings focus upon structure and are full of architectural metaphors acquired from his father. And, following Aristotle, an understanding of the structure of parts is deemed essential in revealing their function.[18]

The arrival of the printing press in the fifteenth century led to a dramatic increase in the rate of dissemination of anatomical knowledge. Works published, however, were largely editions of, or variations on, Galen's originals. Further dissemination was enabled by the movement of dissections from the lecture halls and into theatres. Anatomy lectures evolved into demonstrations and attracted a wider audience. Perhaps the greatest contributor to anatomical knowledge during the Renaissance was Andreas Vesalius (1514-1564) who first studied medicine in Paris before going to Padua where he was appointed demonstrator or surgeon. He quickly gained recognition for his skills at dissecting and the drawings he made, to assist the demonstration, proved popular with the students. This inspired him to publish woodcuts for which he enlisted the help of Johannes Stephanus of Calcar, a student of Titian.[19] This lead eventually to what is now the best known work of anatomical illustration of the Renaissance *De Humani Corporis Fabrica* of 1543. While Vesalius was famed for his surgical precision, it was his willingness to disagree with authority that earned him notoriety. Cunningham recounts an incident where Vesalius, as demonstrator, begins to

express some of his own observations which were at variance with those given in the lecture. Yet rather than ceding to the authority of the professor and, hence, to the authority of Galen's text, Vesalius continued to follow his own course much to the delight of the students.[20] Vesalius' faith in his own skills led him to prefer the *evidence of the body* over that provided by the text. That does not mean that he rejected what was written but, rather, that he was determined to test what he had read using dissection. And in his willingness to confirm theoretical propositions with evidence, Vesalius' remained faithful to Galen's original project, even though it meant contradicting much of what had been written. Eventually, Vesalius came to realise the advantage he had over Galen, namely, that he had access to human bodies for dissection whereas Galen had had to resort to using apes. And, thus, he realised his own task, which was to develop for the first time a comprehensive anatomy of the *human* body; thus appeared the *Fabrica*. As the title suggests this is a work dedicated to describing the 'fabric' of the body, the material assembly from which actions and uses can be determined.[21] On the frontispiece, Vesalius is shown pointing upwards, suggesting that he is continuing the project of revealing the work of God.

The achievements of Vesalius are remembered as a significant part of the birth of science during the Renaissance - where great discoveries were made by great men using their innate 'genius' and rejecting the mantle of authority and tradition which had previously impeded others. Cunningham, however, argues that this is a nineteenth-century construct promoted in large part by Burckhardt's study of the Italian Renaissance published in 1860. Romantic ideals of individual creativity were projected back onto these discoveries with little concern for the social, cultural, economic and technological milieu within which they occurred. Ideals of genius, he argues, fail to explain why the anatomists chose to emulate the Ancients in the first place and, thus, why tension arose between text and body as alternative sources of authority.[22] Moreover, the idea that the Renaissance is an essentially secularising movement is not borne out by the intentions of the anatomists. The body was anatomised, says Cunningham, only as a means to better understand the soul contained therein:

> Every anatomist up to and well beyond the sixteenth century looked at the body as being, in one way or another, the instrument of the soul, and if they were interested in anatomizing it, it was *because* it was the instrument of the soul. [...] The soul is what anatomizing was about."[23]

In contrast, Cunningham suggests that developments in anatomy can better be understood in light of religious events at the time. Rather than describing those developments as an 'anatomical renaissance' he argues that they have much in common with the Reformation. Challenges to the authority of the church initiated by Erasmus and carried through by Luther centred upon the importance of individual interpretation. For Luther, Christianity was a religion of personal engagement where it was each individual's duty to read the Word of God -

available to them in the Bible.[24] The Bible, not the church, was the source of all authority:

> In his confrontation with the defenders of the Catholic Church, Luther's challenge was always for them to show - to literally point out with their finger - the texts in the bible on which their claims were built. Only this would count as authority to Luther.[25]

His was not a rejection of Christian faith but a stress on the importance of direct encounter with the Word. The search for an authentic church based upon the direct participation of each of its members. While there is no direct evidence to connect Vesalius with the reformed church, Cunningham suggests that Vesalius' innovations in anatomy reveal him to be acting as if he were a Lutheran. This is particularly evident in his frequent references to the human body as a 'text': "this true book of ours, the human body."[26] As such, the body is a source of authority available to be read by all. Cunningham writes:

