

National Library of Canada

Acquisitions and

Bibliotheoue nationale du Canada

Direction des acquisitions et **Bibliographic Services Branch** des services bibliographiques

395 Wellington Street Otlawa, Ontario K1A 0N4

395, rue Wellington Ottawa (Ontario) K1A 0N4

You the Vote atomate

Ourble Notice reference

AVIS

The quality of this microform is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

NOTICE

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon if the or university sent us an inferior photocopy.

Reproduction in full or in part of this microform is governed by the Canadian Copyright Act, R.S.C. 1970. C-30. and C. subsequent amendments.

La qualité de cette microforme dépend grandement de la gualité thèse de la soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

qualité d'impression La de certaines pages peut laisser à désirer, surtout si les pages originales été ont dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de qualité inférieure.

La reproduction, même partielle, de cette microforme est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30, et ses amendements subséquents.

anadä

AUTOMATA, PERSPECTIVE AND MUSIC:

Poetic Instruments in the Written Garden of Salomon de Caus



by

Katja Grillner History and Theory Program School of Architecture McGill University

A Thesis submitted to the Faculty of Graduate Studies and Research in partial fulfilment of the requirements of the degree of Master of Architecture.

* Katja Grillner, Montreal 1995



National Library

Acquisitions and Bibliographic Services Branch

Bibliothèque nationale du Canada

Direction des acquisitions et des services bibliographiques

395 Wellington Street Ottawa, Ontario K1A ON4

395, rue Wellington Ottawa (Ontario) K1A ON4

Your life - Votre référence

Our life - Notie référence

The author has granted an irrevocable non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of his/her thesis by any means and in any form or format, making this thesis available to interested persons.

L'auteur a accordé une licence irrévocable et non exclusive permettant Bibliothèque à la nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de sa thèse de quelque manière et sous quelque forme que ce soit pour mettre des exemplaires de cette thèse disposition à la des personnes intéressées.

The author retains ownership of the copyright in his/her thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without his/her permission.

L'auteur conserve la propriété du drcit d'auteur qui protège sa thèse. Ni la thèse ni des extraits substantiels de celle-ci ne être doivent imprimés ou autrement reproduits sans son autorisation.

ISBN 0-612-07909-0



ABSTRACT

This study retraces the steps of the 17th century architect and engineer Salomon de Caus through his written and built works, in an attempt to understand the relationship between what he made and the model by which his world was comprehended. The central questions examined with regard to his works are: what correspondence do they reveal between language as a means of conveying knowledge, the world as the source of knowledge, and God the divine creator; and whether "meaning" resides within or without this relation. The interpretation of De Caus' works reveals an epistemological model of a world baiancing on the threshold of the modern era of scientific discovery and technological progress. His texts and constructions appear as a means of conveying knowledge with the aim of making the Divine appear as mystery in the human world. De Caus is shown to operate two principal layers of meaning in his works. One "mathematical" which addresses the intrinsic meaning of the order of the cosmos and the Divine; the other "narrative", "melodic" or "ornamental", addressing the mediation of situational meaning through matter. Human experience and action was a third factor in the process of mediation. Through the intense experience of the moment of performance, whether architectural, theatrical or musical, man could embody the immaterial knowledge of God. The human artefact was a "poetic instrument" guiding man through life. Today, when living in a world where the dominating paradigm reduces understanding to symbolic logic and God has long since been declared dead, De Caus' poetic model remains highly significant.

