

**The Pen and the Sword:
Philosophy of Science in the Writing of Girard Thibault**

Peregrine Dace

Submitted in partial fulfilment of the requirements for the degree of Master of Arts in Philosophy.
University of KwaZulu-Natal

Submitted November 2009
Supervised by Prof David Spurrett

Acknowledgements

I wish to gratefully acknowledge the patient and capable supervision of Professor David Spurrett. I hope the reader will find that his efforts paid off.

I thank the British Library and its staff for providing me with facsimiles of their copy of Thibault's opus, without which this project would have been impossible.

Thanks to Shân and to my parents, the support of whom has meant so much. Thanks to Heike for constant support.

I am very grateful to the staff and graduate students of the Philosophy and Classics programmes for their support and stimulation and for the provision of sorely needed teas and office space. I also gratefully acknowledge the assistance of Miss Guiditta Toniolo for proofing my French translation and Mrs Anne Gosling for likewise proofing my Latin translation.

To all my friends, without you I would be a nervous wreck at this point. To thank everyone would be impossible, to neglect anyone, unconscionable.

Abstract

This work is an investigation of the influence of academic philosophy on non-academics in the Early Modern period (the 16th and 17th centuries). The first chapter will use Craig's Similarity Thesis to examine Early Modern philosophy in general, Philosophy of Science and Theology and how they interacted to elevate human reason to the level of divine certainty. The second chapter will draw on Dear's description of the changing status of mathematics in academia in the Early Modern period. This second chapter will draw the importance and divine relevance of rationality as developed in the first chapter into the discussion to further explore the relationships between science, metaphysics, mathematics and the divine. The third and final chapter will examine one particular instance of the influence of these ideas on popular thought, specifically in Girard Thibault's early 17th century treatise instructing the reader in swordsmanship, who uses the view of mathematics and the rational mind that is discussed in the preceding chapters to inform his theories of martial arts practice and pedagogy.

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Introduction

“...there is no reason in principle why the ‘dominant philosophy’ of an epoch should not be carried by persons who do not count as philosophers at all in contemporary and recent university practice.” (Craig, 1996)

In this dissertation, I take to heart Craig’s thought that there is much outside the academy of professional interest to philosophers, and that observation of praxes of non-academics may give insight into the philosophical theories that inform those praxes. Penetration of identifiable ideas from academic philosophy into specific non-academic praxes may also be used as samples of popular acceptance of those ideas. This work will move from the cerebral practices typically associated with the “contemporary and recent university practice” of philosophy to the more physical martial arts; specifically to the rhetoric, theoretical principles and pedagogical practice of one particular martial art, arguing that activities previously neglected by historians of philosophy may offer insight into popular appropriation of academic philosophy. That martial art being the Spanish-origin sword art typically referred to as “La Verdadera Destreza”, the True High Art.

La Destreza originated in Spain in the mid 16th century. The founding text was written in 1569 by Don Jeronimo Sanchez de Carança (or Carranza), though not published until 1582, entitled *The book of Jeronimo de Carança, native of Seville. A treatise on the philosophy of weapons and the art of Christian attack and defence.*¹ Carança was the sometime governor

¹ *Libro de Hieronimo de Carança, natvral de Sevilla, que trata de la philosophia de las armas y de su destreza y de la aggression y defension Christiana*

of the Honduras and of Sanlúcar de Barremeda and well respected in Spain for his learning, skill and sense of honour. For as Cervantes wrote in the *Galatea*,

If you would see an equal balance
Of blonde Phoebe and red Mars
Contrive to gaze upon the great Carranza
In whom the one and the other are not parted
You see in him, friends, the pen and the lance
With such discretion, skill and art
That the arts of fencing, in its parts
He has reduced to science and to art²

The next major figure in the tradition is Don Luys (or Luis) Pacheco de Narvaez, a prolific writer (author of more than 15 books on swordsmanship during the early to mid 17th century) who began his career with a commentary on Caranza, and became Master of Arms to King Philip IV in 1624. These men founded a broad tradition that would have influence well into the 18th century in Spain (which had an unusually conservative fencing tradition (Anglo, 2002)). The most famous member of this tradition, in the English speaking world, was Girard Thibault, a Flemish born Fencing master who produced what is likely the most lavish

² "Si queréis ver en una igual balanza
al rubio Febo y colorado Marte,
procurad de mirar al gran Carranza,
de quien el uno y otro no se parte.
En él veréis, amigas, pluma y lanza
con tanta discreción, destreza y arte,
que la destreza, en partes dividida,
la tiene a sciencia y arte reducida."
Cervantes (1585)

of all books ever written on the subject; his *The school of the sword of Girard Thibault of Antwerp in which he demonstrates by mathematical rules founded on an esoteric circle the theory and practice of the true and presently hidden secrets of the use of weapons on foot and on horseback*,³ published by Elzevier⁴ in 1628. It is this text that will form the basis of this dissertation as the Spanish language texts are insufficiently accessible, both physically and linguistically, to me. This will limit my ability to make broad claims about the tradition as a whole, requiring more research to be done in this area in the future.

These Spanish fencing writers and their successors were in touch with the shifting intellectual currents of the 16th and 17th centuries and used their knowledge of changing understanding of science, art, nature and man to inform the theoretical foundations of the content of their teachings and possibly their pedagogical practice as well. The precise details of the pedagogy followed are nowhere described for this tradition and so cannot be precisely described (until and unless such descriptions are discovered) and what inferences can be drawn are beyond the scope of this work, but the content of what was taught is thoroughly detailed. Two major currents in philosophy will inform the first two chapters of this work and Thibault's work will be examined in their light; the first current containing ideas about the relationship between man and God and the second concerning the place of mathematics within the sciences (and of the nature of science itself). The fencing writers were influenced by these currents as well as by classical Greek philosophy, the content of

³ *Academie de l'Espée de Girard Thibault d'Anvers ou se demonstrent par Reigles mathematiques sur le fondement d'un Cercle mystereux la Theorie et Pratique des vrais et jusqu'a present incognus secrets du Maniement des Armes a Pied et a Cheval*

⁴ Not the present company but the dominant academic publisher of the 17th century, from which the current publisher drew the inspiration for its name.

which influences will be the core in this study.

My first chapter will explore the ideas current in the early 17th century about the natures of the human and the divine. I will largely be using the theories expressed by Craig in his 1996 work *The Mind of God and the Works of Man* (from which the epigraph comes). This relationship, influenced by the doctrine of causal similarity, would influence both academic and popular thought, specifically in contemporary notions of the ability of humanity to apprehend the divine and approach Truth and the place of science in those overlapping projects. The doctrine of causal similarity, an important one in science at the time, held that effects derived all properties from their causes and that this inheritance would occur in an intelligible fashion. This meant that human nature shared its essential characteristics with the nature of the divine (with emphasis on rationality as the dimension of similarity) and similarly that the nature of creation reflected the nature of the creator in an intelligible fashion. Investigation of the world thus became seen by some philosophers as being investigation of the divine as well.

The second chapter uses as its core Dear's 1995 analysis of the changing nature of science in the Early Modern period and how those changes accommodated the conceptual linking of the searches for metaphysical, physical and pragmatic or artisanal truths. Central to my examination of this process will be the relationship between mathematics and the physical sciences. I will then draw upon the conclusions of the first chapter to examine how the importance of rationality influenced this development in the sciences and how the growing importance of mathematics, as part of this process, influenced thinking about the search for

divine truths and the status of metaphysical truth in non-academic pursuits.

My third and final chapter will closely examine the first chapter of Thibault's work in which the foundations of the system he taught are laid out in light of the Early Modern⁵ philosophies appropriated by Thibault (and other fencing teachers, though he is one of the clearest examples and so is suited for an initial investigation such as this). I will show that there is significant influence of the academic thinking described in the previous two chapters on Thibault's fencing theory and on how he communicated that theory. This influence serves as an example of the flow of ideas from the academy into public life in the Early Modern Period and as an example of formal philosophical content in a field previously unexamined for such content. Following this chapter will be my translation of the majority of Thibault's first chapter as an appendix and a further appendix on the history of fencing teaching.

⁵ Early Modern is a term I use, in line with other writers to describe the period 16th and 17th centuries, essentially from the Lutheran Reformation to the beginning of the industrial era in Europe. It is a term that overlaps partly with the so-called renaissance but includes the period of the rising nation-state and growing eminence of science while excluding the developments of 14th and 15th century Italy

Chapter 1: Knowing God

The fencing masters of the Destreza tradition believed that their discipline, success in other endeavours, theological correctness and scientific knowledge were united by being different expressions of true knowledge of the world and that the sacred and the profane worlds were united by being governed by the same rules. That knowledge of these rules was achievable, and how such knowledge could be acquired and believed will be examined in this, and the next, chapter before I move on to examining how the fencing masters appropriated and interpreted these philosophical themes in their own writing. This first chapter examines one of the major themes in Early Modern thought that influenced the philosophy of fencing in the “Destreza” tradition. This is the set of concepts that Craig (1987) calls the Similarity Thesis: the idea that man was made “in the image of God” and the various philosophical attempts to explain what that statement amounted to.

While it was long an article of faith in Judaism (the idea being referred to as *bi-demūt Elohim* or *be-zelem Elohim*¹) (Altmann 1968) and its descendants (importantly Christianity² for this work), it was not until the 16th and 17th centuries that European philosophers made a concerted effort to

¹ *Zelem*: Image

Demut: Similitude

Elohim: Lord

Thus *be-zelem Elohim* translates directly as “In the image of God” while *bi-demut Elohim* takes a more equivocal position as “in similitude of God”. Altmann (1968) discusses the nature of and reasons for that equivocation.

² The following are a set of biblical quotes demonstrating the importance of the idea in Christian thought.

“And God said, Let us make man in our image, after our likeness:” Genesis 1:26 (Authorised Version)

“So God created man in his own image, in the image of God created he him; male and female created he them.” Genesis 1:27 (AV)

“Whoso sheddeth man's blood, by man shall his blood be shed: for in the image of God made he man” Genesis 9:6 (AV)

“For a man indeed ought not to cover his head, forasmuch as he is the image and glory of God: but the woman is the glory of the man” 1 Corinthians 11:7 (AV)

investigate their understanding of this similarity and explain the characteristics that most embodied the similarity and its extent. After examining the Early Modern incarnations of the idea, earlier versions of the models of similarity of importance to fencing are examined.

1.1 The Idea of Similarity

In order to better one's understanding of the meaning of any comparison, one must have clear ideas about both objects of the comparison as well as the quality, or qualities, of similarity and how that quality is shared between the objects. Early Modern philosophy was heir to a long tradition of thought about the nature of God and this tradition provided many of the ideas that philosophers would use and modify in their definitions of God as one object in the comparison of human and divine. Likewise the nature of humanity has been deeply thought about through the entire history of the discipline of philosophy. It was these sets of ideas between which points of similarity and difference were sought, and within which such comparisons would lead to further change in each idea.

Craig (1987) identifies two major variants on the Thesis; that of similarity in will and that of similarity in reason and one minor version; similarity in agency. Those arguing for similarity in agency, such as Leibniz, claimed that the divine ability to cause change in the world was paralleled by some property of humanity such as the ability to mentally create sub-worlds through imagination and dreams. Those arguing for similarity in the will claimed that the

“But we all, with open face beholding as in a glass the glory of the Lord, are changed into the same image from glory to glory, even as by the Spirit of the Lord. 2 Corinthians 3:18 (AV)

The above extracts indicate that special similarity that humanity and deity have in terms of creation, but the following two are, in the context of Christianity, even more important. They describe how the incarnation (the defining even of Christianity) was made possible by this close similarity between human and God and further, how the similarity made the incarnation meaningful.

“For whom he did foreknow, he also did predestinate to be conformed to the image of his Son, that he might be the firstborn among many brethren” Romans 8:29 (AV)

“In whom the god of this world hath blinded the minds of them which believe not, lest the light of the glorious gospel of Christ, who is the image of God, should shine unto them” 2 Corinthians 4:4 (AV)

human will is unbounded, being capable of freely making any choice, and is the part of the mind that most closely resembles that of God. For Craig this argument, while more popular than that of similarity of action, was not the dominant one in the 16th and 17th centuries, becoming very important in the 19th century. The dimension of similarity Craig offers as the dominant one in those centuries is that of reason or understanding. If that was the case, then what sort of human understanding was considered similar to the understanding of God, in what respect was it seen as similar and why did Early Modern philosophers interpret the relationship in the way that they individually did?

1.2 Causal Similarity in Descartes and Some of his Contemporaries

To summarise the argument central to most versions of the Similarity Thesis, both man and nature were thought to be creations of a singular deity with very specific properties and they inherited the properties they had from this creative deity. For example, within the particular Scholastic concept of causation that Descartes uses in the *Meditations*, an effect only has properties that it receives from its cause and nothing can cause anything that does not resemble it. The model of causation that these Early Modern philosophers were using was taken from Aristotle's *Physics* and *Metaphysics*. Aristotle presents the reader with four types of cause, the material, efficient, formal and final. The material was that from which the effect is made, the formal was that which it is to be, the efficient was the source of the change and the final was its purpose. These being defined, any or all of them may be used in the explanation of an instance of causation (Falcon 2006).

This is an idea that, according to Buchdahl (1969), is critical for Descartes' demonstration of God's existence. This statement of the principle may seem lacking in detail (for example, details of *how* such inheritance occurs) but a sustained reading of Descartes and his commentators does fill in some of the gaps. Gassendi for example criticises Descartes here for applying this principle to all causes and effects where it should, he felt, only have been applied to material causes and certainly not to efficient causes (Descartes 1955. p159, Clatterbaugh 1980. p 380). Descartes however ascribed to Gassendi the common and easy confusion of the proximal

efficient cause and the total efficient cause, the only example of which he gives is God (Descartes 1970). Clatterbaugh (1980) suggests that there are other examples of efficient causes (causes of motion in the cases he mentions) in Descartes' works that, by virtue of being sufficient to cause a change in the motion of a body and of being similar to the effect, are equivalent to total efficient causes. These are necessary attributes of a total efficient cause and in interpreting Descartes and his contemporaries; we may treat causes of that type as behaving like total efficient causes. However it is not clear that they, in all cases, exhibit all necessary characteristics of total efficient causes.³ Indeed it is not clearly expressed in any of Descartes' writings that any total efficient causes other than God truly exist, especially if we are to take the word *total* literally, as meaning "responsible for all characteristics of the effect".

A question that must still be answered for the purposes of this work is, what type of cause was God seen as being? There seem to be elements of more than one type of causation in the model Descartes uses and this provides us with some of the required answers to Gassendi's criticism. It does not seem that God can serve solely as an efficient cause to either the universe or humanity. If God serves as an efficient cause, then what is the material cause? The material cause of the universe can only be God and while things in the universe may have proximal material causes that are other created things, the chain of material causation must go back to the first cause, which in the world view under discussion was held to be God. The formal cause and the final causes are likewise God (or at least God's plan for creation). Descartes is dissatisfied with the use of the final cause in scientific explanations (Ariew 1992), in this he comes close to Aristotle's treatment of final and formal causes as equivalent in most studies of natural processes (Falcon 2006), but other philosophers, particularly the Jesuits and other Scholastics who emphasised natural philosophy as a theological pursuit (Osler 1997), contemporary with Descartes were not so inclined. For Early Modern Christian philosophers, the efficient cause of the universe can only be God. It may be that the union of all types of cause in the idea of the deity is the cause of some of the disagreement between Gassendi and Descartes.

³ Clatterbaugh does not, for example distinguish between total (sum of all efficient causes of all properties of an effect) and ultimate (first cause in a causal chain) efficient causes.

For Gassendi, the problem at the root of their disagreement is that inheritance through material causation is being confused with the mechanisms of efficient causation. For Descartes, the problem is that proximal efficient causes are being mistaken for total efficient causes. This latter problem is one that is avoidable in cases that include God as the first cause since, in the worldview where this condition is met, God is always the total efficient cause, as discussed above. Gassendi's criticism is a more telling criticism in this case. For the purposes of this work it does not, however, strike a fatal blow to this application of the causal similarity principle since God is as much material cause, being responsible for all the qualities of material substance, as efficient cause. It does however require some consideration as it has reference to the general principles of the model of causation under discussion.

In considering the problem we must first examine what is understood by inheritance. Clatterbaugh (1980) identifies three modes of inheritance, formal, objective and eminent. According to him

..when a reality which exists formally or objectively in an effect, exists formally or eminently in the total efficient cause of that effect, Descartes' similarity condition, the causal likeness principle, is satisfied. (p. 384)

Clatterbaugh goes on to express different sets of conditions of satisfaction of the principle for inheriting different types of reality (or different properties), all of which are rules for determining satisfaction of the condition after causation (and inheritance) have already occurred and which are based on the presence of the reality of interest in the total efficient cause and in the effect. This principle can of course be expanded, though Clatterbaugh does not do so, to include other types of cause for a more complete statement of the test for satisfaction of the causal likeness principle. The major weakness in the approach taken by Clatterbaugh is his interpretation of the principle of eminent inheritance; that being the mode of causal inheritance where the effect exhibits a property not apparent in the cause. Descartes works around this potential weakness in the principle of causal inheritance by positing a mode of inheritance in which a property in an effect can be inherited from another property in the cause that is the "higher exact counterpart" of the former.

In focusing on the place of the causal likeness principle in Cartesian mechanics, he used the case of transfer of heat and motion from one extended substance to another as his paradigm cases. According to him, this is Descartes' major project and his major use of the causal likeness principle but in focusing so strongly on it, Clatterbaugh makes nothing of the importance of the causal likeness principle in Descartes' metaphysical and religious project. Part of the weakness (for the purposes of my work) may have to do with the interpretation of eminent inheritance that he uses. This interpretation is one that uses qualities that can be quantified and exist in different magnitudes, but are of the same kind, in both cause and effect. So, for example,

...consider a case in which two hard bodies of equal size collide when one is at rest and the other moving; the moving body will transfer some, but not all of its quantity of motion to the body at rest... This kind of case, where the cause and the effect have the same kind of reality but the cause has it to a greater extent than the effect, seems to be a paradigm of a cause containing a "*higher exact counterpart*" to the reality produced in the effect. (Clatterbaugh, 1980, p. 380)

This interpretation of eminent inheritance works very well within Cartesian mechanics but does not go beyond it, neglecting the place of Cartesian mechanics within the broader Cartesian project. The limitations are primarily that it only applies to quantifiable qualities and that it only applies to inheritance situations where the quality held by the effect is recognisably (to the human observer and interpreter) the same as that held by the cause. The apparent corollary to this definition of eminent inheritance is that inheritance of formal or objective realities can therefore only be interpreted as involving either the complete transfer of a reality from a cause to an effect (as is the case for a material cause) or the imparting of the reality into the effect without the cause suffering any loss of it.

