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 in anatomy 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, with the practice of partitioning rendering models of cosmic unity untenable. Moreover, the direct investigation of objects came to replace textual authority in the conception of both anatomy and architecture.

CLASSICAL ANTHROPOMORPHISM

Our inherited tradition of architectural theory begins with the writings of Vitruvius from the first century AD. For Vitruvius, the human body was the primary source for architectural composition, since it provided a demonstration of 'good proportion' in the relation of part to whole (Vitruvius, 1930). The figure described by Vitruvius, of a man with arms reaching out to touch the circle drawn from its centre, acknowledges the body as a manifestation of cosmic or Natural order. For Vitruvius, anthropomorphism was a means by which the various parts of a building could be combined to form a unified whole.

Conceptions of the body available to Vitruvius, primarily those of Plato and Aristotle, necessarily included the soul, which acted to unite the parts and give life to the body. For Plato, the soul is the essence of man, 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 concerned with the hunger by which the body is sustained, being the lower, animal, part of man. Man is both soul and body together (Tarnas, 1991). For Aristotle, the soul is what animates all living things; man differs from animals in possessing the capacity for reason, but both are alive because they are permeated by a soul. 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 a concept of unity also expressed in the Poetics, where the whole is an assembly of parts such that no part can be added to nor taken from it without detracting from the whole. In order to understand the soul, Aristotle anatomised the bodies of animals, enabling him to discover the purpose of each part (Steadman, 1979).

Vitruvius applied this notion of unity not only to buildings, but also to the range of subjects that must be studied by the architect. 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." The use of caryatids, for example, originates in the defeat of Caria by the Greeks, who then enslaved the women as a warning. Their punishment of forced labour was recorded and committed to stone a record of the outcome, as an account to inquirers. "The use of caryatids, for example, originates in the defeat of Caria by the Greeks, who then enslaved the women as a warning. Their punishment of forced labour was recorded and made visible by their transformation into columns, where they must bear the weight of the building above. Similarly, after the Spartans defeated the Persians, a colonnade was erected. George Hersey argues that the violence implicit in these commemorations is typical of classical ornament (Hersey, 1988). In particular, he argues that ornament, rather than simply a remnant of obsolete construction techniques, is a trope of sacrifice. These originate in practices of war, where tropes ('trophies') were erected on the battlefield. This practice echoes the symbolic reassembly of parts of the animal during hunting, 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 arose initially from the transformations of body parts, with teeth, bones, and skin 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 headdress. Ornament serves 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.

RENAISSANCE ANATOMY

With the spread of Christianity throughout Europe after the fall of the Roman Empire, the dissection of human bodies was forbidden. In academies where medicine was taught, such as Salerno in the eleventh and twelfth centuries, the bodies of pigs were used for anatomical demonstrations (Cunningham, 1997). However, in the early Thirteenth Century, Christian scholars sought to counter the Cathar 'heresy' that all matter was evil. This led to the practice of 'Natural Philosophy,' demonstrating 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. By 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 that was 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. Although a common rhetorical strategy, Galen's frequent use of analogy in his description of the body perhaps owes something to the education provided by
his father, who was an architect (Temkin, 1973). Galen’s father, Nicon of Pergamum, was connected with the building trade in the temple area of a town famous for its sanctuary of the healing god Asclepius. Galen wrote: "The nature of all the bones, as I said, is to be thoroughly learnt either from man, or 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." (Cunningham, 1997).

Although Galen was interested in human anatomy, much of his work was derived from the bodies of apes and other animals, since dissecting human bodies was not permitted in the Rome of his day. What knowledge of human anatomy he did gain came from skeletal remains, or from his appointment as physician to the gladiators (Porter, 1997). Combined with the architectural metaphors inspired by his father, this led to a focus upon structure in Galen’s writings. And following Aristotle, an understanding of the structure of parts is deemed essential in revealing their function.

The arrival of the printing press in the Fifteenth Century led to a dramatic increase in the rate of dissemination of anatomical knowledge (Eisenstein, 1979). Works published, however, were largely editions of or variations on Galen’s originals. Perhaps the greatest contributor to anatomical knowledge during the Renaissance was Andreas Vesalius (1514-1564). Vesalius first studied medicine at Paris, then went on 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. This led eventually to what is now the best known work of anatomical illustration of the Renaissance, De Humani Corporis Fabrica of 1543. Vesalius eventually rose to the status of professor, made possible by his willingness to challenge authority. Cunningham recounts an incident where Vesalius, as demonstrator, begins to express some of his own observations, 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. 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. Vesalius realised that his access to human bodies gave him an advantage over Galen, and that he could complete Galen’s project of developing 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 can be determined actions and uses.