> Not only does Vesalius insist on the primacy of 'the Word,' that is, the body, over written text and tradition but, like Luther with the Bible, he introduces touching and pointing, into both the practice of public anatomizing and its visual representation, as aids to witnessing the truth for oneself.[27]

Anatomical Space

Anatomy demonstrations enjoyed a popularity that went beyond mere interest in the workings of the body. In *The Body Emblazoned*[28] Jonathan Sawday explains that anatomisations were popular, public events attracting an educated cultural elite and arousing among them a combination of morbid and erotic fascination. To avoid the taboo against violating the body after death only those who had forfeited the right to integrity were dissected. The bodies of criminals, already punished through public acts of execution, were further partitioned to reveal their internal workings. Anatomisations came to replace more violent forms of partition that were used to ensure punishment of body and soul, thus, demonstrating the complicity between sovereign and divine power.[29] This gave the anatomists an agency that ensured their own status as they extracted atonement from criminals in the form of knowledge. Sawday writes:

> [A] natomization takes place so that, in lieu of a formerly complete 'body', a new 'body' of knowledge and understanding can be created. As the physical body is fragmented, so the body of understanding is held to be shaped and formed. [...] The anatomist, then, is the person who has reduced one body in order to understand its morphology, and thus to preserve morphology at a later date, in other bodies, elsewhere.[30]

In the rich symbolism that is the frontispiece of Vesalius' *Fabrica* the setting itself is made complicit in the demonstration. Most theatres at the time were circular or ovoid in plan - a geometry that derives in large part from the position of the body at its centre. Unlike other theatres the point of focus, the corpse, lay flat and was thus visible from above and from all sides. However, the Vesalian frontispiece, Sawday observes, depicts a 'cross-section' of an anatomy demonstration.

> It is as though the complete structure, the surrounding basilica [...] with its massive architectural supports, together with the concentric rings of benches, has been cross-sectioned along the diameter which passes through the cadaver.[31]

The sectioning is, in part, a pictorial device allowing the scene to be depicted with appropriate vertical hierarchy including the subtle gesture of Vesalius' finger raised skyward to indicate the divine source of what he reveals in the corpse. It also allows the return of the corpse to a near-vertical position, negating its death as it gazes fondly at its dissector. The sectioning suggests that what is being viewed is not a spatially isolated event but one whose significance reaches the heavens. At the centre of the drawing we see not a man but a woman, or more accurately, her womb, which Vesalius lays open for our inspection. Sawday argues that, with this frontispiece, Vesalius is challenging Copernicus' view of the universe which had been published earlier that year:

> In the *Fabrica*, the anatomical universe revolves around the conjunction of the womb and the tomb within the 'magnificent temple' - Copernicus' own phrase for the universe itself. It is not the sun, the title page of the *Fabrica* insists, which lies at the centre of the known universe. The world is neither geocentric, nor heliocentric, but uterocentric: the womb is our point of origin, hence its central placement in the image.[32]

The dissected body, combined with the skeleton located above it, present for the viewer a 'drama of life and death' - a reminder of their own mortality. The building itself is implicated in this drama: its sectioning revealing the cosmic implications of the anatomist's work. The innermost secret of the body, its location as the source of life, is laid bare by the anatomist and, with it, the concentric spheres of the cosmos. Along with the body, "the temple of anatomy [...] has itself been bisected for our instruction."[33] Far more than the viewpoint of the perspective representation, the sectioning gives a privileged view into the interior of body, building and world. The anatomists' knife reveals all - the spheres and their concentricity are visible all at once.