For these cases to be considered paradigmatic, it would mean that eminent inheritance would be the type of inheritance with most clear apparent identity between the quality in the cause and that in the effect. My reading of Descartes however does not support this. In Clatterbaugh's reading,

eminent inheritance offers nothing that the other types of inheritance can not. And it certainly does not accord with the description of eminent inheritance in the *Meditations*. Here the example used in the context of the third meditation militates against that interpretation. In the third meditation the first example given of eminent inheritance is that of inheritance of representative reality by ideas from intrinsic reality in the causes of ideas, which causes are external to the mind. In this case, which does a lot of the work in the third meditation proof of the existence of God, the qualities in cause and effect cannot be numerically compared. So in the example of the causation of the idea of the stone by the stone itself, Descartes makes no claims that there is a *numerical* relationship between the objective reality of the thought and the formal reality of the stone (Descartes 1967, p. 162). Similarly, with the causation of heat in something, Descartes says it must be caused by something, not as hot or hotter (which would support Clatterbaugh's interpretation) but by something "of an order...at least as perfect as heat" (Descartes 1967, p. 162)

Since God occupies the position of first cause in Descartes philosophy, both nature and man share in and reflect the nature of God. In determining the area of similarity and expressing it in his behaviour, man can make his behaviour more God like and less base. The next point is that nature had been seen for a long time (as far back as Pythagoras, but importantly for the 16th /17th centuries, by St Thomas (Yaker 1951)) to be a fundamentally ordered system, which would not be the case should God not be ordered as well. It was this order that permitted the development of the arts and sciences. It further followed that a thorough examination of the effect could give insights into the cause (since everything present in the effect must have been present in the cause), provided that insight into the effect was possible. The possibility of insight was contingent on two factors, the intelligibility of the subject matter (the world) and the effectiveness of the tool used to examine it (the human intellect). The inheritance by the world of order from God was seen as likely in light of the model of causation already mentioned, and it was order that permitted intelligibility. That the human intellect was suited to effectively access truth about the world would become central in the development of the Similarity Thesis.

1.3 The Book of Nature

The idea that the nature of God was recorded in the world led to the development of the idea of the two books, the book of scripture and the book of nature; both of which served to inform man about God, but in very different ways; the former through the traditional authority of the ancient patriarchs and apostles and contemporary priests and the latter through observation and reason interpreting that observation. This dichotomy can be seen as early as the twelfth century in the writings of Hugh of St Victor but took on a modified form in the Early Modern period (Pestic, 2000). This leads to a model of science which combines the utility of knowledge to humanity (*a la* classic interpretations of Bacon's philosophy of science in *Valerius Terminus*) with the value of knowledge as access to the divine (Tovey, 1952). Bacon situated himself between the two extremes of seeing the nature of God as entirely deducible from scientific investigation of the world and that of considering the divine to be only accessible to the mind through contemplation (Tovey, 1952, p. 569). Tovey claims that the commentators who have emphasised the secular influence of Bacon's philosophy of science have neglected the place of the divine in his scientific project, with knowledge on the one hand coming from God as "a plant of God's own planting", a metaphor used by Descartes as well (Tovey, 1952, p. 570), and on the other glorifying God and preventing theological error since, "that latter book shall certify us that nothing which the first teacheth shall be thought impossible" (*Valerius Terminus* in Tovey, 1952, p. 571). In this model, study of the book of nature was understood both to give insight into the nature of God and humanity and to make people more God-like by exercising the human quality in which their similarity to God most clearly resided.

According to Crease (2006), the modifications in the 17th century to the vision of the Book of Nature are specifically attributable to Galileo. This is perhaps simplistic (attributing the development entirely to an individual) but his fundamental argument is about modern interpretations of the idea. It does however put the shift firmly in the era of interest for this work. For Crease this shift in the meaning of the metaphor was such that while prior to it, nature was to be interpreted as a symbolic system presenting the same message as religious texts and to be interpreted in their light while after the shift it was to be interpreted as a separate text offering its own independent access to divine truth and as such, was to be interpreted by a separate class of specialists from those who interpreted scripture.

1.4 Descartes' Three Dimensions of Similarity

To consider how the Similarity Thesis was conceived of and expressed by Descartes in the *Meditations on First Philosophy*, God was seen to be omniscient about the world and transparent to himself, to affect the world without limit in choice or competence and to be all good. In fact those things are so central to his notion of God that they lead him into the so-called Cartesian circle of self supporting proof.⁴ Likewise he considers three of those qualities to be possessed by mankind as well, knowing, choosing and acting (it is here that he so famously expresses the “will” version of the Similarity Thesis);

For although the power of the will is incomparably greater in God than in me; both by reason of the knowledge and the power which, conjoined with it, render it stronger and more efficacious, and by reason of its object, inasmuch as in God it extends to a great many things; it nevertheless does not seem to me greater if I consider it formally and precisely in itself. (Descartes 1967, p. 175).

⁴ The argument might be made that the compulsion to believe the clear and distinct, that would be dealt with in the Fourth Meditation prevents him from questioning it. This objection neglects that it is explicitly the purpose of the Evil Genius to permit hyperbolic doubt of those judgements to which the mind immediately springs.

Writers such as DeRose (1992), Doney (1955), Morris (1973) and Newman and Nelson (1999) have argued for readings of this proof that permit escapes from circularity here, other writers however disagree. Craig, whose work forms much of the basis for this work does not entirely agree with either position, for him the difficulty has,

...nothing to do with its leaning too heavily on clarity and distinctness or on any other general Cartesian principle. Just the opposite: it is due to Descartes' breach of one of his own rules in taking at face value just the kind of feelings or state of consciousness which, in the early *Meditations* he has thoroughly trounced as unreliable guides to truth. (Craig, 1987)

It is this interpretation that I will be following.

He does not here add goodness to the list but there is no reason to suspect that he did not think man to possess any; it does however seem to be a matter of being rather than doing. Whatever the dimension of similarity however, it was common to distinguish intensive and extensive similarity. For example Descartes distinguishes the will of God (his chosen dimension of similarity) from that of man only in the number of things on which it makes decisions, the amount of information on the basis of which those decisions are made and the capacity to execute the conclusion (should execution of some task be the desired result of the decision); in other words God's will has a broader reach (extension) but no individual decision that he makes is made any more freely than those of man (intension). The difference between the human and divine wills is thus a difference in the circumstances in which the wills operate rather than any difference between the wills themselves. The intensive similarity between the will of God and that of man is exemplified by Descartes statement that, "... [God's will] nevertheless does not seem to me greater if I consider it formally and precisely in itself (Descartes 1967, p. 175).

Descartes offers us the prime example of the will or freedom version of the Similarity Thesis, but this was by no means the major Early Modern version. In looking for others however we shall not abandon Descartes entirely. An appropriate place to start looking would be his triad of actions, knowing, choosing and doing, these are the three dimensions along which he compares God and humans, finding that God is vastly more knowledgeable and has the power to affect vastly more objects before selecting choice as his dimension of similarity (Descartes, Haldane and Ross (ed & tr), 1967, p. 175). Choosing has already been looked at in examining Descartes' free will version of the Similarity Thesis. According to Craig (1987), for most Early Modern philosophers, action is never a likely candidate for the dimension of similarity. Leibniz however uses a version of it in *Discourses Upon Metaphysics* XXXVI (in part it seems, blending it with an element of the knowledge version) for he says a spirit (including the spirit of man) "knows the world, and conducts itself in it after the fashion of God" (Leibniz 1953 p. 61). This line indicates that Leibniz thinks that man shares somehow in the active power of God. Craig offers us some suggestions of how Early Modern philosophers might have conceived of the perfection of God's actions, that the perfect agent might choose the correct goals, achieve them without effort and act without constraint. To this list I would add that the perfect agent would have been seen to attain its ends instantly if so desired (this may be implicit in the term "effortlessly" that

Craig chooses, but instant and effortless are not synonymous).⁵ What can someone possibly do that exhibits one or more of these qualities? It seems apparent that whatever it is should (as with Descartes' "will" model) involve an intensive, rather than an extensive similarity. Even without the constraint of seeking extensive similarity it is a difficult question to answer, as evidenced by the relative paucity of Early Modern philosophers who pursued this notion of similarity. Even Leibniz, who provided us with the quote that introduces this dimension of similarity, does not do so in a pure fashion, i.e. without introducing another dimension of similarity. For Leibniz, our similarity to God's actions lies in a correlation between his effortless in producing things and our effortless in producing thoughts. "The mind," he says in *Principles of Nature and Grace XIV*, "not only has perception of the works of God, but is even capable of producing something like them, though on a small scale." (Craig 1987, p. 53) As for what it produces, Leibniz offers us ideas, ideas particularly in the form of dreams flowing effortlessly from it, but also in its intentional states. These intentional states are, in Leibniz's model, not a result of focused, conscious thought but seem to result from the same (or similar) free flow of "thought stuff" as dreams. Note that while I pointed to an overlap between Leibniz' action model of similarity and the knowledge model we will be examining next, this exists only in so far as it is the production of thought that concerns him, it should not be understood from my comparison that he means true thoughts about the world (as implied by the word knowledge).

Both Descartes' "free will" model of similarity, and Leibniz' "agency" model present certain problems to the reader. Descartes' because of his characteristic peculiar (certainly to twenty-

⁵ This list shows a distinct conflation that needs to be made clear (whether Craig makes it himself or is ascribing it to early modern thinkers is not apparent, though I suspect the latter). This conflation comes with the introduction to the list of always choosing the *correct goals*. Always choosing the correct goals requires an infallible knowledge of rightness and wrongness of alternatives and the ability to invariably choose the right option. Without this, while correct goals may have been chosen in the past, no prediction can be made that they will inevitably be chosen in the future, or in counterfactual circumstances that render useless rules that coincidentally give the correct result. This brings elements of the knowledge and freedom of choice (Descartes' free will) into the "action" dimension of similarity. We should be reminded of two things by this a) the idea of the unity of perfections (and perfection of unity) that is so strongly expressed in Descartes third Meditation; that these qualities were not easily separable from each other in the notion of a perfect God in the 17th century; and b) that this threefold model of the dimensions of similarity between man and God is imperfect in that it does not cleanly separate all expressions, even all early modern expressions of the Similarity Thesis, but only exists as a tool to help us interpret the components of these expressions.

first century eyes) reliance on “clear and distinct” understanding of God’s nature (primarily non-deception here but also unitary perfection in general) and Leibniz’ because it is not clear how agency and intention or dreams can be meaningfully equated as he does (Again intensively. He never comes close to suggesting extensive equality, nor should we expect him to). Descartes’ ideal of a perfect will is only tenable within a world view that also admits of human error and an omnipotent, omniscient God who is not the author of error. Without these there are four possibilities: there is no human error, God is the author of human error, God is limited in his abilities, or has an Epicurean lack of interest in humanity, or God does not exist. Given that Descartes is quite reasonably convinced of the existence of past error and the possibility of future error and does not need to justify it again, a lack of a perfectly free will would call his ideas about God into question. The problem with Leibniz’ model is that it seems to make analogy a basis for a strong Similarity Thesis, conflating two senses of the word “like”. It is clear how the perceived effortlessness of dreams and intention can be *compared* to God’s effortless action, but this is not the same thing as providing a dimension of similarity in any stronger sense.

With these flaws, from where do these models draw their persuasive power (such as it is)? Well let us look first to their commonalities for the answer. What they share is drawing implicitly on another model of similarity, the knowledge model (in its various versions) that Craig identifies as the Insight Ideal. Descartes draws strength for his argument from this model more clearly than Leibniz does but it is nonetheless present in the latter’s work. For Leibniz the influence is that mental activity is the human quality that is compared to God’s action rather than it being human action that is used in the comparison, for example in *Principles of Nature and Grace XIV* he says

The rational soul or mind...is...an image of the Deity...the soul is architectonic in its voluntary activities also, and, discovering the science in accordance with which God has regulated things, it imitates in its own sphere, and in the little world in which it is allowed to act, what God performs in the great world (Craig 1987, p. 53).

So God's action in creating the world serves as, in Thomistic terminology, the *causa exemplaris* (external formal cause) for the human sub-creation of a mental model of the world.

For Descartes, the impact of the Insight Ideal is far more direct and explicit. In the fourth Meditation, Descartes equates the source of error in human choice with the source of epistemological error. Our freedom applies just as much (for Descartes) to belief formation as it does to any area in which choice is possible (if we take seriously for the purposes of this discussion that belief formation in the sense he means is a matter of free choice). This identification of formation of untrue beliefs about the world with sin suggests that the Insight Ideal has a more important place in Descartes' version of the Similarity Thesis than Craig admits.

1.5 Knowledge and Virtue: The Christian Tradition

The close association between knowledge, sin and righteousness is not one found only in Descartes' thought, nor even only in Early Modern philosophy and theology. It can be seen in Christian doctrine as far back as the 5th century and as recently as 1993. In the Pelagian heresy, sin was seen as a function not of a fallen human nature but of misuse of the will and further this misuse of the will could be guarded against by knowledge of the law. In other words it was thought that knowledge of the moral law was accessible to people and that application of this knowledge through action could prevent the development of a state of sin, not merely that knowledge was *a* way to escape sin, but that it was *the only* way to avoid it (Proceedings of the Synod Of Lydda as quoted by St Augustine of Hippo in "On the Proceedings of Pelagius"). Until the attacks launched on Pelagianism by St Augustine in the 5th c., it was not seen as particularly problematic (It was declared not unorthodox by the Synod of Lydda) and it was certainly informed by earlier orthodox writers such as Ambrosiaster (Evans, 1981). While this doctrine was eventually declared heretical as a result of the actions of Augustine, Pelagius' followers certainly saw themselves as mainstream Christians (*integri Christiani*) (Evans, 1981). Augustine's passionate opposition to this doctrine notwithstanding, he is equally concerned (in

De Libero Arbitrio III.18) with the human condition of ignorance and its retarding effect on the human spiritual condition.

Despite the heretical classification of this doctrine, elements of it remain in Catholic dogma today. In the encyclical *Veritatis Splendor*, Pope John Paul II (1991) said “Truth enlightens man's intelligence and shapes his freedom...”. While actively denying the Pelagian possibility of atheistic true knowledge⁶ (and thus the Pelagian possibility of atheistic sinlessness through knowledge), this encyclical reaffirms Papal acceptance of Thomism in that

Among all others, the rational creature is subject to divine providence in the most excellent way, insofar as it partakes of a share of providence, being provident both for itself and for others. Thus it has a share of the Eternal Reason, whereby it has a natural inclination to its proper act and end. This participation of the eternal law in the rational creature is called natural law (John Paul II 1991)

And further that

[God] cares for man not "from without", through the laws of physical nature, but "from within", through reason, which, by its natural knowledge of God's eternal law, is consequently able to show man the right direction to take in his free actions [ibid.].

The presence of these ideas in this context demonstrates three things. First, that freedom of will and sin are deeply connected in the history of Catholic thought. Secondly that central to the relationship between them is knowledge to inform the will. Third, that Descartes' close association between freedom and the supposed tendency of the mind to leap to items revealed by the natural light is consistent with a variety of positions within Christian thought (and have been seen as consistent for a long time).

⁶ Though it does reaffirm the Second Vatican Council judgement that ignorant heathens of conscience may attain salvation through grace.

This Christian context clarifies the links in the fourth meditation between sin and epistemological error. Since he states that his errors are the only evidence of his imperfection then sin must be included in this category of error, or at least be considered to have essential similarities. These Christian writers on sin also make this link, claiming sin other than original sin to be a product of epistemological error and that resistance to divine knowledge is what keeps people in the state of sin. This link identifies two senses of the word freedom with one another, that of unconstrained choice and that of being “free of sin”.

The importance of Augustinian thought to Cartesian thought should not be neglected. From the Augustinian statement “If I doubt, I exist”⁷ (*City of God* XI.26) to his insistence on duality, Augustine defined the religious doctrine in the tradition of which Descartes would be educated. Augustine of course is as interested in non-rational decision making as he is in the rational, bearing strongly as they do on the process of his own conversion (*Confessions* VIII) but he is also heir to the Hellenistic philosophical tradition that elevates the faculty of reason above all others in the decision making process, witness for example *De Libero Arbitrio* II.3 – II.15. This rational decision making is strongly and explicitly tied to obedience to the divine law in *City of God* XII.1

...the rational nature, even in its wretchedness, is superior to the nature...
bereft of reason... This being so, the failure to adhere to God must be a
perversion in this rational nature... though it is itself changeable, it can yet
obtain blessedness by adhering to the unchangeable good. (Augustine 1984)

Descartes denies significant Augustinian influence on his project but Janowski (2004) has identified themes that occupy major positions in both, including the *cogito* and the evil genius, and used them to argue a significant debt that Descartes owes to Augustine. Menn (1998) further argues that Descartes explanation of error is an appropriation of Augustine’s free-will theodicy, particularly as expressed in *De Libero Arbitrio*. He argues that Descartes’ conceptualisation of false judgements as being the result of the inappropriate use of the will is a

⁷ Si enim fallor, sum.

strong and definite link between the projects of the two men. This does not of course mean that Descartes simply extracted his ideas from Augustine's works, there were many mechanisms through which he might have come in contact with the ideas contained within them.