EVIDENCE AND AUTHORITY

The images in the Fabrica, and in 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, its skin cut and folded back. To render the interior of the body using perspective, it is first necessary to overcome both its opacity and its compaction. The body must be spatialised, transforming it from a compounded mass into an arrangement of parts whose relative positions could be shown. The three-dimensional complexity of the body, the depth beneath the surface, is reduced to a two-dimensional image through a combination of dissection and perspective representation, where the act of dissection is described along with the results (Cunningham, 1997). The opening of the body also gives rise to a spatial continuity between interior and exterior, with the skin removed to allow the penetration of vision.

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. As Walter Ong has argued, dissection of the body provided the model for the organisation of knowledge (Ong, 1958). 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 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 (Foucault, 1975). Later, as Descartes defined the methods of science, the influence of dissection is palpable. The analytic process of simplification through partition reflects Descartes’ own interest: he spent eleven years in Amsterdam at a time when public anatomy was at its peak, making daily visits to butcher shops to collect specimens (Leder, 1990). Dissection gave rise to new series of metaphors, alloying intellectual clarity with the visual clarity that penetrated the body, unobcluded by the veil of skin (Stafford, 1991).

The anatomical discoveries of the Renaissance thus formed the foundation of modern scientific practice. The contribution to science of anatomists like Vesalius
have largely been interpreted through nineteenth-century histories of the Renaissance, such as that by Jacob Burckhardt (Burckhardt, 1944). More recently, however, historians have argued that the Romantic idea of individual genius acts to obscure the political, social, and economic influences under which such discoveries are made. Sawday, for example, argues against the idea of the Renaissance as an age characterised by a unified sense of selfhood. Instead he describes it as a “culture of dissection,” where anatomy inspired an “urge to particularize” in all forms of social and intellectual endeavour (Sawday, 1995). Moreover, he argues that the opening of the body constituted a ‘conquest’ of its interior, overcoming the mysterious nature of its procreative powers, and the danger of its threat of death.

Similarly, Andrew Cunningham has argued against the idea that the anatomists were striving to secularise knowledge (Cunningham, 1997). The body was anatomised, he argues, 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 understanding the soul contained therein: ‘Every anatomised, he argues, 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 understanding the soul contained therein: ‘Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: "Every anatomised, he argues, only as a means to better understand the soul contained therein: 

In the French Academies during the Seventeenth Century, the conflict between judgement and authority was to reach its height, characterised as a ‘battle’ between the ancients and the moderns (Rykwert, 1980). One of the major protagonists of the moderns, Claude Perrault, was both an architect and comparative anatomist. While Perrault believed that the rules of proportion that gave beauty to architecture were to be found in the human body, he accounted for the difference between the orders with reference to variation in bodies, formed by nature according to different purposes. For Perrault, there was not one body (Vitruvian Man), but many. His method of comparative illustration of the orders was later adopted by J.N.L. Durand in his study of building types, Recueil et Parallèle des Édifices of 1801 (Steadman, 1979). In Germain Boffrand’s theory of caractère, whereby a building should express the ‘character’ of its occupant or function, the free invention of rules met with the principle of appropriate expression (Kruft,
Blondel extended this principle to the character of individual rooms, as the exterior decoration is seen to announce the interior 'distribution' of the building (p. 148). Blondel also applied caractère to various building types, associating "[...] temples with décence, public buildings with grandeur, monuments with somptuosité, promenades with élegance, etc." (p. 149). Later, Claude-Nicolas Ledoux used the principle of caractère, in combination with social ideals borrowed from Rousseau, in the series of houses designed according to the occupations of their inhabitants (pp. 160-161). With such principles, ornament is validated by its expressive function.

**CONCLUSION**

While architects of the early modern period sought to emulate the success of the anatomists, the shift in the conception of knowledge was to prove problematic. With anatomy, textual authority was rejected in favour of direct visual evidence of the body; with the Reformation, the authority of the church was rejected in favour of direct interpretation of the Bible. But for architects, no objective referent existed, leading instead to a reliance upon their own judgement. But architects differed in their conception of both rules and their application. The result was a series of contentious differences, a 'crisis of sensibility' that was to undermine architectural authority (Benevolo 1978). The 'crisis' was resolved in part with the emergence of Modernism, as ornament was rejected as unable to provide correspondence between interior and exterior. Instead, 'form' came to be regarded as the proper means for expressing function, while a new degree of spatial continuity between interior and exterior was made possible by new materials of steel and glass. But even Modernism's claim to universality has proven untenable, largely due to its inadequate characterisation of its inhabitants. In their attempts to find an alternative, architects have moved away from science, looking instead to history (postmodernism) or linguistics (deconstruction) in their search for meaning. Through these fields, the body continues to provide a source for architectural composition, albeit in forms vastly different from its classical origins. How the dialectic of part and whole will play out is yet to be seen.

**REFERENCES**