The reproductive capacities of the female body, writes Sawday, had been conquered and usurped by the creative capacities of the minds of men. Along with the image of Vitruvian Man, the idea of creative genius led the Renaissance to be regarded, by Burckhardt and others, as an age characterised by a unified sense of selfhood. Sawday, in contrast, argues that anatomisation was highly

influential and that the "the urge to particularize" reached into every form of cultural endeavour. The influence was so pervasive, he argues that the Renaissance can be regarded as a "culture of dissection."[34] He writes:

> [...] partition stretched into all forms of social and intellectual life: logic, rhetoric, painting, architecture, philosophy, medicine, as well as poetry, politics, the family and the state were all potential subjects for division... The pattern of all these different forms of division was derived from the human body."[35]

The images in the *Fabrica* and many contemporary anatomical texts owe as much to the means of inquiry as to the body itself. The interior is made visible by *opening* the body, the skin shown cut and folded back, thus, the *act* of dissection is described along with the results. To render the interior of the body using perspective, it is first necessary to overcome both its opacity and its compaction. That is, the body must be *spatialized*, opened and partitioned by the hand so that the eye can follow: "The body, then, has been carefully rearranged, with structures removed, or pushed to one side, or 'fractured' to enable art to intervene within the body cavity."[36] This spatialisation of the body transformed it from a compounded mass into an arrangement of parts whose relative positions could be shown. The three-dimensional complexity of the body and the depth beneath its surface is transformed into a two-dimensional image through a combination of dissection and perspective representation.[37] The penetration of vision into the body interior is only possible when preceded by the hands. The discontinuity of surface is lost as the interior of the body is revealed as an apportionment of space. Moreover, the spatiality of the body, as microcosm, becomes metonymic of space in general: "Space, the positioning of the body within a three-dimensional matrix, was the key to anatomical understanding. [...] The study of anatomy *was* the study of the organization of space."[38]

The importance of the spatial continuity between interior and exterior is revealed in illustrations which show flayed corpses standing in idyllic landscapes. Intended to show musculature, a crucial element of the *fabric* of the body, the images do away with the enclosure of the skin by omitting it altogether. Continuity is further emphasised by the fact that the figures are still alive, adopting the poses of classical statuary, unperturbed by their condition. In their equanimity the figures reveal a complicity in their own dissection. Sometimes this complicity is more literal as figures hold back their own skin to reveal interior organs. In this way the anatomists' involvement with death is effaced by the significance of what they reveal:

> Anatomy is shown to be a science which (contrary to what we might expect) seems to animate the body, and endow it (albeit temporarily) with a life of its own so that it could assist in the engaging spectacle of its own division.[39]

The images show a corpse that is neither a passive nor reluctant subject of anatomisation but is, instead, an accomplice to the process of revealing its

internal fabric. The absence of the anatomist from the images further emphasises this 'rhetoric of self-dissection.' The violence of anatomy is obviated as the corpse is shown to willingly give up its secrets without suffering. The 'naturalness' of the process is asserted where the body, despite being dissected, is able to retain its place amongst the world of the living. The classical ruins within the landscapes emphasise the continuity of the anatomical knowledge with that of the ancients whilst also stressing the inevitability of death and decay - the mutability of human affairs.[40]

Conquest of the Body

The symbolism of the Vesalian images serves to hide the violence behind the anatomisation of the body. What is presented as natural arises only as a result of the anatomists' negotiation of a variety of social and religious prohibitions in relation to the body. While resulting in ever more precise articulations of human anatomy, dissection involves a transgression of structures of unity. Thus "[...] a dissection might denote not the delicate separation of constituent structures, but a more violent 'reduction' into parts: a brutal dismemberment of people, things or ideas."[41] This is emphasised by the anatomists' involvement with the legally imposed violence of execution. By cutting up corpses the anatomists were violating the domain of the dead. An act that should have brought infamy and condemnation. This was avoided, in part, by using the bodies of executed criminals against whom the violence of dissection was a matter of justice but it was also because the anatomists offered, in exchange, a complete view of the body interior which could then be used to preserve the health of other bodies.