There is a strong connection between the use of the will and the knowledge that informs the will in both Descartes work and the work of his antecedents. Descartes explicitly makes the free will the dimension of similarity between humans and God, but both he and Augustine are at pains to point out that it is not a moral good in itself but is the mechanism permitting both terrible epistemological and moral error. Likewise it is epistemological error that licenses and empowers misuses of the will. It is knowledge in the case of both thinkers that permits error to be avoided. And it is the avoidance of this error that increases the similarity between humans and God just as it is commission of the error that separates us. As Augustine says, "...the image needs to be refashioned and brought to perfection, so to become close to him [God] in resemblance." (*City of God* XI.26)

It seems that both Descartes' freedom model and Leibniz' action model draw on elements of the Insight Ideal, which it is worth examining in some depth. A leading light in Early Modern science and philosophy of science, Galileo relied upon the Insight Ideal in his notion of similarity and in his justification of his intellectual project. For Galileo, the Book of Nature was the most direct access that a man of learning had to understanding the nature of God, and of himself. In his *Dialogue Concerning the Two World Systems*, Simplicio says to Salvatio (who speaks largely for Galileo) that they have just established that there is a vast gap in understanding between man and God, yet he reserves some of his greatest praise, "if not indeed the greatest of all ... for the understanding which you attribute to natural man." (Craig 1987) This does not seem to be a problem however for Salvatio, or indeed for Galileo. It is in this discussion that he establishes both his commitment to the Insight Ideal of the Similarity Thesis (though of course not in those terms) and establishes the difference between intensive and extensive similarity, a distinction that would colour the entire history of the Similarity Thesis. In that extract from the Dialogue, Galileo claims great honours for human understanding, but this is not yet an explicit claim that understanding is the dimension of similarity.

Later in the same text however, it becomes clear that he is making this human quality (understanding) the basis of a strong statement of Similarity. Salvatio claims that;

With regard to [that] which the human intellect does understand, I believe its knowledge equals the divine in objective certainty, for here it succeeds in understanding necessity, beyond which there can be no greater sureness.
(Craig 1987)

And here Galileo, through the mouth of Salvatio, makes explicit the distinction that seems to be important for all versions of the Similarity Thesis that we have discussed; that of intensive and extensive similarity. Salvatio limits this great objective certainty to certain specific areas of knowledge, for neither he nor any other Early Modern philosopher makes claims for the universal scope and perfection of human knowledge. Rather he limits it to particular fields, geometry and arithmetic, in which the necessity of the truths of those fields of knowledge are accessible to the human mind. Here they are not merely accessible in principle, but many of these truths have been discovered⁸ in practice. Galileo's specific choice of these particular fields of knowledge prove to be very important to the Early Modern scientific developments discussed in Chapter 2 and central to the approach to science adopted by the teachers of the "Destreza" tradition. It is this centralising of thought in the Similarity Thesis that seems to inform both Descartes and Leibniz in their own version of the Thesis.

Once we have identified thought as the major field of interest there are several aspects of it to which the thesis can be applied; speed or ease of understanding or of acquisition of knowledge, extent of knowledge and the certainty or what we might call "intensity" of understanding. If we start with a concept of a perfect God, and in considering this time and place we should, all of these will be maximised, so what combination of them will be appropriate for drawing comparisons with man? By the very nature of their calling these were men to whom intellectual endeavour was very familiar (and it is interesting to note that it is men with these particular skills who selected them as the areas in which man came closest to God, but that discussion falls outside the scope of this work). For none of these men did knowledge or understanding come

⁸ To use an early modern understanding of the development of mathematics.

instantly or without effort (despite Galileo's view that assiduously practiced mental exercises may become as smooth as to feel almost effortless). Neither did anyone feel that they understood *everything* or indeed everything on one subject. The only thing then remaining (or at least the only thing which they had identified) then becomes the intensity of a given piece of knowledge, the certainty with which it can be said to be known.

Leibniz, Descartes and Galileo all make quite clear that they are talking about intensive rather than extensive similarity in their chosen dimension of similarity. For Leibniz we differ "from God only as greater from lesser, as finite from infinite." (Leibniz' letter to Arnauld of 9th of October 1687 in Craig 1987, p. 51). For Descartes, the difference that God's will is further reaching and better informed than his, but "nevertheless does not seem to me greater". Galileo likewise distinguishes quantity of knowledge from its certainty in the above quote from Craig (1987). Descartes' statement here has the potential to be interpreted as breaking the intensive/extensive model because of the presence of the term "greatness" in this translation. The context however makes it clear that he is in no way making a claim that includes extensive similarity, but rather is making a claim similar to that of Galileo. The characteristic they are discussing (free will and the ability to recognise logical necessity) is being characterised as either present or absent and therefore extension is irrelevant to them and they cannot be measured on any scale of extensive similarity. Insofar as that is the case, it is only intensive similarity to which they refer.

Now that we have established the terms of comparison in the Similarity Thesis it is time to examine the nature of comparison both in itself and in terms of the specifics of the Early Modern Similarity Thesis. Comparisons may be said to have two functions, the descriptive and the didactic (which are by no means mutually exclusive); the descriptive telling the listener/reader something about the world (at least those parts of it that are being described) and the didactic attempting to instil understanding in the listener/reader about one or other term of comparison or the relationship between the two. The descriptive must have a didactic component (it must convey some understanding of the relationship between two things) but the reverse is not necessarily true; attempts to communicate understanding about something may involve analogies that do not describe real affinities, relationships or similarities but rather "useful lies"

that guide a pragmatic understanding. I suggest that all Early Modern versions of the Similarity Thesis are both descriptive and didactic: they represent what the authors think are real relationships in the world *and* are thought of as instructive about both terms of the comparison. A solely didactic comparison without a descriptive element would imply that they did not feel that any *real* relationship of similarity existed between humans and God. This however is not borne out by the texts, particularly in the case of Descartes' writings, in which we see him going to significant lengths to establish the reality of the relationship and in which he bases similarly significant tracts of reasoning on that idea. For Galileo, in the quotes already given, the language is that of comparison rather than that of claims about the world, in other words it is not necessarily a descriptive comparison. They do not, however rule this possibility out and nowhere does he state that this comparison is solely for the purpose of illustration or that it is not to be taken seriously.

According to, among others, Mary Hesse (Hesse and Arbib, 1986), analogies modify the meanings of not only one of the terms of comparison, as may intuitively be understood from comparisons of the form A is like B (1), but both terms are objects of comparison, more like A and B are like each other (1'). 1' does not however entirely convey the sense of her argument as it has the potential to be understood as an overlap of properties of objects that statically possess those properties. Here we must distinguish between ontological and epistemological concerns. In so far as comparisons are made between qualities held by objects and in the context of the comparisons being studied in this work it is epistemological claims that I am making, though my sources were, in many cases making claims about the world. It is precisely because they were making claims about the world that the interactive theory of metaphor offers us so much here.

1.6 In Conclusion

In this chapter, we have established much of the background needed to understand Thibault's *Academie*. Many early modern philosophers were promoting a view of the human and the divine that emphasised their essential similarity. This view extended the borders of acceptable and attainable knowledge about the divine and the natural by using descriptive and didactic comparisons in which the mind, and particularly the rational mind, was the major dimension of

similarity. This mind, operating within a world that was seen as a product of a rational agent similar in nature to it, was capable of understanding that world in a manner intensively like the way God did and by understanding that world, could understand certain truths about God. This view made the practice of science a pursuit that was capable of philosophically approaching metaphysical truths, not merely physical ones, and a potentially religious activity in its own right.

In the next chapter we will look at certain changes taking place within the sciences in the Early Modern period, particularly the inclusion of the mathematic within the sciences proper. Mathematics is important for the relationship described in chapter 1 because it is the science most reliant on, as its Early Modern proponents suggested, the rational mind, and least reliant on the vagaries of observation. It is also important for the study of Thibault because of its bridging of the gap between trade or technical knowledge and scientific and metaphysical knowledge.

Chapter 2: Knowing the World

In the previous chapter, I discussed the importance of the mind to 17th century philosophers in their idea of human similarity with, and understanding of, the divine, in part through rational investigation of the world. In this chapter I will consider the question of how the intellect was to accomplish that task. Section 2.1 of this chapter will consider the methods promoted by Early Modern apologists for mathematics by which the mind could best understand nature, in particular, mathematics and its place within the academic environment of the universities and within natural science. Then in section 2.2 I will consider how the mathematical methods discussed in 2.2 bear on the ideas of similarity discussed in Chapter 1.

The period 1500-1700 has been claimed as the formative era for the developments that would be institutionalised in the sciences in the 19th century (Dear 1995). Key to these developments was the shifting status of mathematics and the mixed mathematical sciences¹ (particularly astronomy and optics for the early part of that period, along with mechanics). Under the form of Aristotelianism dominant in the 16th century, mathematics was not considered a science but rather a tool useful in the sciences proper since it did not speak of the world and did not give people knowledge about causal relationships between its objects of study (Dear 1995 pp35-37). This opinion was particularly strong among the followers of Piccolomini and the authors of the influential Coïmbra commentaries on Aristotle (Wallace 1984 p142) and through them, on the Jesuit educational system as a whole. Contrary to this was the view that mathematics fitted perfectly within the Aristotelian definition of science with reference to both its method and its subject matter. The first portion of this chapter will deal with the process by academics' opinion of mathematics changed from the former view to the competing latter, resulting in a view of mathematics more familiar to the 21st century mind.

2.1 Breaching Disciplinary Boundaries

¹ The mixed mathematical sciences were the category of sciences in the Aristotelian scientific tradition that used mathematical methods to investigate non-mathematical objects. Discussed further in section 2.1.2.

The state of affairs faced by the proponents of the new view of mathematics and the process by which they changed the position of their discipline are examples of the dynamic relationships that existed between Renaissance humanism, medieval philosophy (especially the scholastic tradition) and the authority of the ancients in the 16th and 17th centuries.

Key to this process was the Jesuit mathematician Christopher Clavius. Professor of mathematics at the Collegio Romano (now the Pontifical Gregorian University) from 1565 to 1612, he was one of the most influential proponents of a new conceptualisation of mathematics. This importance is the result not only of his mathematical expertise and his having written some well thought of mathematical texts, but his position within the Jesuit educational system. The Collegio Romano was one of the most important educational institutions established by Loyola and occupied a place of significant seniority in the development of the Jesuit educational programme. The Jesuit programme formed a central part of the Counter-Reformation, but as Cesareo (1993) points out, the Jesuit educational mission balances these Counter-Reformationary goals with those of the personal development of the pupil and benefit to his society. These goals were not unrelated as for an orthodox Catholic thinker like Loyola, an enlightened, moral person and society was a Roman Catholic person or society (though as the presence of reformatory pressures inside the Church shows, the reverse was not seen as necessarily the case).

The problems with which those for whom mathematics was a science proper (in the Aristotelian sense) were faced related to how the academic degree structure had evolved by the 16th century. The focus of the late medieval university degree was professional training in one of the “big three” fields; theology, law and medicine. Mathematical training was limited to the liberal arts courses comprising the classical trivium (grammar, logic and rhetoric) and quadrivium (music, astronomy, geometry and arithmetic) which prepared students for advanced study in the higher faculties. As such, teachers of mathematical disciplines were considered both different from (cf Salmone 1979, Baldini 1992) and lower in status than teachers of philosophy and natural philosophy (cf Galluzzi 1973), those being the disciplines with which Clavius would associate mathematics.

The principal objections to giving mathematics the status of a science (and so making it a proper part of philosophical study) were that it did not provide knowledge about the world; that it did not operate recognisably through the scholastic causes² (Wallace 1984, Dear 1995). The requirements of the late scholastics for a field of study to be considered science proper were strict ones. The tenor of the attacks on the status of mathematics can be gleaned from Clavius' mathematical apologetics. In the 1580s he wrote against the philosophy teachers who were dismissive of mathematics, saying there were those who claimed that "mathematical sciences are not sciences, do not have demonstrations, abstract from being and the good etc" Clavius presents some counter arguments to these, some technical, for example that the importance of mathematics to astronomy and cosmology made mathematics an inextricable part of natural philosophy; some textual, for example that it was impossible to understand certain passages in the classical philosophical authorities without mathematical understanding; and some social advice, encouraging mathematicians and mathematics instructors to take part in public events and debates to enhance the profile of their discipline in the academic world. (Society of Jesus, 1901. Translated in Dear 1995 pp 34-36)

The major objection the anti-mathematics voices raised was that of causation. Central to the late scholastic understanding of Aristotle's scientific categories was the causal demonstration of a scientific principle in the form of a deductive syllogism. The ideal version of this syllogism was one in which the middle term expressed the necessary and sufficient cause of the effect to be explained (Dear 1995, p36). For mathematics, and particularly geometry this was not seen to be the case by those who denied it scientific status. In their view, what mathematical demonstrations expressed was the logical relationship between ideas, there was no causation involved. The fact that mathematics dealt with the relationship between ideas specifically allowed another blow to be struck against it. In the model of mathematics prevalent among the late scholastics with whom Clavius was disagreeing, mathematical objects existed nowhere outside the mind and therefore nothing dealing with their relationships or natures was seen as sharing any essentiality with objects in the world, and according to Aristotle:

² Aristotle's model of causes was central to the scholastic understanding of science. A scientific demonstration was to show not the existence of an effect but its necessity given the nature of its cause and the operation of material, efficient, final and formal causation, any or all of which could be invoked in a given explanation (Falcon 2006).

Attributes which are not essential in the sense which we have defined do not admit of demonstrative knowledge, since it is not possible to give a necessary proof of the conclusion...(Aristotle, *Posterior Analytics* I.6 tr. Treddenick 1962)

This was not a claim that mathematical concepts do not have essential characteristics, but that their essential characteristics are not shared by those objects that are studied in the mixed mathematical sciences, i.e. those that used the principles of mathematics to treat of non-mathematical objects such as optics (using geometry to treat of vision and light) and acoustics (using arithmetic to treat of sound). If the objects of fencing were appropriate objects of scientific knowledge in the same way that light, sound or astronomical bodies were and if they and their interactions could be mathematically described then a mathematical approach to fencing would also fit into this category, since it would use geometry to treat of the human body and its motion. Thibault devotes most of his first chapter to establishing that the human body and the sword were governed by the same laws as the rest of nature and describing their proportions in terms of geometric figures to justify this conclusion (see Appendix A).

For Clavius it was difficult to directly contradict these criticisms, and it is easy for us to see why. If the nature of science requires necessary *causal* relationships, and causality was defined as described above, then there is no way that mathematics could be considered a science within the Aristotelian tradition. The only options acceptable to defenders of mathematics would be to change how the idea of causality was applied or to change the definition of science itself to permit mathematics within its borders. When defining the relationship of two things (science and mathematics in this case) to one another, either or both of them can have its definition modified but the supporters of mathematics did not propose to change the definition of mathematics, this implies that they placed more importance on the purity of mathematics than on orthodoxy in their interpretations of Aristotle. Both strategies (reinterpreting causation and changing the terms by which science was defined) would be applied to some extent, but the former would be the one used most immediately by the proponents of mathematics-as-science.

2.1.1 Causal relations in mathematics

How then could the detailing of logical relationships between ideas that comprised mathematical demonstration be made conceptually equivalent to the understanding of causal relationships (and importantly, their necessity) between non-ideal things and events in the world that comprised science? Doing this would require the demonstration that whilst the characteristics of science and mathematics might not be the same, at least the cognate characteristics of the objects of and within each field relate to one other in the same way.

These relationships within each field of study can be expressed in the following form, a form which emphasizes the parallels between mathematics and the sciences.

1_s: The objects of scientific enquiry are the physical objects that interact with one another in the world.

1_m: The objects of mathematical enquiry are the conceptual objects³ such as numbers or lines and the relationships between them.

2_s: The essential characteristics of the objects of scientific enquiry include volume, shape, movement, composition, function.

2_m: The essential characteristics of objects of mathematical enquiry are number, magnitude and angle.

For instances of causation involving objects of scientific enquiry the composition, for example, of the causal agent acts as *causa materialis* of the composition of the effect, so to generalise the example:

3_s: When an object of scientific enquiry acts as a cause of another such object, the characteristics of the cause are causally responsible for the characteristics of the effect.

³ According to Blacanus' *Dissertatio* (pp 5-7), they are objects by virtue of being *entia per se* and that their existing only in the mind does not detract from this. He adds that all science abstracts from its objects' specific existences and that this is no different for mathematical objects. (Wallace, 1984. p 142)

The simplest case of this process is like that of composition mentioned above, where the relationship between cause and effect is between characteristics of the same type.

For mathematics to be a science then there would have to be a true statement 3_m that corresponds to 3_s , or some other statement that similarly defines mathematical causation as sharing its essential properties with scientific causation.

It was Blancanus, a student at the Collegio Romano under Clavius (Wallace, 1984. p 141), who drew the major parallels between causal relationships within science and within mathematics (specifically within geometry). Magnitude, he said in 1615 in *De mathematicarum natura dissertation una cum clarorum mathematicorum chronologia*, is equivalent to the matter composing physical objects. Mathematical objects, being objects (see footnote 3) and composed of intelligible matter, are composed of parts that are sufficient to serve as material causes exhibiting properties (Wallace, 1984. p 142). For this reason, mathematical demonstrations relying on magnitude are equivalent to syllogisms demonstrating scientific causation where the middle term of the syllogism expresses material causation and so geometrical demonstrations use material causation. Further, he argued, descriptions of geometrical objects specify their essences (form and magnitude) and so used formal causes as well (Dear, 1995 p 40, also cf. Wallace, 1984 pp 142-143). In this argument, Blancanus restricts his comments to geometry, but the same arguments can be made of arithmetical demonstrations.

These arguments for causation in mathematical demonstrations draw on the tradition of debates on the nature of mathematical objects. Early Modern mathematicians and philosophers drew on two major classical sources for their definitions of mathematical objects, Aristotle and Plato (Radford, 2004. pp 5-8). Both philosophers understood mathematical objects to be different in some way from the physical manifestations of those objects (lines from straight things, circles from round things, number from groups of things) but they differed in their understanding of the nature of that difference. For Aristotle, mathematical objects were abstracted from the physical; they were known through the senses and then understood. Saying, for example

The mathematician is able to study surfaces, volumes, lengths and points in isolation from their physical instantiations because...he is able to separate the two in thought...Having been separated by thought, mathematical objects are free from the changes which physical objects undergo. (Aristotle, *Physics* II, 193b33-34)

Implicit in this statement is the dependence of mathematical ideas on the separateness of the object from the object as perceived, since it is the object in thought that is separated, not the object in the world. This dependence is made explicit in his *De Anima* in which he claims that all learning is sense dependent and further that conceptual objects require images, images which behave like “sensuous contents except in that they contain no matter” (*De Anima*, III, 8). This abstraction allows the mathematician freedom from the vagaries of specific instances to make universal judgments about mathematical objects.