RÉSUMÉ

Cette étude revient sur les pas de l'architecte et ingénieur du 17ème siècle Salomon de Caus à travers ses écrits et ses constructions pour essayer de comprendre la relation entre ce qu'il a produit et le modèle par lequel son univers a été compris. Les questions centrales examinées par rapport à ses travaux sont: quelles correspondances ceux-ci révèlent-ils entre le langage comme moyen de transmettre la connaissance, le monde comme la source de la connaissance, et Dieu le créateur divin; et si la "signification" réside à l'intérieur de cette relation ou dehors d'elle. L'interprétation du travail de De Caus révèle un modèle épistémologique d'un monde qui balance sur le seuil de l'ère moderne de la découverte scientifique et du progrès technologique. Ses textes et ses constructions apparaissent comme des moyens de transmettre la connaissance pour objectif de faire paraître le Divin comme un mystère dans le monde des hommes. De Caus est monstré comme utilisant deux couches principales de signification dans ses travaux. Une "mathématique" qui s'intéresse à la signification intrinsèque de l'ordre du cosmos et du Divin; l'autre "narrative", "mélodique" ou "ornementale" s'intéressant à la transmission du sens situationel au moyen de la matière. L'expérience et l'action humaine était un troisième facteur dans le processus de transmission. Par l'éxpérience intense des instants de l'interprétation, qu'elle soit architecturale, théâtrale ou musicale, l'homme pourrait incarner la connaissance immaterielle de Dieu. L'artéfact humain était un "instrument poétique" guidant l'homme à travers la vie. Aujourd'hui, alors que l'on vit dans un monde où les paradigmes dominants réduisent la compréhension à la symbolique logique et où Dieu a depuis longtemps été déclaré mort, le modèle poétique de De Caus demeure d'une très grande portée.

ACKNOWLEDGEMENTS

I wish to express my sincere gratitude to all those who assisted me in the completion of this work:

To Dr. Alberto Pérez-Gómez for his most valuable and insightful criticism and for providing the inspiring framework in which the study took form.

To Marco Frascari, Dan Hoffman, Jerker Lundequist, Timothy McDonald, Detlef Mertens, Stephen Parcell and Sören Thurell, for contributing at decisive moments with encouraging and fruitful comments.

To my colleagues in the History and Theory program for critical discussions and inspiring input, and to Susie Spurdens for her kind assistance. Especially I wish to thank Victoria Bernic, Joanna Merwood, Joanne Paul and Tracey Winton, for their challenging ideas and continuous encouragement and support.

To the McGill Library systems, the Canadian Center for Architecture and the British Museum for providing access to important primary sources.

To the Swedish Academy of Science for financial support.

For editing the text and correcting my English I am very grateful for Joanna Merwood and Tracey Winton's assistance. For help with translating the abstract into French I am indepted to Nathalie Bussières.

At last I wish to thank all my other friends who have guided me through this time in Montréal. Especially my family for their considerable support, patience, and belief in my work, and Martin for his sincere encouragement and friendship.

Tusen tack!

Abstract

Acknowledgements

Table of Contents

	Prologue	i
Chapter 1	The Garden of a World in Return to Progress	
	Salomon de Caus - Presentation	1
	The Protestant Court and the Renaissance Magus	2
	The Neoplatonic Genesis	5
	Calvinist Faith	10
	Universal Learning and the Mediation of Knowledge	13
	Vitruvian Architect and Deean Archemaster	16
Chapter 2	Order and Ornament in the Texts	
	The Art of Memory and the "Encyclopaedia"	21
	Four Euclidian Compositions	25
	Secondary Layers of Meaning	35
	De Caus' Epistemological Synthesis	49
Chapter 3	Divine Harmony - Music and the Spheres	66
	Institution Harmonique and the Music Theory of the 16th century	68
	Musica Humana - Virtuous Effects of Music on the Human Soul	82
	Musica Instrumentalis - The Spiritual Vehicle	97
Chapter 4	Reading the Palatinate Garden	
	The Materiality of Language in the early 17th Century	107
	"Post Tenebras Spero Lucem" - A Garden for the New Dawn	112
	Hortus Palatinus - walking the text	114
	Hortus Palatinus - looking back	118
	Conclusive remarks	122
	Epilogue	vi
Bibliography		

List of Illustrations

"I followed him down the narrow garden. Everything was overgrown with bindweed and briars. Tall skeletons of last year's thistles stuck up starkly. The backs of houses rose all around us. The sky was still light. A new moon was visible above the chimney-pots. Felix put his hands in his pockets and stopped to survey the scene.

- There is order in everything, he said. lsn't it wonderful? Look at this place. It seems a wilderness, but underneath it all there's a garden.



We walked along a weed-grown path, and came upon a dark pool overhung by a stunted, bare tree. Dim forms moved in the depths of the water. We stopped, and leaned to look, and slowly the fish floated up, like something in a dream, lifting weak, hopeful mouths, their pallid fins feebly beating the moss-brown water. Felix's face grinned up at me, with a fish-mouth for an eye.

- What are numbers, after all? he said. Music, that kind of thing, it's all sums isn't it?