What made this violation of the dead necessary was the dangerous and mysterious nature of the body interior. Using *dead* bodies prevents the pain caused by vivisection and its association with torture.[42] For the same reason the common scientific strategy of experimenting upon one's own body was denied to the anatomists. To breach the interior of the body causes pain and possibly death. This threat marks the interior of the body as the most private of spaces. Moreover, explains Sawday, "[...] the interior recesses of the body are not merely private to others, but peculiarly private - that is expressly forbidden - to the owner or inhibitor of the body."[43] The interior of the body, despite being always present for us, is not available to us. It can neither be seen nor controlled. When the body interior becomes apparent it is usually indirectly via traces that find their way to the surface. Their appearance, while bringing the interior to our attention, further emphasises the mystery and danger of the body interior.[44] Thus, the body interior must be understood indirectly, endlessly deduced via representation and trace. The bodies of criminals, deemed to have forfeited the privacy of their interior, become the focus of an outwardly directed gaze. The

corpse, laid bare by the anatomist, becomes a reflection that alludes to our own interior. Sawday writes:

> [...] it is, perhaps, this very impossibility of gazing within our own bodies which makes the sight of the interior of other bodies so compelling. Denied direct experience of ourselves, we can only explore others in the hope (or the fear) that this other might also be us.[45]

Sawday describes the anatomical 'conquest' of the body as having its mythical counterpart in the story of Perseus and the Medusa. The Medusa, one of the three gorgons, would petrify anyone who saw her. Perseus was able to decapitate her with his sword by viewing her reflection in the polished shield given to him by Athene. The anatomist's knife and mirror, like the sword and shield of Perseus, were used to conquer the danger lying deep within the body, the sight of which brings death. The dangerous interior, like the Medusa, was conquered by indirection (using shield/mirror) and partition (sword/knife). What the Medusan myth also reveals is that the threat posed by the interior is more than that of dissolution and death. The Vesalian frontispiece shows the anatomist revealing the greatest mystery of the body, namely its creative capacity, occurring only within the female interior in the shape of the womb. "The Medusa," writes Sawday, "stands for fear of interiority; more often than not, a specifically male fear of the female interior."[46]

Renaissance Bodies

Throughout the Renaissance, while the image of Vitruvian Man was continually reiterated, the partitioning of the body in anatomy came to influence architectural theory. In the work of Francesco di Giorgo Martini, during the late fifteenth century, plans, facades, entablatures and whole cities are drawn with bodies superimposed. In one illustration Francesco shows a familiarity with anatomical illustration as a skeleton is juxtaposed with a figure showing proportion. Yet while the body is the source of principles these must be complemented by talent and experience applied in accordance with the discretion and guidance of the artist. In what is perhaps the best known of the renaissance texts - Leon Battista Alberti's *On the Art of Building in Ten Books*[47] - a detailed familiarity with the interior of the body is demonstrated. Alberti's descriptions of construction techniques make frequent, metaphorical reference to the body describing parts of the building as being like: bones, ligaments, flesh, and nerves.[48] This suggests a familiarity with Galen while frequent reference to the bodies of animals implies a familiarity with Aristotle's works.[49] So too does his explanation of beauty: "Beauty is that reasoned harmony of all the parts within a body so that nothing may be added, taken away, or altered, but for the worse."[50] In the books of Sebastiano Serlio, published from 1537 onwards, an attitude to surface that is clearly inspired by anatomy is demonstrated. For Serlio, knowledge of the

interior is vital for the correct representation of surface,[51] while surface is crucial for shielding from vision those parts that are necessary but unappealing.[52] Yet in Serlio's work the idea that principles are to be followed in accordance with the discretion and guidance of the artist is reiterated. In the work of Palladio the organic correspondence of interior and exterior is emphasised by the use of combined sections and elevations enabling both to be seen together juxtaposed in a single drawing.

Science and Method

While the 'culture of dissection' had made possible a new conception of the architectural interior, a more profound change was underway. Leonardo Benevolo, in his historical account of Renaissance Architecture, describes the emergence of modern science as constituting "crisis of sensibility."[53] The increasing precision of the description of the world in material terms was seen as having a more reliable access to truth. Correspondingly, whatever could not be studied in scientific terms was relegated to the realm of art.