Plato took quite a different view. Rather than the objects being ideas abstracted from sense, they are perceived by the mind independent from the senses. They existed the outside mind, but present to it. Mathematical objects occupy an important place in the Platonist theory of Forms (Brown, 1999 p 24). The reason for its special place in Platonism is a problem that Kant would later present in a way that I think is enlightening (though he draws very different conclusions to either Plato or Blacanus). This is by no means a problem unique to the period of Clavius and his disciples; for example in the *Critique of Pure Reason* Kant distinguishes mathematical concepts from those he thinks of as more purely philosophical by virtue of their having exact definitions (Smith, 1962. p 564), contrasting them with, for example the lack of precise shared definition in legal and moral philosophers’ understanding of the right (Kant 1929. p 588). If the Forms are present to the mind and in some non-sensory way perceivable by it, then the ease with which mathematical Forms were understood makes them ideal examples for development and expansion of Platonism, more so than any other Forms of abstract concepts. The special nature of mathematical concepts among the Forms can be seen in Speusippus’ (Plato’s nephew and successor) rejection of all other Forms but mathematical (Tarán, 1981. p. 23) (mathematicals being the term to distinguish mathematical Forms from other Forms by e.g. Tarán, 1981 and

Mendell, 2004. Some commentators consider them to be a separate class of existents intermediate between phenomena and ideas e.g Petrie, 1911).

Blancanus drew on both the Aristotelian and Platonic models of mathematical concepts in developing his ideas on mathematical causation. Following Plato he classed mathematical objects as independent intelligible objects.

These do not exist in the nature of things, since in the mind of the Author of Nature, as well as in the human mind, their ideas do exist as the exact archetypes of all things, indeed, as exact mathematical entities, the mathematician investigates their ideas, which are primarily intended per se, and which are true entities. (*Dissertatio*, quoted in Mancosu, 1996. p. 180)

He does however also adopt Aristotelian views, saying that the phrase “mathematical perfection” is a way of describing the perfection of that which is abstracted from the sensible (Mancosu 1996. p 180).

The combination of Platonic and Aristotelian elements in Blancanus’ writing indicates that we should not be surprised to find such a combination in other writings of the period. It may also stem from a problem in adopting a more purely Platonic perspective. For Blancanus to achieve a general academic acceptance of Mathematics as a science, he would need general acceptance that it obeyed Aristotelian causal laws and abandoning the Aristotelian framework for a purely Platonic one, would preclude that acceptance from being given. The combination also reminds us that even though the followers of Clavius, such as Blancanus classified the sciences in ways that differed from the dominant Scholastic classification of science, they agreed that Aristotle’s model of science was broadly correct. There are some parts of Plato’s philosophy of number that make it difficult to fully integrate with Aristotelian science. According to Wallace (1984 p. 142), for example, it is the divisibility of mathematical concepts into component parts that renders them suitable as Aristotelian causes, with each separable property responsible for a property of the effect. For Plato however, mathematical concepts such as the ideal numbers are perfect unities, indivisible (Tarán 1981 p 14). This indivisibility makes it difficult to adopt a

purely Platonic position, as does the institutional importance of the Aristotelian position for those who were trying to justify mathematics as a Scholastic science.

Arithmetical demonstrations can also be framed in the terms Blacanus uses to make geometry an example of scientific mathematics but geometry is markedly more important in Blacanus' attack on the boundary between mathematics and science. The relationship between geometry and arithmetic in the context of this debate and this period do demand closer attention but it is geometry that is used in the mathematical approach of Thibault and his antecedents and so the specific place of arithmetic is not critical to this dissertation.

2.1.2 Ancient Authority

Blacanus' approach to the problem dealt with the primary methodological objection to mathematics' place among the sciences. The next objection to be dealt with was that which required sciences to fit within the scholastic system of classifying the sciences and defining their relationships to one another, and denied that mathematics did so.

The first and simplest approach was that taken by Clavius, to begin with what was already assented to: that mathematics was a valuable tool in certain sciences, and then to extend that idea. The importance of mathematics to the scientific enterprise was pretty well accepted by teachers of philosophy contemporary with Clavius. It was particularly useful in the so-called mixed or subordinate sciences. These, such as optics, astronomy and music, used mathematics to examine non-mathematical objects (hence the "mixed" appellation), this ran contrary to the paradigm of science at the time but the value of using mathematical techniques in these fields had become apparent. Clavius used this model of the sciences and the place of the mixed sciences in Aristotle's writings to argue for the inclusion of mathematics. The paradigm for a science in the Aristotelian tradition required the science to obey the rule that their principles of a science be of the same type as the objects of that science, nevertheless Aristotle made a special dispensation for the mixed sciences, allowing them within the sciences despite their composition. So for example,

Hence it is not possible to prove a fact by passing from one genus to another –e.g., to prove a geometrical proposition by arithmetic. There are three factors in a demonstration: (1) The conclusion which is required to be proved, i.e., the application of an essential attribute to some genus; (2) the axioms on which the proof is based; (3) the underlying genus, whose modifications or essential attributes are disclosed by the demonstration.

and later in the same chapter

How transference [between genera] is possible in some cases will be explained later. Arithmetical demonstrations always keep to the genus which is the subject of the demonstration, and similarly with all the other sciences. Thus the genus will be the same, either absolutely or in some respect. (Aristotle, *Posterior Analytics* I.7 1962a) (insertion mine)

According to Treddenick (1962a), the phrase “in some respect” refers to the mixed (or as he puts it, subaltern) sciences. Further, in *Metaphysics* XIII.3, Aristotle proceeded to show how mixed sciences are legitimate sciences despite their apparent breach of the rule requiring internal coherence of principle and object in a science.

...neither [harmonics nor optics] studies objects *qua* sight or *qua* sound, but *qua* lines and numbers; yet the latter are affections peculiar to the former. The same is also true of mechanics.

Thus if we regard objects independently of their attributes and investigate any aspect of them as so regarded, we shall not be guilty of any error on this account, any more than when we draw a diagram on the ground and say that a line is a foot long when it is not; because the error is not in the premises. The best way to conduct an investigation is to take that which does not exist in separation and consider it separately; which is just what the arithmetician or the geometrician does. (Aristotle, *Metaphysics* XIII.3 1962b) (insertion mine)

Clavius makes the argument that if Aristotle actively provided a special category of the sciences to permit the mathematical fields to fall under the definition “science”, as he did, then he intended them to be considered sciences proper and any commentary on Aristotle denying this was based on a profound misunderstanding (Dear, 1995 p.39).

2.1.3 From object to method.

The previous two objections that Blacanus and Clavius dealt with were concerned with the subject matter of mathematics and applied mathematics; the first that the subject matter could not demonstrate necessary causation, and the second that the subject matter of the mixed sciences was not of the same type as the mathematical principles they used. The next major apology for mathematics to which we turn would bypass the question of subject matter almost entirely and deal solely with its methodology and the type of outcome resulting from this methodology.

According to Clavius, mathematics “alone preserves the way and procedure of a science.” (Dear 1995 p. 40) Note that he makes no mention here of suitable objects of study, simply of procedure, and then he proceeds along the same lines to say, “for they always proceed from the particular foreknown principles to the conclusions to be demonstrated, which is the proper duty and office of a doctrine or discipline, as Aristotle, *Posterior Analytics* I, also testifies.” (*ibid.*). This shift of the essential definition of science was a strategy Clavius deemed likely to be successful for the reclassification of mathematics and one he pursued.

As long as science was required to treat of the world, then the defenses of mathematics on the basis that it involved causation would be insufficient (though needed). In Clavius' writings we read him complaining of those who claimed that mathematics was not science by virtue of it “not [having] demonstrations [and being] abstract from being and the good etc” (*Monumenta Pedagogia Societas Jesu*, quoted in Dear, 1995. p. 35. Insertions mine). The issue of “demonstrations” is that of the proper scientific use of Aristotelian causation as discussed in

section 2.1.1. The rest of the quote is what concerns us here. The claim being made is that investigation of certain subjects (along with other requirements) is required of a science and that mathematics does not investigate those subjects.

These criticisms were based in the differences between 1_s and 1_m in 2.1.1 above. The substance of the claim is that objects of mathematical enquiry are not objects at all, or at least not objects about which scientific knowledge can be had. For the proponents of mathematics to be successful in redesignating it as a science that criticism would have to be confronted and shown at least unconvincing or ideally for them, untrue. The mathematicians made no claims that mathematics directly studied physical objects in the world but they did deny that that was a necessary characteristic of science. This could be done, as Clavius did, by claiming that other characteristics of science were more important, to the extent that the nature of the object was inessential, or at least that the object being what the late Scholastics required it to be was inessential, or as Blancanus did, by claiming that the difference between objects made of sensible matter and object made of intelligible matter was not significant enough to make a difference to the scientific status of inquiries concerning them.

Clavius' argument ran that the central goal of scientific enquiry was certain and incontrovertible truth and that any other description or definition of the scientific enterprise was inessential. The sciences, he said,

“delight in and honor Truth – so that they not only admit nothing that is false, but indeed nothing that arises only with probability, and finally, they admit nothing that they do not confirm and strengthen by the most certain demonstrations – there must be no doubt that they must be conceded the first place among all the other science” (*Opera Mathematica*, quoted in Dear 1995 p.38)

and goes so far as to criticize the other sciences for their lack of certainty, saying that Ptolemy had described natural philosophy as “rather to be called conjectures than sciences, on account of

the multitude and discrepancy of opinions” (Dear 1995 p.38). This is a reference to Ptolemy’s *Almagest*, in the preface of which he says that:

...the other two genera of the theoretical [the physical and the theological] would be expounded in terms of conjecture rather than in terms of scientific understanding: the theological because it is in no way phenomenal and attainable, but the physical because its matter is unstable and obscure, so that for this reason philosophers could never hope to agree on them; and meditating only on the mathematical, if approached enquiringly, would give its practitioners certain and trustworthy knowledge with demonstration...
(Ptolemy 1952 pp5-6)

All of this indicates strongly that Clavius and those who similarly supported the inclusion of mathematics among the sciences were placing some emphasis on the relative consistency of opinion among mathematicians about the fundamental truths of their discipline. This level of agreement being distinct from what they categorized as the relative plurality of views in natural philosophy, mathematicians like Clavius classed themselves and their field above the uncertainties of the other sciences.

There seem to be two factors contributing to the ability of the mathematicians to make these arguments. The first is the empirical success and practical advantage afforded to the mixed sciences by their use of mathematics and the second is the relatively enviable certainty of mathematical demonstrations within the pure field. The empirical successes of the mixed sciences are nicely exemplified by the astronomical work of Galileo while the latter characteristic is related to the Renaissance and Early Modern idea of the object.

The empirical and practical successes of the mixed mathematical sciences are themselves further divisible into two areas. The first is the enhanced ability of individual researchers to make inferences on the basis of the data available to them and the second is the ability of those researchers to make use of data collected by multiple individuals in a way that researchers in fields less dependent upon mathematics were unable to do. The impact of both these benefits in

the late 16th and early 17th centuries is well illustrated by the advances in astronomy occurring at that time. My selection of astronomy to illustrate the point should not indicate that such benefits are not observable in the other mixed sciences (see e.g. Dear, 1994, p. 51 for some discussion of geometrical optics in the 17th century), but rather that astronomy was the mixed mathematical science attracting the attention of the scientific, philosophical and mathematical communities because of the growth in the field spurred by, among other influences⁴, Galileo and his telescope.

Cabeo makes the point in his 17th century commentary on Aristotle's *Meteorology* that astronomy cannot be done beyond a very basic level by one observer, but requires the accumulated experiences of astronomers across time and space (Dear 1994 pp93-94). This may seem to fit with the Aristotelian idea of experience and evidence as that knowledge shared by, and available to, the community, and Cabeo himself does seem to have held this conservative view. Collected astronomical knowledge however, especially as the field advanced at the end of the 16th century, did not follow that pattern of generally accessible knowledge; requiring as it did increasingly specialised expertise and resources. This sort of knowledge was created by, and only meaningfully accessible to, specialists. The creation of knowledge, and its addition to the astronomical corpus, had significant technical, technological and social barriers. Key to this barrier is the distinction Blancanus made in his *Sphaera Mundi* between phenomena and observations. Phenomena in his sense are those characteristic operations of the heavens that were accessible to and accepted by the general public as universal truths, as orthodox Aristotelian evidence (for example, the phases of the moon or the movement of the rising point of the sun from a given observation point on the Earth's surface through the year). Observations on the other hand he defined, in a marked break with previous understandings of the terms (Dear 1994 p48), as privileged knowledge, available only to observers with access to, for example, telescopes and with the mathematical skills needed to calculate speeds and relative sizes and motions of heavenly bodies on the basis of the data provided through the telescope. A researcher also had to have the professional capital among other researchers to have their findings admitted to the common body of astronomical observations (Dear, 1994, p. 99).

⁴ One other reason that astronomy was of such philosophical importance then and of such interest for this work was the theological importance of science as discussed in the previous chapter and the particularly pure knowledge of the divine supposedly available from study of the heavens, being more perfect than the Earth.

Further development of astronomy would depend more and more on observations rather than phenomena (in accordance with Blaucanus' new definitions of the terms). This development would prefigure the increasing reliance of all the sciences on specialized knowledge and individual expertise as their own advancement came to require more and more specialized types of observation.

The successes afforded to astronomy (and the mixed sciences in general) by its use of mathematical methods certainly served to support Clavius' claim of the reliability of mathematical demonstrations in general. The other major support for his claim comes from the internal coherence and methodological reliability of Early Modern mathematics itself. Its demonstrations were, in general, more reliable than the demonstrations and predictions of the natural sciences for reasons Dear (1992) deals with briefly in his discussion of the distinctions between the thing being studied, the thing as it is present to the mind (the thing as *object*, or that which is present to the mind) and scientific knowledge about the thing as present to the mind. In his discussion of the development of the term *objective*, Dear (1992) reminds us that the differences between these things were understood to be important in Early Modern science. The distinction in mathematics however is very different to that in the other sciences. Even with careful, lengthy and collaborative observations of a physical object there is a marked difference between the thing being investigated and the idea of the thing about which other things are known but this is far less the case with mathematical objects. In an Aristotelian understanding they are present in the mind, in a Platonic understanding, present to the mind without the mediation of the senses. So the thing and the *object* (thing as present to the mind (Dear, 1992)) are the same, or at least far closer than a physical thing is to a mental representation of it. In 1646, Honoré Fabri distinguished "objective" from "formal" certainty, the former being certainty of a proposition as a function of its nature, the latter a function of the mind actively granting assent to the proposition (Dear 1992, pp 622-623). For mathematicians like Clavius and his followers, this gave them a distinct advantage over the other sciences in terms of the certainty of their demonstrations and conclusions.

2.2 In Conclusion

In the previous chapter we looked at the relationship between the human and the divine in terms of rational knowledge. The human and the divine share the characteristic of rationality, particularly of the ability to recognise logical and mathematical truths. In this chapter we have discussed the changing status of mathematical understanding in the academic environment. God and humanity were seen, as discussed in Chapter 1, as sharing specially in rationality and knowledge, in a manner that no other creation in the world shared and mathematics had become seen, through the efforts of the mathematicians, not only as a science, but as a science with special claims on certainty in knowledge and on truth. Both of these would, in Early Modern Europe, go on to influence strongly the search for a certain science of swordsmanship, a science coherent with the bodies of knowledge describing humanity, the world and the divine.

Chapter 3: Knowledge in Action

In the first chapter we examined some Early Modern views of the relationship between humanity, nature, the divine and rational knowledge. In the second we looked at how some aspects of the idea of rational knowledge held by some philosophers changed in the late 16th and early 17th centuries from one based on common experience to one based on specialised knowledge and observation by individuals possessing that knowledge. We also examined how mathematics came to hold a place of prominence in academia as such a body of specialised expertise. In this final chapter we will examine Thibault's 1630 *Academie* in light of the preceding chapters and the commentary of de Ley, who devotes a chapter of his *The Movement of Thought* (1985) to Thibault. Most of the philosophical foundations of the *Academie* are found in the first chapter, the bulk of which is found in Appendix A of this dissertation both in transcription and my translation. Where quotes from other parts of the book are needed, they will be taken from John Greer's 2007 translation. The first section of the chapter, from 3.1 to 3.2.1 will offer a synopsis of the *Academie*, particularly those parts of it that will be discussed in the remainder of this chapter.

3.1 Publication of the Book

The first thing we will be considering is the religious content of the opening chapter of Thibault's work. This book received publication licences from Louis XIII, the United Netherlands and Frederick II (Thibault 1630). Of particular interest in this context is the one under the authority of the Holy Roman Emperor. Although his predecessor, the Emperor Matthias, was a religious peace-broker, Ferdinand was a powerful supporter of Catholicism, and this was expressed in his policies regarding printing and publishing. For example, after the suppression of the protestant rebellion in Bohemia, all books had to be passed by a Jesuit committee before printing and in accordance with an order dated April 1628, all privately owned books in the region had to be taken to the nearest priest for inspection and approval. While Thibault was not writing within the Holy Roman Empire and he and the house of Elzevier were not subject to any of the specifically Holy Roman regulations of the publishing industry, the presence of this authorisation in the book suggests that it was well in keeping with orthodox

Roman Catholicism. The importance of religious orthodoxy in a book devoted to a physical and practical skill may not be immediately apparent to the 21st century reader but Thibault was not only offering practical advice, he was making truth claims about humanity and the world, and relying explicitly and implicitly on claims made by other writers about humanity and the world. Henri James Martin emphasises the importance of social mobility in creating a customer base for the sort of self help text that fencing manuals were (de Ley 1985). Part of the process of learning for these newly armed families and individuals was making sure that what was learned was socially and religiously orthodox.

In his analysis of censorship in Stuart England, Milton (1998), makes the point that the state was not in a practical position to effectively control publishing output by force, but the pressure for writers to submit themselves to the demands of the various stages of censorship, which in the English system he describes involved approval from the diocese and the Stationers' Guild (Milton, 1998. p 627), and checking of previous approvals and required corrections before printing. Despite the lack of capacity of the government to enforce compliance, writers still went through the process. Milton makes the argument that the point for the writers was not legal compliance, but the social capital of being seen as one of the approved spokesmen of orthodoxy. This is particularly relevant in Thibault's case since, as a fencing instructor, he needed access to and respect from the socio-economic élite for his living. It is also of importance for Thibault because the warrant for the truth of his practical claims is the truth of the theological and metaphysical claims in his first chapter, and attestations of orthodoxy in turn warranted confidence in those claims.

This specifics of the process Milton describes are not, of course, the same as those of the continent but the principle he describes is instructive. The situation on the continent was complicated by the parallel power structures of Church and State, such complication not being as problematic in Anglican England. Powis (1983) describes the difficulties by the French censors in walking the line between Catholic obedience and Gallic self-determination, and their solutions to them. They pursued a policy whereby the authority to discipline the consciences of France was vested in the state, specifically in the king, but that a secure state required orthodox Catholicism for the maintenance of public order. That degree of local control did not imply

freedom of conscience, but national sovereignty. Thus the multiple national licenses of publication should not be read as having separate requirements for religious orthodoxy, but rather as an assertion of national identity and, especially in the context of this book, an assurance of suitable social orthodoxy to European élites.

3.2 Content

3.2.1 The Plates

The bulk of the book is comprised of explanations of the various plates¹ (called Tabula I, Tabula II etc), each plate subdivided into smaller scenes, each designated by a number (Circle 1, Circle 2 etc) and most of them (particularly from Tabula III onwards) capturing a moment in an armed encounter between two people. These plates tend to depict detailed features iconic of the interior of a magnificent building, some of the individual circles are on the floor of this building, but others are painted on the walls or are on tapestries etc. To my eyes and those of other modern readers I have consulted this does not seem particularly strange, but Thibault felt the need to insert an authorial note explaining it. In this note he claims that the presence of images within images as anything other than representations of art within the scenes depicted was not a common thing in art at or before this time. In his explanation he assumes that the reader would not automatically interpret all the images as representations of three dimensional space but might rather interpret the picture *of* the room in three dimensions but the pictures *in* the room in two unless informed otherwise making specific mention of “the majority of people who do not understand perspective” (Thibault, 1630, see Appendix A, p 75 of this work). He also specifically makes the comparison in that note between the images and maps, particularly nautical maps, emphasising their nature as two dimensional representations of real space.

Each design called a “circle” is in fact a complex diagram comprised of a square containing a circle and various chords to that circle and lines connecting intersections of the circle, square and chords. This construction is explained in the first plate and the chapter associated with it. The

¹ The team of engravers were some of the finest of the period, led by van de Pass the Younger (Anglo, 2000. p 75)

diameter is equal to the height of a person from the feet to the tip of a finger stretched up above the head and the rest of the lines are drawn from this circle, the square circumscribing it exactly and the rest of the lines constructed from it according to the procedure Thibault describes at the end of that chapter, giving explicit instructions for the physical construction of such a circle using chalk, string and a sword. The fact that the instructions are very physical and practical is of interest for this study and this will be discussed later. While each diagram is a complex construction containing several shapes, Thibault calls them circles and clearly considers the circle to be the defining characteristic of the diagrams, so I will continue to use that terminology.

The first two plates are slightly different to the rest, describing, not moments in an encounter, but the principles of the training system. In the first plate, pictured below in figures 1 and 2, are shown five circles overlaid with the human body in various configurations. Circle 1 had the body facing the reader, half in full and half just showing the skeleton and with 25 anatomical points indicated running from the top of the brow at A to the ankles at Z (and leaving out the letter J). Circle 2 is the only one with no human body and merely details the names of all the lines in the figure (for example principal diameter, perpendicular diameter (both diagonal to the circumscribing square), oblique diameters (parallel to the sides of the square), exterior transverses, exterior collaterals etc).² Circle 3 shows a skeleton from the side and the circle has footprints on it showing the number of paces of Thibault's favoured length along the diameter showing how each of those paces end with a foot on one of the intersections of the figure. Circle 4 shows the human body from behind, stretched along the primary diameter of the circle and with footprints at points on the diagram showing the three categories of distance (3 Instances) between combatants in which different possible actions can be taken. Circle 5 has a figure from the front, but inverted with respect to the other figures on the page, it partners Circle 4 and details the types of attack possible in the three Instances (the three distance relationships detailed in Circle 4). There are then several images showing his preferred length of sword³ and comparing it to various parts of the human body, this is an interesting example of the interplay between the empirical and rational contributions to his work, to which we shall return in section

² *Diameter principalis, diameter perpendicularis, diameter obliqua, transversæ exteriors, collaterales exteriores*

³ For which the distance from point to quillions (cross guard) equal to that from the navel to the soles of the feet, or half the diameter of the circle.

3.2.2.3. The second plate continues the anatomical theme with a comparison of the points on Plate 1, Circle 1 with the anatomical points and proportions found in Dürer's *Vier Bücher von Menschlicher Proportion* (Book II p. 60). Thirteen of these are shared between the systems, twelve are specific to Thibault, and Dürer has fifteen points on the body and four on the arm that Thibault does not (Thibault does not detail any points on the arm). The third plate and onwards start to describe actions performed with the weapon in hand, which will not occupy much of our attention, so I will not describe the rest of the twenty three plates of the first book and thirteen of the second; the first book detailing the actions of single sword against single sword and the second having two plates of astrological significance and then showing how the sword alone is to be used against sword and dagger, sword and shield, two handed sword, left handed swordsmen and firearms (the last not using the circles to describe the movements of the swordsman).

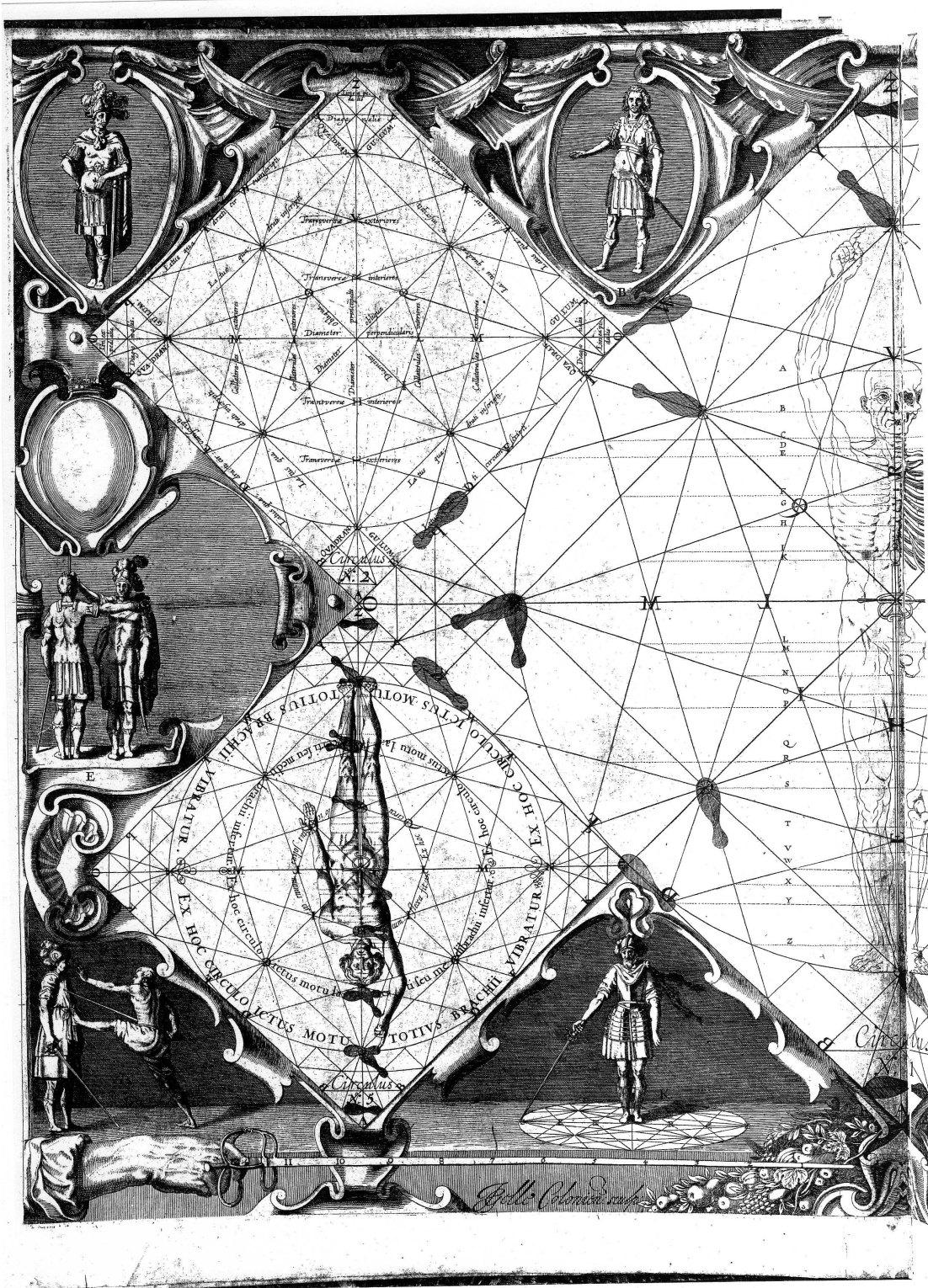


Fig 1: Thibault's Tabula I. Left half

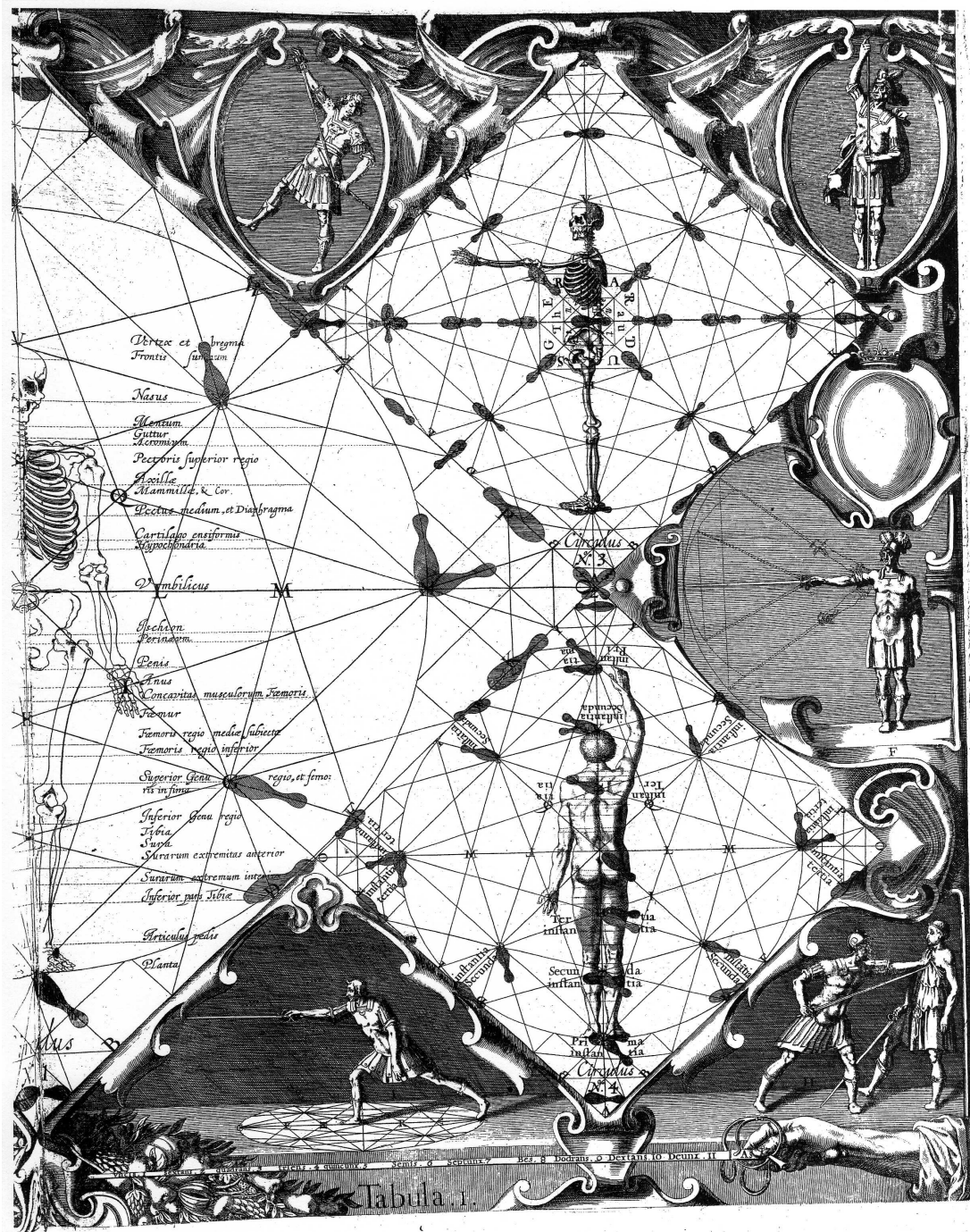


Fig 2: Thibault's Tabula I. right half

3.2.2 The Text and the Context

The plates are accompanied by text explaining their content. This dissertation will focus on the text associated with Tabula I.

3.2.2.1 The History of Mathematics in Fencing

In the previous chapters we made much of the academic attitudes to mathematics in the period and this text combines some of those same attitudes with what we might describe as external (non-professional) esteem for mathematics. This esteem can be seen in two different ways, esteem for mathematics as useful for description and esteem for mathematical laws as prior to and determinant of the behaviour of people and the world. Thibault uses mathematics descriptively but his writings begin with defining the human body and the universe in terms of their essential (as he saw them) mathematical properties, which he saw as the same as their theological properties.

Man...exhibits...with all the other signs of divine wisdom, a nice representation of the Universe in its entirety and its major parts...body has condensed within it not only that of the base Earth that we see, but also the heavens. (Thibault 1630. See Appendix A, pg 79 of this dissertation.)

The first text to make the connection between fencing and mathematics is reputed to be the lost book of Phillipio di Bartolomeo Bardi, professor of mathematics at the University of Bologna in the early fifteenth century whose first book dealt with geometry and whose second explained swordsmanship in terms of it (dei Liberi, 1902, p. 108, note 179). That there was this link between fencing and mathematics was an idea that was to remain popular, but not always well understood or explained by those who espoused it. Filippo Vadi, for example, in his late fifteenth century treatise on personal combat claims that fencing is “a true science and not an art”⁴ because the sword is subject to geometry and is therefore like music “so geometry and music combine their scientific virtues in swordsmanship to adorn the bright star of Mars” (Vadi,

⁴ “Che le scienza vera e nõ e arte” (3 verso)

2002 pp 40-43) yet he never mentions mathematics again in his text. This *topos* can be seen in several treatises on swordsmanship, but nowhere is more attention paid to it than in the treatises of the *destreza* tradition, this makes the *destreza* tradition a good case for an initial examination of the idea.

3.2.2.2 Description and Descriptive Mathematics

The earliest surviving treatise on swordsmanship, dating from the first years of the 14th century has the combatants floating free in space. It is impossible to tell which leg is forward and the weapons and other items held change size from plate to plate⁵ as well as having no depth or angle (the plane of the blade is always parallel to the plane of the page). Over the next three hundred years there would be significant developments in artistic technique that would allow the communication of significantly more information about depth and angle through perspective. This primarily involved the addition of a line or other features⁶ suggestive of the ground. Modifications would be made to this in terms of the addition of regular tiles to the floor as Fabris (1606) did. The next addition to this area of growth in the artistic representation of combative training would be Henri de Sainct Didier who, in 1573 added numbered footprints to his woodcuts. Anglo (2000 p 65) calls Sainct Didier's ground plans geometric but, while many of them do have the footprints connected to make polygons, calling it geometrical in the sense that we see geometry in Thibault is misleading as precise information about distance or angle cannot be determined, nor is it intended to be so, from the diagrams.

Apart from the footwork, fencing instructors and writers and their artists also made progress over those three centuries in communicating movements of the arms and weapons. The first major development was the ability to represent the sword which, although obviously a three dimensional object, may be represented in art like a tilted plane in terms of its angle and perspective in pictures. In terms of geometrical description of its movements, the next great

⁵ It is worth noting that the size change of the bucklers (small, fist gripped shields) do correspond to their orientation. The larger bucklers are always facing along an axis in the plane of the page (bucklers edge on to the reader) while the smaller ones at 90 degrees to it. Thus it seems possible that this inconsistency is for improved visibility.

⁶ Hans Wieditz' woodcuts for the 1531 *Der Alten Fechter* do not show a floor, but indicate it's presence by the shadows the combatants cast

innovation came in 1553 in the *Tratatto di Scientia d'Arme, con un Dialogo di Folosofia* by the architect Camillo Agrippa⁷. Agrippa described the fencing lunge using geometrical constructions to demonstrate different angles of the leg and placements of the arms (Anglo 2000, p 63, plates 42 and 43).

It was Thibault who was to build on these communicative methods in a manner which, although clearly owing much to his predecessors, was truly novel. When one examines the circles, the reader should note that Thibault explicitly compares his diagrams to maps and the idea of the map grid, both in his authorial note about the plates and in his discussion of the first plate (Thibault, 2007. p 30), in the latter case specifically comparing them to marine charts. The type of marine chart to which Thibault's diagrams have the most marked resemblance is the Portuguese *portolan* charts of the 13th through 16th centuries. These charts did not have a fixed square grid but a circular pattern with chords emanating from points around its circumference, the chords indicating, not fixed points, but distance and direction along a constant bearing from a starting point or a waypoint (Turnbull 1996, pp 9-10). This has significant correspondence with Thibault's use of the circle which indicates, not fixed points on the floor, but defines various angles of movement based on the starting points of the combatants. The relevance of Thibault's use of bearing and of the *portolan* model is important when comparing the footwork diagrams of the *Academie* to those of Henri de Saint Didier⁸. Saint Didier's footprint diagrams indicate points to which the fencer must step in execution of certain actions just as Thibault's do, but there is a major difference in that Saint Didier's footprints are simply presented as numbered points on the ground while Thibault gives the rule for determining them based on the angle along which the fencer must step. This was a novel development in fencing literature as well as a method specific to the *portolan* charting method. Given that Thibault is explicit that he draws

⁷ Agrippa was one of the engineers tasked with moving the Vatican obelisk in 1586 and can be assumed to have significant mathematical knowledge. He also wrote on marine navigation, meteorology and geography.