> The rise of science, removed from the system of the arts its main argument for stability and social utility, ie. its value as a vehicle for knowledge; artistic mimesis could no longer be the imitation of reality and had to become the imitation of emotions.[54]

The effect upon architecture of this division was less extensive than that upon other arts such as painting or music. This was due, not only to the usual resistance to change caused by socio-technical methods of architectural production, but also to its lack of representational content. And since architecture could not direct the emotions as effectively as other arts, the crisis was manifest mostly in contentious differences in the 'guidance' of the architect. Benevolo explains:

> In reality the crisis of architectural culture, which was coming to a head during the 1620's, consisted in the collapse of the objective criteria of choice typical of recent tradition; these objective criteria were replaced not by other criteria of the same kind, but by tendentious proposals, and often by a number of conflicting and complementary ones; the outcome of this crisis was not the formation of a new common repertoire, as an alternative to the previous one, but the start of a debate for an indefinite period.[55]

This crisis is seen to result from the increasing influence of science at the time particularly with the publications of Galileo, Kepler, Bacon and Descartes in the early seventeenth century which described the motion of the earth and other planets. These ideas were reinforced by inventions such as the pocket watch, which allowed more precise divisions and measurements of objects, space and time. Yet the methods and metaphors for all of these forms of scientific inquiry

were heavily influenced by the anatomisation of the body. This is particularly evident in the work of René Descartes. As Sawday explains Descartes was familiar with the work of Vesalius and spent eleven years in Amsterdam at a time when public anatomy was at its peak.[56] Descartes did not, however, engage in these anatomies but, instead, resorted to the dissection of animal carcasses. In both his philosophical descriptions of the body and the mind it contained, as well as his enumerations of scientific method, the influence of dissection is readily apparent. Descartes' partitioning of the world into objects (*res extensa*) and mind (*res cogitans*) occurs most profoundly at the level of the body. The identity of the individual, the formerly complete unity of body and soul, is separated. Moreover, the separation is based upon the body's susceptibility to partitioning through dissection. Sawday writes:

> The impossibility of sustaining the 'link' between soul and body was itself based on a radical anatomy of the human subject. Indeed, it was the susceptibility of the body (as opposed to the mind) to the process of division which confirmed the distinction between body and mind inherent within the Cartesian project. Since bodies could be divided whilst minds appeared to be entirely resistant to division, then, as Descartes observed in the sixth of the *Meditations on the First Philosophy*, no matter that as a 'thinking thing' the subject may have perceived itself as 'one single and complete thing', the human subject was bifurcated.[57]

The body, relegated to the world of objects, is seen to act solely in accordance with the laws of mechanics. And, like a machine, the body could best be understood by taking it apart. Anything that was too complex to understand as a whole could be partitioned into its constituent elements. Thus, partitioning as a method of inquiry became central to Descartes' work. As a 'rule' of method he stated that he would "[...] divide each difficulty I should examine into as many parts as possible, and as would be required the better to solve it."[58] Although Descartes is remembered for formalising scientific method, the idea of partitioning was not new. Sawday describes, following Walter Ong, that 'method' emerged in response to the problem of the systematic organisation of knowledge.[59] While the arrangement of elements of discourse was necessitated by the invention of printing, the patterns of spatialisation and ordering were derived from the anatomised body: "[The] ordering of discourse was akin to the progressive partitioning of the body in anatomical demonstration, and thus indebted to a language of the body at every point."[60]

The revolution in the anatomical understanding of the human body epitomised by Vesalius' texts is a visible manifestation of a deeper revolution. Practitioners of anatomy emerged victorious in the confrontation between ancient texts and their own methods of direct visual evidence. With approval from the church, the anatomists managed to overcome taboos against the violation of corpses, offering in return a graphic demonstration of the wonder of God's creation. The delicate process of dissecting a body gave rise to an entirely new mode of investigation involving a systematic procedure of partitioning the subject and

recording the results. Dissection of the body provided the model for the organisation of knowledge. This gave rise to a whole new series of metaphors which allied intellectual clarity with the visual clarity that penetrated the body when unoccluded by the veil of skin.[61] In the analytic method of simplification through partition described by Descartes the influence of dissection is palpable. Similarly, the scientific process of the *tabulation* of information mimics the act of reducing a whole body to parts that are then arrayed across the dissection table.[62] In this way, the process of partitioning and describing the fabric of the body was replicated in the study of the natural world. For architects, the move away from textual authority was to prove problematic. Without an objective referent architects resorted to one of two alternatives: either adopting a variety of rules from nature applied according to their own discretion and guidance or revelling in the freedom brought about by the absence of rules. Attempts to provide a taxonomy of architectural design in the form of typological studies of the French Academy were of limited success.[63] So, too, were modernist efforts to ground architecture using the idea of 'function.'[64] Through dissection, the reduction of the body to an object amenable to partition, the use of anthropomorphism had been rendered untenable. For the dissected body, no longer animate, is insufficient for the purpose of anthropomorphism - the imparting to architecture of the living force of the body.