⁸ Author of the 1573 fencing text *Traicté contenant les secrets du premier livre sur l'espée seule, mère de toutes armes, qui sont espée dague, cappe, targue, bouclier, rondelle, l'espée deux mains & deux espées, avec ses pourtraictures, ayans les armes au poing por se deffendre & offencer à un mesme temps des coups qu'on peut tirer, tant en assillant qu'en deffendent, fort utile & profitable por adextrer la noblesse, & suposts de Mars: redigé par art, ordre & pratique*

on maps as a communicative device, it is a reasonable assumption that he had some exposure to the *portolan* method.



Fig 3. Detail from *Carte Pisante* (c. 1290), the oldest known European sea chart. Vellum, 50 X 105 cm. (Turnbull 1996, p 10)

Despite this affinity there are some problems in drawing too close an analogy with geographical maps. According to Liben (2001, p 50), cartographic maps (as contrasted with conceptual or

other maps) have three essential characteristics, purpose, duality (both as things and as representations of things) and spatialisation (it represents what it represents in relation to space). The problem with applying this analysis of maps to Thibault's circles is that the space they describe is defined by things not fixed with reference to one another as most cartographic maps are; landmarks, buildings, rivers in large scale maps etc. Thibault's circles are defined only by the fencers, who are observing both their own movement through the environment and their opponent's movement with respect to themselves and the environment, in which each action must take place in a given place with respect to the opponent. One might compare this with a naval chart prepared as the ship moves and drawn with other ships as reference points. Useless for a ship trying to navigate reefs, but it may be described with a simile not available to Thibault as being like a radar display, which is optimised for informing actions in a dynamic environment involving other agents.

Thibault draws on a number of knowledge traditions in developing his system of notation, particularly the mapmaking tradition of Iberia which used the radial presentation of direction from starting points around a circle and the fencing tradition which had started to depict footprints to indicate footwork (such as in Saint Didier's work) and the use of geometric construction lines to indicate movements of the blade (for example in the work of Agrippa). All of these developments are to be found in Thibault's *Academie* with modifications; the lines of direction and distance are calculated not from fixed starting points but from the mobile fencer, the footprints were used before but Thibault presents them with precise distance and direction from the starting position of the feet to intersections of the lines of the diagram and while Thibault does not often show construction lines around the blade (beyond his demonstration of the range of motion of the blade in Tabula I), he explicitly communicates their positions in terms of the grid of lines on the ground by showing their shadows in a novel fashion for fencing, or any other, Early Modern instructional treatises. In this text Thibault far surpasses the visual clarity of his master's or *his* master's books (Anglo 2000). While both of them had geometrical diagrams to express principles of space and distance, neither of them used those diagrams to develop anything like a consistent notation for communicating precise motions and actions. This is the first time in the surviving 300 years of texts on fencing, that they or texts on sports or dance contain the amount of information and precision of information that Thibault's work does.

Turnbull (1996 pp4-60) points out the importance of information-rich, copyable and interpretable diagrams in the development of early modern and modern science, and the developments in movement notation made by Thibault and the other fencing writers points to a spread of use of these diagrams and development of techniques in this sort of communication well outside the academic zone.

This idea of information rich diagrams suggests some of the importance and interest in Thibault's use of descriptive geometry. The lavish buildings in which the individual pairs of figures are depicted make it tempting and easy for readers such as Castle in the 19th century (Castle, 2003) to think of them as naturalistic depictions of pairs of swordsmen but this is far from the truth, even an obstacle to understanding them. One must look carefully to see indications that the images are not intended to be naturalistic representations but the clues are there, the first is contained in the text with his use of the comparison of the plates and the circles to maps, not naturalistic pictures, and the second is the use of shadow in the plates, the shadows of the fencers are angled as if the light source was off the reader's left shoulder while the shadows of the swords are placed as if there were a far brighter light directly overhead; where naturalism conflicts with precise communication, Thibault makes the former give way. The diagrams are attempts, not to depict scenes of combat or training, but to communicate information about of space and movement to the reader. Some training schools may have made use of them, for example there is a woodcut of the fencing school at the University of Leuven in the late 16th century which shows such a floor pattern⁹ but Thibault makes clear in his text that they are purely aids to the reader's, and student's understanding, but do not depict a real place.

3.2.2.3 Mathematics as constitutive

Thibault's diagrams are intended as communicative devices but their import goes beyond that, they do not simply provide a framework for the space in which movements take place and allow those movements to be described, but they are claimed to indicate what the appropriate movements are. Each step ends exactly on a vertex, not only to show where it is, but because

⁹That school had been instructed by Ludolf Van Culen, Professor of Mathematics there, but I cannot definitively attribute the floor pattern to him.

Thibault claims that the laws of mathematics made the vertices the best places to step prior to the his empirical successes using that method. The reasons for this are what most strongly relate Thibault's work to the Similarity Thesis of the first chapter and the position of mathematics in relation to it as described in the second chapter. In practice these steps, being comparatively short, more closely approximate the normal walking and pace and normal standing position than the relatively longer steps and lunges and the pitched body positions taught by many of Thibault's professional competitors. In his introduction, Thibault talks about the standing posture as best for fencers because it is natural to humanity and that other postures are "repugnant to the ordinary way of walking or standing: the effect of this is that instead of displaying great courage, they inconvenience themselves and reduce their own power" (p. 84 of this dissertation). This still does not justify his claims on anything other than pragmatic grounds, movements to which the body is used, or which the body performs more efficiently may well prove more successful without having direct relevance to metaphysical concerns or the relationship of theological to practical truths. He takes what he requires for this extra leap from other areas of the Similarity Thesis to convince the reader of that relationship. These are, firstly that humanity is uniquely similar to God, secondly that the universe necessarily reflects the nature of God. These together would give the human a special place in the universe and would give actions that specially characterize the human such as reason, science, art and technology a special role in defining and upholding that place; both the human mind in terms of its rationality and the human form in terms of its "most naturally human" postures and movements.

The most rational human mental activity having been seen as the mathematical, Thibault must then demonstrate "natural" similarities between the human body and the divine plan, and in particular between his method and the divine plan. He attempts this, apparently succeeding to his own satisfaction, in the *Explanation of the First Plate*¹⁰ (see Appendix A, p. 77 *et seq.*). This is the section where he most explicitly compares the human form to the universe, and to the *theologia prisca* of the neo-Platonists, here explicitly making reference to Pythagoras and Plato. Here, not only is the form itself holy, but knowledge of the form and its proper functions makes one holy. Where he compares the body to the Ark and the temple of Solomon, for example he implicitly makes improper movement or use of the body a misuse of divine gifts. This

¹⁰ Declaration du Tableau Premier

comparison is analogical, Thibault analogises the body to both the heavens and to the parts of buildings, the legs to pillars, the proportional dimensions to those of Noah's Ark. Thibault thus presents us with a curious mix; a Early Modern, scientific sensibility geometrically mapping the ranges of movements of joints and overall movement possibilities but justified by reference to neo-Platonic imagery and analogy.

Herbert de Ley (1985) discusses the shift from one Foucauldian *episteme* (one of analogy) to another (one of quantification and classification) in the late 16th and the 17th century in France, specifically using a comparison of Henri de Saint Didier's and Thibault's works as illustrative of this shift, classing the former as falling largely within the *episteme* of resemblance or analogy, as evidenced by the generally metaphorical language used, and the latter in the *episteme* of classification based upon its use of geometrical description. He does acknowledge that Thibault uses the language of analogy in places, particularly in Thibault's opening comparison of the human body and the universe and in his later comparison of the interplay of sword combat with the give and take of juridical argument (de Ley, 1985. p. 59). He uses these comparisons to situate Thibault's work within this epistemic shift from the "analogical" to the "logical", including elements of the old even as it is exemplary of the new. Although he admits that Thibault does include elements of the analogical, he does not see the mathematical (for him logical and classifying) elements as dependent upon the analogical, though he does not explain why he sees them as separate. He simply states that the analogies of, for example the human body to the planets in the introduction are separate from the logical elements, for example Thibault's desire to reduce "infinite operations" to a few laws applicable across all (*ibid.* p. 63).

The logical and analogical parts of the work can be considered separately and certainly one could develop a model of physical conflict without his premises, but to ascribe this thinking to Thibault and his readers would be anachronistic. Thibault begins his book with a comparison of the human body with the universe and with the divine, adopting alchemical and astrological language to express the affinity of not only the human body in particular, but also the human more generally, with the greater creation and claiming that that affinity is to be seen most easily in numerical and geometrical terms. This combination of neo-Platonic, analogical elements with the mathematising, quantifying elements that de Ley identifies as characteristic of the "new

episteme of 1605" (*ibid.* p. 55) are important to understanding Thibault's work and its place in Early Modern intellectual history. Thibault justifies the one with reference to the other, saying:

Man...exhibits with all the other signs of divine wisdom, a nice representation of the entire Universe and its major parts, and has this with some justification been called by the philosophers of old Microcosm, or the Little World

...

[the body has] condensed within it not only that of the base Earth that we see, but also the heavens; thus mirroring the totality with harmony, beauty and completeness, and with the proper consistence/coherence of numbers, measurements and weights, which correspond/reference marvellously the properties of the four elements and the effects of the planets, there is no other with this resemblance. The most perfect number, Ten, is constantly to be seen before our eyes, in full with our full complement of fingers; & divided into two even parts between the two hands, divided into the number of five digits which are divided unequally between the thumb and the other digits into one and four, where the One is composed of two sections and the Four of three¹¹: thus the entire structure contains and comprises the primary and most excellent numbers, 1, 2, 3, 4, 5, 10, which many of the most famous philosophers, like Pythagoras, Plato and those of the learned Schools held in the highest esteem, and used to both conceal and reveal the greatest mysteries of their doctrines. (Thibault 1630, Book I Tableau I, p. 1) (see Appendix A, p 77)

This may seem a philosophically strange expression, seeing excellence (and not mere usefulness or normality) in, for example the number ten as something independent of our number of fingers and a mark of the excellence of the body. The explanation for this can be found in the Similarity Thesis and the related idea of the Book of Nature. If, as was an important idea in European thought at the time, the causal similarity principle applied to humans and the universe as

¹¹ Likely the joints of the fingers.

creations of God, then affinities and similarities should be present. Likewise if the special quality shared by human and divine was in terms of people's ability to perceive and understand the nature of the universe and themselves, then that similarity should be both evident and understandable by the educated of the time, that is, scientifically understandable. In understanding the universe, people could understand God, themselves and qualities shared by them, particularly order and rational understanding.

It should not be strange to us to find a slightly self pleading streak in a text exhibiting elements of the Similarity Thesis but it would be overly simplistic to call it simply a fashioning of the universe in the image of humanity. Thibault certainly seems to believe that the human body, the world and the heavens all conform to the same pattern and that that pattern has primacy over the vagaries of the human body. For example, in the discussion of Tabula II, in which Thibault's set of human proportions are compared to Dürer's, Thibault says that where the two systems differ "it is the circle which will settle the question" (Thibault 2007, p. 40). Deciding between two systems on the basis of one of them is, of course, problematic but beyond that what is interesting is that it is to the circle, to the rules, that Thibault appeals rather than to the body itself. He also seems to feel that determining the proportions from a picture of the body or from the body itself (as Dürer did) is an inferior method to one based on the application of simple rules, calling Dürer's parallelograms "artificially ordered"¹² whereas the lines and vertices that define his circular system fall as where they may¹³ based on the rules he has established for drawing the diagram. He then corrects the length of the hand in Dürer's system because it should be shorter because "according to the demonstration of the Circle... its length should be no more than the length of the head, which is equal to half the side of the quadrangle" (Thibault 2007, p. 41). At points where Thibault corrects Dürer, e.g. the ratio of thigh to shin and the position of the buttocks, he does not explicitly say whether he is doing so on the basis of empiricism or rationalism but the claim about the hand is clearly on the basis that Dürer's proportion does not correspond to the rule and that those rules are what Dürer ought to have followed. This claim is an embrace of the mathematisation that de Ley (1985) claimed as characteristic of the new *episteme* and that Dear (1995) identified as part of the shifting ideas of the nature of science at

¹² *artificiellement ordoneés* (Thibault, 1630 Book I, Tableau II p. 2)

¹³ *quasi à l'aventure* (Thibault, 1630 Book I, Tableau II p. 2)

the time, rejecting individual observations for mathematical rules. Thibault however does not justify his rules inductively, but by reference to implicitly neo-Platonic ideals.

For Dear (1995) this mathematisation is accompanied, and is required for, the production of evidence from discrete observations and data but this does not seem entirely to be the case in Thibault's work. The notional body that Thibault uses in his circle is defined as the ideal, "perfectly proportioned" body and his claim is that other systems, such as Dürer's are a result of getting evidence from bodies that are "poorly proportioned" (Thibault 2007, p. 41). So the best knowledge about the body and its construction comes not from gathering knowledge from several bodies and mathematically determining the 'standard body' but by selecting the ideal body based upon the rules already geometrically determined. Part of the distinction that exists between the two types of mathematisation, one turning individual data into public evidence and the other defining what is acceptable as evidence based upon its conformity to pre-established mathematical rules, may be understood from Thibault's title. He uses the phrase "demonstrated by means of mathematical rules"¹⁴ in his titular announcement of the method he will be using. Since he is distinctly using a geometrical method, this is perhaps not surprising, but the phrase *Reigles Mathematiques* has connotations in French that go beyond that. The earliest use of the phrase that I've been able to find, and one that was translated under the guidance of the Royal Society's editors at the time of its publication, is by de Luc (1778, pp. 545-546) who says,

We are obliged to take up with probability in Nature in so many respects, that it is perhaps of more importance to us to investigate the physical rules of probability than to attend to its mathematical rules upon hypotheses.

Nous sommes obliges de nous contenter du probable à tant d'égards dans la Nature, que chercher lès règles mathématiques sur des hypotheses.

This quote is from the late 18th century and is more sympathetic towards the inclusion of probability and uncertainty in scientific investigation than an early 17th century scientist would be but the distinction he makes is clear. Measurable instances are subject to the vagaries of

¹⁴*Demonstrent par Reigles Mathematiques* (Thibault, 1630)

probability, or uncertainty, but rational mathematical rules are not. According to Hacking (1995, p. 22 et seq.), the Thomist view separated probability from science on the basis that probability is a function of opinion and approbation, etymologically related to *probity* (Byrne 1968, p. 188 in Hacking 1995, p. 23), while scientific demonstration provided a far higher standard of evidence and promised knowledge rather than opinion. So mathematics would fit the bill for certainty after Clavius' claim that mathematics and mathematicians...

“delight in and honor Truth – so that they not only admit nothing that is false, but indeed nothing that arises only with probability, and finally, they admit nothing that they do not confirm and strengthen by the most certain demonstrations – there must be no doubt that they must be conceded the first place among all the other science” (*Opera Mathematica*, quoted in Dear 1995 p.38)

It is also in this context that the relatively higher status of mathematics in terms of the other sciences has a slightly longer currency than Dear (1995) argues. The fifteenth century quote from Vadi cited above suggests that outside of the schools, mathematics was considered an exemplary science and of sufficient status to warrant the association Vadi clearly wanted to make between his art and the sciences.

With the fencers' opponent already being unpredictable and knowledge of possibly variable success with their defences, the embracing of certainty and rejection of chance in at least their own techniques is something readily desirable by many swordsmen who understood the difficulties and uncertainties inherent in a sudden encounter, an uncertainty tacitly admitted to by Thibault (2007, p. 57) even though mathematical certainty is the basis of his system of training. Given the promise of certainty that science offered and the claims from within the academic community by writers such as Clavius and his followers that mathematics was not only a science but the science of greatest certainty then the intellectual path Thibault and his predecessors took become clear. Mathematics allowed them to reduce the number of possible situations to a few and describe their essential properties, showing

“one or two examples; so that according to them, and following the same method one is able to counter thousand or more other operations, which differ only in circumstances and in no way prevent the counter from having effect.” (Thibault, Greer (tr), 2007, p. 239)

So the essential properties of the attacks were identified mathematically and their certain counters determined according to the “mathematical rules” that promised so much.

3.3 In conclusion

Thibault very clearly believes that philosophy and mathematics are important and that they afford him both intellectual access to the greatest available truth and professional access to his preferred clientele.

Thibault's *Academie* provides insight into interactions between academic philosophy and society, represented by the socio-economic elite, in the Early Modern period. The book was written for members of this elite and calculated to appeal to them, as well as present the author's thesis. In making the book appealing in this way, Thibault needed to promise that his method was socially orthodox and would offer the reader (who would also potentially provide Thibault with further income as a student) comparatively certain success compared to other teachers' methods.

Intellectual orthodoxy and practical success were promised using the same method; appeal to the philosophical tradition. Thibault drew on the elements of that tradition that promised that the practicalities of his practice (fencing) were governed by the same laws that governed the natural world. That world was seen as an orderly and structured one, the creation of a rational deity. This deity imbued the world and humanity with elements of its own nature by virtue of the casual similarity doctrine. Knowledge of the laws governing the world would therefore provide information about the laws governing the physical interactions of fencing agents. He further believed that applying a full understanding of those laws would result in a greater chance of victory and or survival than a purely empirically derived training system. Changes in the

sciences were enhancing the status of mathematics as a science and as a truth seeking discipline. Mathematics as science, as opposed to mathematics as methodological tool, offered both the perceived precision of mathematics with the insight into the world that its scientific status promised. These were presumed to be of benefit to fencers in that by understanding the properties of the objects, bodies and swords, being a manipulated in space, better decisions could be made and more desirable outcomes ensured.

The best way to understand those movements and manipulations was seen as being mathematics, with its record of success in analysing movement of heavenly and earthly bodies. Its new status promised to the 16th century mind that the knowledge that was being produced by this approach was not merely a predictive model, but was true and about the world, and that these same truths applied to the divine and material worlds. The appeal to philosophers and scientists in the Western tradition was a further promise to the reader of the correctness of the theoretical background of the system and an assertion of the appropriateness of a highly rationalist approach to the development and pedagogy of a body of fencing knowledge (and by extension any praxis).