Notes and References

[1] Vitruvius [Marcus] Pollio, *De Architectura*, translated by F. Granger, London, Loeb Library, 1930. "Now the navel is naturally the exact centre of the body. For if a man lies on his back with hands and feet outspread, and the centre of a circle is placed on his navel, his figure [sic] and toes will be touched by the circumference. Also a square will be found described within the figure, in the same way as a round figure is produced. For if we measure from the sole of the foot to the top of the head, and apply the measure to the outstretched hands, the breadth will be found equal to the height, just like sites which are squared by rule." 3.1.3-4, p. 161.

[2] "In like fashion the members of temples ought to have dimensions of their several parts answering suitably to the general sum of their whole magnitude. Therefore if Nature has planned the human body so that the members correspond in their proportions to its complete configuration, the Ancients seem to have had reason in determining that in the execution of their works they should observe an exact adjustment of the several members to the general pattern of the plan. Therefore, since in all their works they handed down orders, they did so especially in building temples, the excellence and the faults of which usually endure for ages." 3.1.3-4, p. 161.

[3] "The planning of temples depends upon symmetry; and the method of this architects must diligently comprehend. It arises from proportion (which in Greek is called *analogia*). Proportion consists in taking a fixed module, in each case, both for the parts of a building and for the whole by which the method of symmetry is put into practice. For without symmetry and proportion no temple can have a regular plan; that is, it must have an exact proportion worked out after the fashion of the members of a finely-shaped human body." 3.1.1-2; p. 159.

[4] On Plato and Aristotle and their fundamental significance to western philosophy see Richard Tarnas, *The Passion of the Western Mind: Understanding the Ideas that Have Shaped Our World View*, Ballantine Books, New York, 1991. On the relation between body and soul in both Plato and Aristotle see Andrew Cunningham, *The Anatomical Renaissance: The Resurrection of the Anatomical Projects of the Ancients*, Scholar Press, Aldershot, 1997.

[5] This is explained as follows: "Now, as each of the parts of the body, like every other instrument, is for the sake of some purpose, viz., some action, it is evident that the body as a whole must exist for the sake of sawing and not sawing for the sake of the saw, because sawing is the using of the instrument, so in one way the body exists for the sake of the soul, and the parts of the body for the sake of those functions to which they are naturally adapted." Aristotle, *The Parts of Animals*, as quoted in Philip Steadman, *The Evolution Of Designs: Biological Analogy in Architecture and the Applied Arts*, Cambridge University Press, New York, 1979, p. 10.

[6] Countering the possible objection that the variety of subjects needed to be studied by an architect is too large, he argues that they must be perceived as interconnected, "For a general education is put together like one body from its members." Vitruvius *De Architectura*, 1.1.11, p. 17.

[7] Ibid., 1.1.5, p. 11.

[8] "There they placed statues of their captives in barbaric dress - punishing their pride with deserved insults - to support the roof, that their enemies might quake, fearing the workings of such bravery, and their fellow-citizens looking upon a pattern of manhood might by such glory be roused and prepared for the defence of freedom." Ibid., 1.1.6, p. 11.

[9] Hersey, *The Lost Meaning of Classical Architecture: Speculations on Ornament from Vitruvius to Venturi*, MIT Press, Cambridge, Massachusetts, 1988.

[10] "Trophies, that is to say manikins formed of the arms, weapons, and helmets of the slain enemy were set up to appease their shades and to prevent the gods from punishing the victors who had killed them. Their deaths were thus 'turned,' troped, from murders into sacrifices." Ibid., p. 9.

[11] "The human content of the Doric, Ionic, and Corinthian orders is both patent and implicit. But in Vitruvius, the more sculptural cousins of the three basic orders are fully anthropo- and gyneco-morphic. The elements of ancestral strife and the founding of buildings as a way of mediating or resolving that strife are also present. Indeed, the stories of the caryatid and Persian porticoes give to architecture a distinctly punitive aspect. They reinforce its role as the exhibitor of justice accomplished." Ibid., p. 75.

[12] Cunningham, *The Anatomical Renaissance*, p. 37.

[13] On the rise of Natural Philosophy and its relationship to anatomical practice see ibid., chapter 2, and passim.

[14] "The sequence of learning anatomy that Galen recommends in *On anatomical procedures*, was that one should first learn about the *bones*, because they play the same role in the human body as walls do in houses. That Galen took such a view of the relation of the skeleton to the flesh and organs may owe something to his experience of the building techniques of his time - the use of load-bearing pillars and beams, the space between them being filled in with curtain walls - and to the fact that his own father was an architect by profession." Ibid., p. 27.

[15] Owsei Temkin, *Galenism: Rise and Decline of a Medical Philosophy*, Cornell University Press, Ithaca and London, 1973, p. 3.

[16] Galen, as quoted in Cunningham, *The Anatomical Renaissance*, p. 27.

[17] A job which, remarks Porter, "enlarged his anatomical and surgical expertise, since wounds afforded windows onto the body." Porter, *The Greatest Benefit to Mankind*, Harper Collins, London, 1997, p. 73.

[18] "The thesis that Galen maintains in *On the use of parts* is that all the parts of the human body were made for a purpose; that they were made in the best way to fulfil that purpose; that this purpose is the evidence for, and the expression of, Nature's foresight and wisdom; and that anatomizing to reveal the *uses* of the parts is the key to both understanding and appreciating that purpose and hence the wisdom of nature." Ibid., p. 30.

[19] Ibid., p. 93.

[20] Ibid., pp. 103-111.

[21] It is, according to Cunningham, an '*anatomy of structure*': "What Vesalius sees is the human body, *built on and supported by* the bones, to which the *muscles are attached*; it has *great systems of vessels* (the veins, arteries, and nerves)." Ibid., p. 120.

[22] Ibid., pp. 191-197, and passim.

[23] Ibid., pp. 196-197.

[24] This was in part due to the proliferation of texts made possible by the production of the printing press circa. 1450. On the influence of printing, see Elizabeth L. Eisenstein, *The Printing Press as an Agent of Change: Communications and Cultural Transformations in Early-modern Europe*, Cambridge University Press, Cambridge, 1979.

[25] Ibid., p. 218.

[26] Ibid., p. 226.

[27] Ibid., p. 227.

[28] Jonathan Sawday, *The Body Emblazoned: Dissection and the Human Body in Renaissance Culture*, Routledge, London & New York, 1995.

[29] "The denial of burial [...] was intended to evoke an added dimension to capital punishment, in that it drew upon the widespread belief that lack of a proper burial was not merely a disgrace to offenders and their families, but involved the posthumous punishment of the criminal's soul which would not rest while the remains lay ungathered within sanctified ground." Ibid., p. 55. On the role of punishment as a demonstration of power, see Foucault, *Discipline and Punish*, passim.

[30] Sawday, *The Body Emblazoned*, p. 2.

[31] Ibid., p. 67.

[32] Ibid., p. 71.

[33] Ibid., p. 71.

[34] Ibid., pp. 2-3.

[35] Ibid., p. 3.

[36] Ibid., p. 101.

[37] Ibid., pp. 95-97.

[38] Ibid., p. 86.

[39] Ibid., p. 113.

[40] Ibid., p. 115.

[41] Ibid., p. 1.

[42] See Cunningham, *The Anatomical Renaissance*, p. 22-25, and passim.

[43] Sawday, *The Body Emblazoned*, p. 15.

[44] "Those traces, often (though not always) encountered at moments of trauma or potential danger – the glimpse of a wound cavity, the fluids of the body and its expelled substances in sickness or in childbirth – are greeted with varying degrees of fascination and horror. [...] The interior of the body is perceived by a trace which may also become a token, a harbinger of dissolution." Ibid., p. 8.

[45] Ibid., p. 8.

[46] Sawday, *The Body Emblazoned*, p. 3.

[47] Leon Battista Alberti, *On the Art Of Building in Ten Books*, translated by Joseph Rykwert, Neil Leach and Robert Tavernor, Cambridge, Massachusetts, MIT Press, 1988.

[48] Ibid., 3.14, pp. 85-86.