De Ley's study of Thibault interprets this appeal as, not unfaithfully, but fundamentally an appeal to the modern (according to de Ley) mode of quantifying events, situations or possibilities to understand them and describing them mathematically. Thibault's writing certainly demonstrates that he had accepted that mathematics was key to understanding the universe in a scientific fashion as the proponents of mathematics described in the second chapter desired. However I think de Ley underestimates Thibault's commitments to neo-Platonic qualitative thinking; the analogising tendency from which he claims Thibault makes a clear break to situate himself on the opposite side of the ancient/modern divide. Thibault's explicit appeals to the *prisca theologia* in his opening chapter make de Ley's strong position untenable.

The use of non-academic sources like Thibault emphasises to us that the influence of philosophy on society does not follow the relatively clean "party lines" that de Ley suggests and that Thibault in particular straddles the divide without apparently seeing any contradiction in his position.

3.4 Areas of potential further study

This work has demonstrated some of the philosophical content of Thibault's work but there is space for further research into Thibault and into the writings of other martial arts masters of pre-modern Europe. Given Thibault's use of the human form, it may be fruitful to examine other masters' understandings of anatomy and optics (something commented on by a few fencing writers) to see how widely and swiftly changes in academic consensus penetrated the public sphere. Likewise the importance on mathematics to the other masters, although mostly less explicit than in *l'Academie* is worth discussing, particularly with reference to the importance of first causes in the works of Carranza (Anglo, 2000, p. 67). Also of potential interest is the relationship between class, state sanctioned military or civil violence and the personal violence that is the subject of the pedagogical systems described in the masters' texts. The occasions where Thibault offers to his reader practical and physical instructions in, for example, laying out the circle with string and a peg and his use of the word *Esquierre* in his note about the illustrations which I have translated as grid but has connotations in 17th century French of a carpenter's set square¹⁵, invite comparison to the place and status of artisanal skills in the development of experimental science that Dear (1995) discusses.

¹⁵ A set of instructions particularly de Selbyesque in its baroque precision.

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Thibault G, Greer J (tr) (2007) *Academy of the Sword*. Chivalry Bookshelf, California

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Appendix A:

Transcription and translation of the first part of

Thibault G (1630). *Academie de l'espée de Girard Thibault d'Anvers ou se demonstrent par reigle mathematiques sur le fondement d'un cercle mysterieux la theorie et pratique de vrais et iusqu a present icognus secrets du maniemment des armes a pied et a cheval*; Elzevier, Leiden

This appendix was transcribed by me from a photocopy provided by the British Library of the copy in their collection or from other texts where noted. The translations are by me unless otherwise noted.

Notes on translation:

As far as my abilities have allowed, I have stuck as closely to the original language as possible in this translation. A 'freer' translation would read more smoothly in the English, but I did not want to create the illusion of proximity between writer and reader. The slight stiltedness in the expressions, and the maintenance of the original (and unusual to most modern readers) punctuation is intended to serve as a reminder that there is a linguistic and temporal distance between the modern English and the 17th c. French.

One change that has been made is that there are, at times, paragraph breaks in the English that are absent in the French. This was to keep the parallel columns as close to synchronised as possible. All footnotes attached to the French text are my own insertion to clarify references made by Thibault.

Since completion of this translation, a freer translation has been published as Thibault G, Greer J (trans) (2007) *Academy of the Sword*. Chivalry Bookshelf, Texas, to which the reader is directed for another view of the text. Consulting that publication has served to increase my confidence in my own translation but there are a few differences in our interpretation of the text. My translation of the note concerning the figures (on the third and fourth pages of this appendix) has undergone substantial revision in light of this publication. This translation goes up to page four of the original, including the theoretical basis of his method, but stopping at the point where Thibault will begin to give instructions for laying out the circle using lines and compass drawn curves to construct it as a geometrical diagram.

Academie de l'espée de Girard Thibault
d'Anvers ou se demonstrent par reigle
mathematiques sur le fondement d'un
cercle mysterieux la thoerie et pratique
de vrais et iusqu a present icognus
secrets du maniemment des armes a pied
et a cheval.

The School of the sword of Girard
Thibault of Antwerp in which is shown
by means of mathematical rules based
on a mysterious circle the theory and
practice of the true and currently
unknown secrets of the used of weapons
on foot and on horseback.

<Latin praises of Thibault>

Alius Applausus
Super eodem Opere
Noliblis Viri Gabrielis von Danuf.

Salvatoris eram quondam admirator &
ipse, cum gladiatoris luderet ille modis;
en reputans toties, ane hic perdificto
quædam est?

Mars mihi Censor eris vel age testis
eris.

Error: Quin dicam? Rumpantur ut illa
Marti in Salvatore, Pallade Mars caruit.
An Caruit? Caruit. Num plane?

Ignoscite dicam sitque auris verbis
vesra adaperta meis: Salvator,
gladiatorum clarissime quondam, Mars
permulta ribi, ast pauca Minerva dedit:
Ponderis, & Numeri, Mensuræ &
Temporis ^(usum) (Artis opus:) Prudens
none Minerva negat?

Horum Invenorem mango celebramus
honore Thibauldum, cuivos, puto,
cuncta dedistis, quæ artem hanc
absolvunt, condecorantque simul.
Magnus Salvator, major Thibautius ille
Cui Mars nulla negat, cuncta Minerva
tulit.

Hinc Palladi, hinc Marti, herois simul
omnibus issthinc, regibus hinc charus
principibusque viris.

Amy Lecteur, n'attendez pas que par quelque longue preface on vous recommande l'entreprinse, les peines & depense excessive que l'Auteur à employé en ce grand & precieux ouvrage; Les Preinces & Seigneurs à qui il l'a de dié, de qui on voit à l'entrée d'iceluy les armories, sont ceux qu'on prent en tesmoins des admirables preuves & effects qu'il à donné en leur presence de l'Excellence de l'art qu'il y enseigne, qui pourtant l'ont eu en grande estime & l'ont honoré en plusieurs endroits de leut faveur & beineveullance & pouffé a en donner part a la posterité.

<Privileges of publication>

Advertissement sur la consideration des Figures de ce livre.

Pource que le spectateur trouveroit estrange, que plusieurs Images ne sont fixement poseés sur le fondement, tant au dessus qu'au dessous de l'Horison: nous avons trouvé bon de le'avertir, qu'il les faut concevoit comme estant despeinte aux muraille; ce la estant fait à cause des Cercles inegaux tant dessus de l'Horison que sur le plan, pour la representation plus commode de la doctrine, & pour l'intelligence plus facile du commun qui n'entende les perspectives: ainsi au Tableau 3. au dessus d'un & d'autre costé sont despients 4. homes aux parois, & en la Table 5. il y à quatre pieces en forme de peinture au milieu de la muraille ou massonnerie, desquels Cercles chascun suffit pour soy, & es Tables 6. 16. 21. 22. 25. & 28. au milieu des toilles peinturées, & au costez sont despeintes à la paroy, es Tables 7. & 27. faut entendre que cela est fait en forme de chartes & en la Table 19. un tapi tendu ou pendu au milieu, dans lequel les doctrines sont tissues, & es Tables 5. 8. 14. 17. 18. 20. 22. 25. 26. 27. 28. 29. de mesme despients aux murailles, mais les premieres pieces se demonstrent plus viviment sur le fond ou base que les autres, car la se voit la façon des accordes

Dear Reader, do not expect a long foreword in which the work is commended to you, the excessive toil and expense to the author described in this great and precious work. The Princes and Lords whom it concerns, those ones seen practicing with weapons, are those whose testimony is admirable evidence of the excellence of the effects of the art taught in their presence which, although it is held in great honour must nevertheless have a part left through kindness and benevolence to posterity.

Privileges of publication from the Holy Roman Emperor Ferdinand II dated 1630, Louis XIII of France dated 1620 and the United Netherlands dated 1627.

Note concerning the figures in this book

Some viewers find it strange that many images are not fixed to the ground but can be above as well as on the horizon: we thought it good to advise that you should conceive of them as painted on the walls; this has been done in order that some circles can be above the horizon as well as on the ground, for the more commodious representation of our teachings, and for the ease of understanding of the majority of people who do not understand perspective: also in Figure 3 on the tops of both sides are depicted 4 men on the walls, and in Figure 5 there are four pictures in the form of paintings in the middle of the wall of stone, which circles are enough for anyone., and on figures 6, 16, 21, 22, 25 and 28 in the middle are painted cloths, and on the sides, some images are painted, in Figures 7 & 27, it is intended that they be in the form of maps, & in Figure 19 a tapestry hangs in the middle in which the teachings are woven, and in Figures 5, 8, 14, 17, 18, 20, 22, 25, 26, 27, 28, 29, similar depictions are on the walls but the primary images are shown in a more lifelike manner on the ground in front of the others, because agreement can be seen between the

Des espées & leur operation par les lignes du Cercle; pour ce que en forme d'Esquiere de la ligne Inferieur ou base, on trouve un accor des lame, fait au fond ou Cercle, par lequel, le jugement des operations mouvantes des espees que les figures tiennent en main, est rendu tres-facile.

directions of the swords and their actions and the lines of the circle; by means of the grid down on the ground one can find agreement of the blades, with the circle on the ground by which the judgement of the movement of the blades the figures hold in hand is made very easy.

Declaration du Tableau PremierContenant

Les proportions du corps de l'homme, rapportées à la figure de nostre Cercle, & à la iuste longueur de l'Espee.

Discours de l'excellence & perfection de l'homme, declarant que son corps est exactement compasse par Nombres, Poids, & Mesures, ayant des mouvements qui se rapportent à la figure Circulaire.

L'Homme est la plus parfaite & la plus excellente de toutes les Creatures du Monde; auquel se trouve, parmy les autres marques de la sagesse divine, une si exquise representation de tout l'Univers, en son entier & en les principales parties, qu'il en a esté appellé à bon droit par les anciens Philosophes Microcosme, c'est à dire, le Petit Monde. Car outre la dignité de l'ame, qui a tant d'avantages pas dessus tout ce qui est perissable, son corps contient un abrégé, non seulement de tout ce qu'on voit icy bas en terre, mais encores de ce qui est au Ciel mesme; representant le tout avec harmonie, si douce, belle, & entiere, & avec une si juste contenance des Nombres, Mesures, & Poids, qui se rapportent si merueilleusement aux vertus des Quatre Elements, & aux influences des Planetes, qu'il ne s'en trouve nulle autre semblable. Le tres-parfait nombre de Dix luy est continuellement representé devant les yeux, en son entier sur ses propres doigts; & dereches en deux moitez egales sur ses deux mains, à chascune par le nombre de Cinque doigts qui son dereches partis inegalement par les poulce, & par le reste an Un & Quatre, don't l'Un est compose de Deux articles, & les Quatres des Trois: de façon que ceste structure luy met tousiours en veuë les premieres & plus excellents Nombres 1. 2. 3. 4. 5 .10. dont tant d'Illustres Philosophes, comme Pythagoras, & Platon, & tout ceux de leurs Escholse, ont fait tant d'estime, qu'ils y ont voulu cacher, & en deduire les plus grands mysteres de leur doctrine. En outre on voit aussi en

Explanation of the First Plate

Containing

The proportions of the human body in terms of our circle and the appropriate length of the sword.

Discourse on the excellence and perfection of man, describing his body with exact numbers, weights and measures and having motions referable to the circular figure.

Man is the most wondrous and excellent of the creations of the world; and exhibits with all the other signs of divine wisdom, a nice representation of the Universe in its entirety and its major parts, and has thus with some justification been called by the philosophers of old Microcosm, or the Little World. With all the dignity of the Soul, which has many desirable characteristics above all that is transient, the body has condensed within it not only that of the base Earth that we see, but also the heavens; thus mirroring the totality with a harmony so beautiful and complete, and with the complete coherence of numbers, measurements and weights, which correspond/reference marvellously the virtues of the four elements and the effects of the planets, there is no other with this resemblance. The most perfect number, Ten, is constantly to be seen before one's eyes, in full with our full complement of fingers; & divided into two even parts between the two hands, divided into the number of five digits which are divided unequally between the thumb and the other digits into one and four, where the One is composed of two sections and the Four of Three¹: thus the entire structure contains and comprises the primary and most excellent numbers, 1, 2, 3, 4, 5, 10, which many of the most famous philosophers, like Pythagoras, Plato and those of the learned Schools held in the highest esteem, and used to both conceal and reveal the greatest mysteries of their doctrines. Also, one sees in the length, la

¹ Likely the joints of the fingers.

longueur, largeur, & espaisseur de ce mesme corps, que les mesures y sont si justement observées que les plus grands Architectes Anciens & Modernes n'ont sceu choisir aucune chose au Monde plus propre pour leur servir de regle, selon laquelle ils deussent former les ordonnances de leurs ouvrages, que ce seul patron de l'homme; auquel ils ont remarqué une perpetuelle proportion gardée de Dieu mesme en la fabrique du corps; laquelle ils ont prinse en exemple, pour façonner à l'advenent les Architectures des Temples, Theatres, Amphitheatres, Palais, Tours, Vaiffeaux, & autres Instruments, soit de paix, soit de guerre, non seulement en leur entiere, mais ausi en chascune des prencipales, Colomnes, Porteaux, Chapiteaux, Piedestaux, & autre members semblables. Ainsi lit on, que le Temple de Salomon, ce grand ornament & miracle de la Republique Florissant des Iufs, a Esté compassé selon ceste mesme proportion: Et qui plus Est, que Dieu mesme auroit commandé au Patriarche Noë, en bastissant l'Arche, d'ensuivre la mesme regle. Car tout ainsi que le corps de l'homme contient 300 minutes en longueur; 50 en largeur; & 30 en espaisseur par le milieu de la poitrine: aussi pareillement l'ordonnance de l'Arce a esté 300 coudees de longueur, 50 de largeur; & 30 de hauteur: de sorte qu'en l'un & l'autre la longueur est six fois autant, que la dix foit, que la profondeur. Qui est une proportion, dont nous avons tousiours devant nos yeux les nombres, & les pouvens nous demonstrier clairement sur nos doigts, où nous avons coustume d'arrprendre les premieres leçons de l'Arithmetique naturelle. Car la somme entiere, qui en est 10, estant multipliée par 3, fait 30 pour l'espaisseur; & par 5, fait 50 pour la largeur; & multipliée par 10, avec le redouble de 3, fait 300 pour la longueur. Et à ces mesures s'accorde ausi ce que plusieurs graves Autheurs ecrivent touchant la mesme matiere: comme entreautres, que Vitruve a rapporté la stature de l'homme à 6 pied de mesure Geometrique; le pied à

breadth and depth of the same body, the measurements which were so nicely observed by the greatest architects, ancient and modern, such that they could not have chosen anything in the world more correct to serve as rules according to which they ordered all the guiding principles of their work using only man as a guide; and to which, they, noted, God kept constantly in the design and construction of the human body, which they have as their prime example for their work on the architecture of temples, theatres, amphitheatres, palaces, towers, ships and other works, either tools of peace or tools of war, not only in their respective entireties, but also divided into their major components, columns, doorways, column headpieces and bases and other similar components. We also read of the Temple of Solomon, the great ornament² and miracle of the Republic of the Jews in its flourishing, which was measured out with the same proportions: to which we add when same shining God commanded the Patriarch Noah to build the Ark by these same rules. The body of a man measures 300 minutes in length, 50 in width and 30 in depth at the chest. Similarly the dimensions of the Ark were 300 cubits in length, 50 in width and 30 in height. So that in the one and the other, the length is six times the width and 10 times the depth. This is a single proportion, one of which the numbers we have before our eyes, & which we can clearly demonstrate on our fingers, on which depend the first lesson of Natural Arithmetic. The complete sum, which is 10, then multiplied by 3, is 30 for the depth, & by 5 gives 50 for the breadth, & multiplied by 10 and again by 3, gives 300 for the length. These measurements also accord with the many significant Authors who have written concerning this same matter: for example, Vitruvius reports that the stature of a man is 6 foot of the Geometrical measure; the foot is

² In the sense of "that which adorns" rather than anything trivial.

10 degrez; & chasque degree en 5 minutes; qui font 60 degrez, & 300 minutes, retirants justement aux trois cents coudees de l'Arche. Combien que je ne veuille pas m'arrester si precisement sur l'autorité de Vitruve, à luy donner six pieds Geometriques de longueur; ce m'est assez qu'on la puisse partir en six mesures egales. Pline remarque ausse livre 7. chapitre 17,³ que ceste stature naturelle de l'homme bien proportionné s'accorde exactement à la mesure de sa propre brassee, de puis le bout des doigts de l'une mains jusques au bout de l'autre. En somme tous Philosophes ont fait tant d'estime de ceste mesure, & de la proportion de ce corps humain, & l'ont tant recherchée, les uns d'une façon, les autres de l'autre, que Pythagoras a osé nommer l'homme La Mesure de tout. Quant à la proportion des Poids, il ne faut pas douter, qu'ell n'y soit aussi observée avec tout autant d'artifice, que les Nombres, ou les Mesures. Ce qui est aisé à cognoistre, par ce que c'est l'homme seul de tout les animaux qui marche droit; de façon qu'il se tient tousiours en contrepoids & balance en tout actions, autrement il en seroit à tout moments incommode. Car sa structure est telle, que tous ses members (excepez les bras) à mesure qu'ils sont plus relevez de la terre, aussi sont ils plus pesants de plus en plus; si que les parties plus legeres & flus foibles soustiennent les autres plus pesantes & plus robustes: qui seroit chose contre Nature & du tout insupportable pour continuer longuement, en tant & en si diverses sortes de mouvements, comme on voit que ce corps humain pratique., s'il n'estoit moderé au regard du Poids en tout

³ 17. Quod si homini spatium a vestigio ad verticem, id esse pansis manibus inter longissimos digitos observatum est, sicuti vires dextra parte maiores, quibusdam aequas utraque, aliquis laeva manu praecipuas, nec id umquam in feminis; mares praestare pondere et defuncta viventibus corpora omnium animalium et dormientia vigilantibus; virorum cadavera supina fluitare, feminarum prona, velut pudori defunctorum parcente natura. (Mayhoff ed.; 1967)

10 degrees; & each degree in 5 minutes; which makes 60 degrees, & 300 minutes, which refers exactly to the 300 cubits of the Ark. I am not sure to what extent we can rely exactly upon the authority of Vitruvius when he gives six feet geometrically as the length, but it suffices that the height may be divided equally into six. Pliny says, in his book 7, chapter 13,^{3t} that the natural height of a man is exactly proportional to the spread of his arms, from the fingers of the one hand to the other. In sum, all philosophers have so esteemed this measure and the proportions of the human body, and have so deeply studied it in one way or another that Pythagoras even called man the measure of all things. With regard to the proportionality of weight, it is not possible to doubt that this can also be observed with the all of the same degree of art as number and dimension. We can easily take cognizance of this because man alone among all animals walks upright in such a way that there is always counterweight keeping him in balance in all actions, if not then he would be awkward in all movements. This is because his structure is such that all his components (except the arms) become heavier the higher they are from the ground and so components that are lighter and more fragile support those that are more weighty and robust. This would be contrary to Nature and could not be supported in the long run with all the diverse movements that we can see the human body being used for if the body did not regulate its weight from the top of the head to the bottom of the feet with a single, united and perfected art.