[49] For example: "The physicians have noticed that Nature was so thorough in forming the bodies of animals, that she left no bone separate or disjointed from the rest." Ibid., 3.12; p. 81. 'Physicians' here meaning Natural-Philosophers.

[50] Ibid., 6.2, p. 156.

[51] Sawday writes: "Anatomy and perspective shared a common tendency. Both, Serlio suggested, were concerned with volume rather than surface. Any attempt at rendering surface convincing without an understanding of volume was to be content with the 'bare shew of superficiencies' rather than the full complexity of the body functioning within space." Sawday, *The Body Emblazoned*, p. 86.

[52] "For just as in the human body there are some parts that are noble and beautiful and others that are rather ignoble and ugly, but of which we have the greatest need and indeed would not be able to live without; so also in buildings

there ought to be some parts that are respectable and honoured, and others less elegant, but without which the former could not be free and would lose part of their dignity and beauty. But just as the Blessed Lord has arranged our organs so that the most beautiful are in the most exposed and visible places, and the less attractive in hidden places, so too we, in building, will locate the main parts, which are to be looked at, in visible places, and the less beautiful as far from sight as possible. And in these latter parts we will put all the ugly things of the house, everything that might cause shame and uglify the most beautiful parts [2.2]." Serlio, as quoted in George Hersey, *Pythagorean Palaces: Magic and Architecture in the Italian Renaissance*, Cornell University Press, Ithaca, 1976, pp. 113-114.

[53] Leonardo Benevolo, *The Architecture of the Renaissance*, Translated by Judith Landry, Routledge and Kegan Paul, London and Henley, 1978.

[54] Ibid., p. 594.

[55] Ibid., p. 596.

[56] Sawday, *The Body Emblazoned*, pp. 147-148.

[57] Ibid., pp. 145-46.

[58] René Descartes, *Discourse on Method;* as quoted in Geoffrey Broadbent, *Design in Architecture: Architecture and the Human Sciences*, John Wiley & Sons, Chichester, 1973, p. 60.

[59] Sawday, *The Body Emblazoned*, Chapter 5. See also Walter Ong, *Ramus: Method and the Decay of Dialogue*, Harvard University Press, Cambridge, Massachusetts, 1958.

[60] Sawday, *The Body Emblazoned*, p. 136.

[61] Barbara Maria Stafford, *Body Criticism: Imaging the Unseen in Enlightenment Art and Medicine*, Cambridge, Mass,: MIT Press, 1991, p. 54, and passim. Stafford writes: "Anatomy and its inseparable practice of dissection were the eighteenth-century paradigms for any forced, artful, contrived, and violent study of depths. Metaphors of decoding, dividing, separating, analyzing, fathoming permeated ways of thinking about, and representing, all branches of knowledge from religion to philosophy, antiquarianism to criticism, physiognomics to linguistics, archaeology to surgery. Analogies of dissection, specifically, functioned on two interrelated levels. The literal, corporeal sense derived from tactile cuts inflicted by actual instruments. Digging knives, invading scissors, sharp scalpels mercilessly probed to pry apart and distinguish muscle from bone. The figurative sense played upon the allusion to violent and

adversarial jabbing. Such excavation stood for an investigative intellectual *method* that uncovered the duplicity of the world. Discursive thought called upon powers of baring abstraction whereby the lowly particular was mentally separated from the elevated generality. The trivial predicate was severed from the significant subject, the unimportant individual was subtracted from the important universal. Both meanings shared the connotation of a searching operation performed on a recalcitrant substance, One involved manual probing, the other cerebral grasping. Each suggested the stripping away of excess by decomposition and fragmentation for the purpose of control." p. 47.

[62] Michel Foucault, *The Order of Things: an Archaeology of the Human Sciences*, Tavistock Publications, London, 1970.

[63] G. C. Argan, "On the Typology of Architecture," Translated by Joseph Rykwert, *Architectural Design*, December 1963, pp. 564-565; See also Anthony Vidler, "The Idea of Type: The Transformation of the Academic Ideal, 1750-1830," *Oppositions* 8, 1977, pp. 94-115.

[64] Larry L. Ligo, *The Concept of Function in Twentieth-Century Architectural Criticism*, Ann Arbor, UMI Research Press, Michigan, 1984.