^{3t} 17. We know that the height of a man is the same **[length]** as the span of his arms from fingertip to fingertip, likewise **[we know]** the right part to be the stronger, though sometimes the strength is equally distributed **[between the hands]**; occasionally the left is stronger, but never for women. Men have the greater mass and the dead of all creatures are heavier than the living as the sleeping are than the waking. The bodies of men float supine and those of women, prone; as if nature were sparing her modesty.

ses parties depuis le sommet de la testes jusqu'aux plantes des pieds, d'un singulier & parfait artifice. La declaration plus ample de ceste matiere appartient aux Anatomistes, qui font profession de declarer les particularitez de ceste noble structure: nous qui ne pretendons que d'en exposer seulement ce qui touche l'exercice des Armes, serons centents d'en declarer quelque chose en gros, notamment touchant les proportions exterieures, asin qu'il soit par cy après d'autant plus facile à juger de la nature & portee de chascun des mouvements, qui en precedent. Puis donc les mouvements se sont quelquesfois & plus souvent avec les bras & les mains, & autrefois avec les jambes & les pieds, nous demonstreserons presentement, que les homes sont capables d'exploiter leurs mouvemēts necessaries & utiles en plus grand nombre & plus aiseement & plus promptement, que ne font les autre animaux. Don't il sçavoir que c'est ordinaire & proprement l'office des bras & des mains d'executer le commandement de la volenté, en faisant les actions que l'utilité ou la necessité demande; & que les jambes & les pieds ne servent communement à autre chose, qu'à transporter & à tourner le corps, & à mettre les bras & mains en places, où la Volonté pretend que l'execution soit faite: & advantage, qu'il y a ceste difference, que les bras & les jambes sont specialement propres à faire les grands mouvements, ainsi que les pieds & les mains sont propres aux moindres: & comme les bras sont particulierement capables à executer ce où il faut de la force, ainsi les mains le sont d'autrepart pour travailler avec dexterité. Les Pieds, comme pilliers qui soustiennent les corps, sont devers les talons quasi immobiles, mais devers les orteils ils se meuvent assez promptement: de fort que par l'inegalite de ceste structure le corpse se peut affermir dessus, au moyen de l'un, comme il se peut d'autrepart remuer & tourner vistement & commodement de tous costez, au moyen de l'autre. En l'un & en l'autre derechef il

Complete explanation of these subjects is the office of the anatomists, whose profession it is to explain the particularities of this noble structure: we shall not pretend to show of this subject beyond what touches on the exercise of arms, but will be content to make some general declarations about it, touching on the external proportions, after which it will be easier to judge the nature and applicability of movements that come from it. Sometimes the movements are made with everything & most frequently with the arms and hands, and at other times with the legs and feet, we will presently demonstrate that men are capable of using their necessary and useful movements in greater number and with greater ease and more swiftly than any of the other animals.

It is the normal and proper office of the arms and the hands to execute the commands of the will, and make possible the actions that utility or necessity demand; and the legs and the feet generally serve to do nothing other than to transport and steer the body and put the arms and hands in the place where the will intends the execution **(of the tasks)** to be done: also, their difference is that the arms and the legs are especially appropriate to make large movements whereas the feet and the hands are appropriate for smaller ones: and the arms are particularly capable of executing what must be done with force, likewise the hands, for their part, work with dexterity.

The feet, being pillars that support the body, are nearly immobile at the heels, but at the toes move with promptness and ease: strength comes from this inequality in the structure of the body from the one, while it is also gets the ability to move and direct itself easily and swiftly in every direction from the other. Both the one and the other provide

reçoit un grand soulas par la juste longueur, qui luy fournit un fondement stable & solide quand il s'arreste; & quand il marche, elle aide à le pousser & luy donner sa course. Les Mains se meuvent fort agilement en tous leurs parties, & contiennent en leur plus large la juste moitié de la largeur de visage, qui est le quart au regarde de la poitrine: la longueur en est deux fois autant: & estant la main fermée, le contour le poing sera le tiers du contour de la poitrine: en sorte qu'elle luy peut naturellement servir d'escusson pour la defendre, en la tenant devant, soit ouverte & esendue, ou bien soit fermée. C'est pouquoy Philo, auteur Juif, a tres bien recontré à dire, qu'au lieu de tous les ornements & defenses naturelles des autres animaux, l'homme a esté doué de la Raison, comme Directrice, & des Mains, comme Instruments pour executer ce qu'elle veut: & que la Raison est la Main de l'Entendement; la main de la Raison c'est le Parole; et les Mains corporelles celles qui font l'execution de ce que la Parole commande. Instruments, qui contiennent en eux toute la suffisance des autres, & qui par consequent les egalent et dignité, voire les surmontent. Pour laquelle cause il vient au Monde despourveu de toutes armes, tant offensive que defensive, & n'a que ce seul instrument de la main, au moyen duquel il se puisse prevaloir de toute. Les autres animaux se defendent & offensent leurs contraires l'un avec les dents, l'autre avec les ongles, les pieds, les cornes; ainsi qu'il se voit es Elefans, Lions, Ours, Chevaux, Taureaux, Tigres, & autres bestes, à qui la Nature a départiassez chichement une seule espece d'Armes à chascune, pour la necessité de leur defense; mais à l'homme, qui en semble estre du tout privé, en recompense elle l'a doué d'Entendement pour les cognoistre, d'Esprit pour les forger, & de Mains pour s'en aider de toutes & telles qu'il en puisse estre. mesme afin qu'il s'en peust aider avec plus d'avantage, elle luy a donné par special privilege de pouvoir à mesme instant

great succor in the proper length, providing a stable and solid foundation when it is stopped and when it walks, they help by pushing and by providing direction. The hands move with great agility in all their components, and at their greatest they measure one half the breadth of the face, or they are on quarter of the breast: which length is double that size: and the closed hand has a circumference of one third the circumference of the breast: this means that it can serve naturally as a shield for defense which held out forward, either open and extended or well closed.

This is why Philo, the Jewish author, had had good opportunity to say that in lieu of the ornaments and natural defenses of other animals, man has been given reason, his guide, and the hands, which are instruments for the execution of what is willed: and reason is the hand of understanding; the hand of reason is speech; and the corporeal hands are what execute the commands of speech.

These instruments, which contain all the capacity of the others, are in consequence their equal in dignity, even surpassing them.

For this reason, he arrives in this world deprived of any weapon, either offensive or defensive, and having only the instrument of the hand, through the use of which he has the power to prevail over all. The other animals defend themselves and attack their rivals, one with the teeth, another with claws, or hooves, or horns, all of which can be seen with elephants, lions, bears, horses, bulls, tigers and other beasts, which nature has meanly given one single type of armament for the necessities of their defense; but man who seems deprived of these, has been recompensed by her with understanding to know them, the soul/mind to make them and the hands to help himself with the power of all of them.

Also, to help him with a greater advantage, she has given him by special privilege the power to simultaneously

fleschir les bras en arriere & les pieds en avant; chose impossible aux autres creatures: comme ausi pour la mesme, ou pour semblable cause, la situation naturelle des bras a esté placée en tel endroit, que les operations des mains fussent tousiours sous le gouvernement de la veuë, pour en secourir & assister tant plus aisement le reste des members en leurs necessitez. Tout ainsi donc que les susdits Artistes, Architectes, Prespectivites, & autres ont tasché de prouver les fondements de leurs regles par les proportions du corpse de l'homme, ainsi avons nous pareillement tenu la mesme course, mais avec meilleure adresse, & avons trouvé à l'aide de ceste mesme buxole la vraye & proportionelle mesure de tous le Mouvements, de tous les Temps, & Distances, necessaires à observer en nostre Pratique: comme il vous sera demonstré tout à l'instant en la declaration de nostre Circle; où les mesures & proportions de l'homme sont appliqués à l'homme mesme, & aux mouvements qui l fait avec ses proper members, où ladite proportion se trouve, & sans laquelle il luy est impossible de faire la moindre action du Monde. En practiquant donc cest Exercise, comme l'ay fait par plusieurs annees, en divers pays, & avec des grands amateurs; dont les uns tiroient à la Françoisse, les autres à l'Itallienne, & somme chascun à sa mode; j'ay veu qu'on s'accoustume par tout à des postures estrange, le corps plié en pluseirs courbures à pieds & jambs disioinctes hors de proportion naturelle, & en situations du tout repugnantes à la mode ordinaire qu'on tient en cheminant ou en demeurant ferme: de forte qu'au lieu de faire paroistre par ces mines quelque grand courage, on s'incomode & amoindrit on ses propres forces, plustost que d'en obrenir l'effect de l'intention pretendue. Ce que considerant de pres, & sachant d'autrepart, que tous les Artes ensuivent la Nature, sans jamais y contrevenir, j'en ay prins occasion de vousoir conduire ausi nostre Exercise à la mesme Eschole de ceste Souveraine

shoot the arms out to the rear and the feet to the front, something impossible for any other creature: also, because of the same, or a similar cause, the natural position of the arms are right in front, where the actions of the hands are constantly under the guidance of the vision, in order to secure and assist with ease the rest of the parts and their needs. Similarly, all abovementioned Artists, Architects, Perspectivists, and others have tried to prove the foundations of their rules in terms of the proportions of the body of man, we have taken the same course in parallel (with them), but with more impressive results, and we have found with the aid of the same method the true and proportional measure of all Movements, all Times and Distances the observation of which is necessary for our practice: all of these we will show at the same time in the explanation of our Circle; where the measure and proportions of man are applied to man himself, and to those movements he makes with his parts (limbs), in which those proportions are found, and without which it would be impossible to perform any action in the world. In practicing this exercise, which I have done for many years, in different countries, and with great practitioners, some preferring the French manner, others the Italian, & each in his own fashion; all follow the custom of using strange postures, the body bends at several angles, the feet and legs separated from their natural proportion, and positioned in ways repugnant to the ordinary way of walking or standing: the effect of this is that instead of displaying great courage, they inconvenience themselves and reduce their own power, not gaining the benefits claimed for these actions. Closely considering this, and knowing for its parts that all the arts follow Nature, without going against her, I have decided to conduct our exercise after that same school of the Sovereign

Maistresse des bonnes inventions. En quoy j'ay remarqué premierement, que tous les Mesures & Instances à observer en ceste Pratique (qui sont les premiers fondements & l'appuy de tous les parties suivantes) precedent de la proportion du corps de l'homme; comme aussi sans la mesme cognoissance elles ne scauroyent estre deuemēt comprises, non plus que d'estre pratiquées avec assurance. & qu'aussi le semblable en est il des Pas & Demarches ordinaires ou extraordinaires, que l'usage de l'Exercice & la varieté des occasions requierent. Par où il appert, qu'il faut entrer si avant en ceste cognoissance de la proportion des memebres & parties du corps humain, qu'on puisse à tout le moins faire quelque raisonnable jugement de le portee de chascun mouvement, à proportion du member ou des members, d'ou il depend, & desquels il doit estre continué, fini, tourné, retourné, lasché, bandé, ou change en mille & mille manieres.

Il faut donc sçavoir pour le premier, que les Philosophes attribuent à ce Microcosme du corps humain diverses figures, don't il sera parlé autrepars de la triangulaire, quadrangulaire, & pentagone. Presentement nous disons, qu'il est aussi rondo u circulaire en la figure de ses mouvements. à quoy s'accorde le dire d'Hippocras Prince des Medecins, que le corps est un Cercle. Ce qui se peut entendre tant au regard des actions & operations naturelles de ses parties interieures & de leurs alterations subalterns, tellement reciproques & succedantes le unes aux autres, qu'il ne s'y trouve non plus de commencement ne de fin, qu'en la rondeur d'une circonference. aussi se peut il rapporter à la figure de tous ses mouvements locaux, qui va tousiours en rond s'estendant depuis le centre de sa force jusqu'a l'extreme circonference de la foiblesse. Or puis qu'il est donc present question, de vous faire voire la Mesure, qui soit convenable & proportionnée à la stature, situations, demarches, &

Mistress of good inventions. Just as I said at first, all measurements and positions that are observed in this practice (which are the basic fundamentals and on which all that follows is based) proceed from the proportions of the human body, and without knowledge of which those (measurements and positions) cannot be taken up and neither can they be practiced with certainty. And also it is similar with Paces and Steps both ordinary and extraordinary, the use of which the Exercise and various occasions may require. It is obvious therefore, that we must first acknowledge and understand the proportions of the parts and components of the human body, so that one may at least judge reasonable the range of each movement, in terms of the proportion of the component or components on which it depends, and as a consequence of which it can be continued, stopped, turned, returned, released, bent or changed in thousands and thousands of ways.

It is therefore first necessary to learn, that the philosophers attribute to this Microcosm, the human body, several figures, of some of which, the triangle, quadrilateral and pentagon, we will speak elsewhere. For the present we will say that it is also round or circular in the figure of its motions. This is agreed with by the dicta of Hippocrates Prince of Doctors, that the body is a circle. This we should understand with regard to the natural actions and operations of the internal parts and their subordinate changes, reciprocating and succeeding one another, so that we cannot find either the beginning or the end, just like the circumference of a circle. Likewise it can be compared to figure describing all the movements in their places, each being a circle extending from the centre of its strength to the circumference of its weakness. Because the question will soon be asked, where do you get the Measure, that is convenient and proportional to the stature, situation, stride, and

generalement à tout les mouvements extérieurs de ce mesme corps; voici la figure de nostre Cercle, que nous disons contenir toutes les susdites qualitez, & estre tire de la proper mesure & proportion du corps de l'homme. Touts les Mathematiciens sçavent, que la figure circulaire ou ronde est la plus simple, la premiere, voire aussi la plus parfaite, la plus excellente, & la plus capable de toutes pour la defense; comme celle qui ne se laisse toucher en la surface, qu'en un seul point à la fois: dont une figure si accomplie ne devoit pas manquer à une corps si noble: auquel aussi elle peut estre démontrée en diverses manieres; & principalement sur la longueur estendue; c'est à dire quand il se tient droit sur ses jambs, à pieds joints, & les bras estendus droitement en haut, tellement que les coudes luy egalement le sommet to la teste. Car lors qu'il se tient en telle situation, soit debout conte un mur, soit estendue en la mesme sorte par terre, & qu'on luy mette l'une des branches d'un grand compass sur le nombril, & l'autre sur les orteils ou contre la plante des pieds, & qu'on en tire en rond une circonference, il en sourdra un Cercle; dont le Centre sera sur le nombril de la personne, le Diametre en sera comme la hauteur estendue, & la Circonference en touchera d'un costé la plant des pieds, & à l'opposite les bouts de ses doigts. Si on y trouve de la faute, le corps n'as pas esté exactement proportionné siuvant les regles de sa composition. Or voilà maintenant le Cercle, duquel nous pretendone user en tout ce Livre pour l'adresse de nostre Exercise: lequel, d'autant qu'il est proportionné à la longueur estendue de l'homme, nous disons aussi estre proportionné à tous les moueuements qu'il sçauroit faire, avec bras & jambes, & avec tout le corps entier, ou avec chascune de ses parties. On pourroit tirer encor d'autres Cercles de ceste proportion de l'homme en diverses manieres (comme en mettant le Centre sur les parties honteuses, & la Circonference au sommet de la teste & à la plante des pieds.) mais iceux ne

in general to all the external movements of that same body; here is the figure of our circle, which we say contains all the above qualities, and is taken from the proper measurements and proportions of the body of man. All mathematicians are aware that the circular or round figure is the most simple, the first and also the most perfect, the most excellent and the most useful of all figures for defense, because it does not make contact along a surface, but on a single point at a time: and it is a figure too accomplished to be lacking in a body so noble: and also it can be demonstrated there in several manners; principally through the fully extended length; which is to say standing upright with the legs and feet together and the arms extended directly upwards, in such a way that the elbows are equal with the top of the head. When standing in this manner, either against a wall or stretched out the same way on the ground, and placing one arm of a great compass at the navel, and the other at the toes or otherwise the bottom of the feet, and drawing around a circumference, it creates a circle, the center of which is at the person's navel, the diameter being the same at the height at full extension, and the circumference touching on the one side the bottom of the feet and on the other the tips of the fingers.

If this is not the case, then the body not exactly in proportion according to the rules of its composition.

This is now the circle, which we propose to use throughout this book for the purpose of our exercise: being in proportion to the extended length of a man, we also say that it is in proportion to all the movements he knows how to make, with arms and legs, and with the entire body, or with any one of its components.

One may draw many other circles based on the proportions of man in diverse ways (such as putting the center on the shameful parts⁴, and the circumference at the top of the head and the bottom of the feet) but

⁴ Genitals

peuvent avoir la mesme suffisance, ne le convenance des mesures que nous cherchons presentement; à raison qu'ils n'ont pas de proportion avec les bras estendus, auxquels il appartient en cest Exercice d'executer la principale partie de la besoigne: pour laquelle cause, ensemble aussi pour quelques autres considerations, s'il est question de server icy de Cercle, il n'y faut advouer autre mesure de Diametre, que celle qui s'accorde exactement avec ceste longueur estendue.

these do not have the same sufficiency, for the convenience of measure as that which we have presented; the reason is that they do not have the proportion of the extended arms, and it is quite apparent that these are needed for executing the great part of our exercise: for this reason, and for a variety of other considerations, it is a question of using this circle, I cannot advocate any Measure of the Diameter, than that which accords exactly with the length at full extension.