Dusk was settling in the streets, the lamps were coming on. There was a bitter wind, and patches of damp on the pavements. We walked by the railings of the square, under the dark trees. Felix pointed to the gutter.

- Ever wonder, he said, who it is removes squashed cats from the road? There was one run over this morning, now it's gone.

He halted, cupping his hand to his ear. Music sounded faintly in the distance, a tinny blare.

- Hark! he said. The herald angels."

...

John Banville Mefisto (pp 160-2)

Wittgenstein's words may echo in the streets of the modern city, between the walls of contemporary buildings, as well as in the long compilation of words which makes up this thesis. His proposition raises a fundamental question not only for philosophers and poets but also for contemporary architectural practice: is there anything meaningful to be said anymore. and if so do we have the means to say it? In other words; can architecture still act as a poetic language, as a medium for the unsayable, or does the architect of today merely litter the world with senseless chatter, spreading the bricks from the ruins of Babel? Looking for an answer in the built reality surrounding us, the latter proposition is sadly verified; very little is said but the noise is loud. Still, the answer to the first question cannot be entirely negative. Experience proves that sometimes something important does slip out of the babble; a clear melody, providing a regained faith in the ability of architecture to convey poetic meaning. Wittgenstein came out of his silence when he realized that somehow it was possible to speak of important things. He saw that it was not language itself that had become useless, but the very model he had imposed on it in order to understand its function. The model of Tractatus Logico-Philosophicus did not allow anything invisible or mysterious within its realm. In theory one must be silent; in practice Wittgenstein saw that no-one was.

"The sense of the world must lie outside the world. In the world everything is as it is and happens as it does happen. In it there is no value - and if there were, it would be of no value.

If there is a value which is of value, it must lie outside all happening and beingso. For all happening and being so is accidental...It must lie outside the world... Hence also there can be no ethical propositions....Ethics is transcendental (Ethics and Aesthetics are one.)^{"2}

The assumption that the world can be conceived as a limited whole and be logically described, postulates the necessity of a transcendental dimension in order to anchor the world in human values and truth. True meaning here lies outside the visible world and the spoken word. As Wittgenstein realized, in a world where a unifying "other-worldly" dimension has disappeared, this model forces all ethical values into the shadow cast by the "real", the visible

¹Ludwig Wittgenstein Tractatus Logico-Philosophicus, § 7.

²Ibid, § 6.41, 6.42 and 6.421.

and the evident; they become not only unsayable but virtually non-existent. From this realization he constructed his language-game theory, based on the assumption that it is lived life *within* the world, and not the world in itself, which provides and communicates meaning. It is not within the scope of this thesis to be so bold as to propose a similar model for architectural meaning; one that would allow the invisible into the world of built matter. Nevertheless the basic method which Wittgenstein applied; to carefully examine those instances where the unsayable is, and was, spoken; underlies both the choices of material and the interpretations made in this thesis. Through collecting and interpreting "samples" of architectural meaning, a differently structured model that is better suited to frame the meaning of our lived world of today, might be disclosed.

Paul Ricoeur wrote that "by opening us to what is different, history opens us to the possible, whereas fiction, by opening us to the unreal, leads us into what is essential in reality"3 thus stating the paradoxical cross-reference between historical and fictional narratives. While the positivistic tradition maintains that history has its true reference in the real, and fiction is completely devoid of any true reference in the world, Ricoeur turns the argument around and makes fiction the mimetic art of the real, and history a vehicle for the imagination. Both history and fiction, he claims, are mimetic narratives which serve to open up an absent world of action for the reader, a Lebenswelt, and point to other possible forms of life. In making the other, both in terms of another being and another world, present to human experience, both fiction and history shape the reality which forms the basis of our actions⁴. The meeting between the work and its reader, produces, in the interpretative act a new reality⁵. From the suspended position of a "fictional" reality, the reader is allowed to view the flow of his present life from the outside, confronting the unreal of the present and the real of the past. We might agree with Nietzsche that the real world at last has become a myth⁶ but could not the world of *appearance* still provide a momentary ground to anchor man in the reality of his situation rather than the reality of the world? If mimesis refers to the

³Paul Ricoeur The narrative function in Hermeneutics and the Human Sciences, p 296.

⁴Paul Ricoeur The Function of Fiction in Shaping Reality, Man and World 12, p 123.

⁵Paul Ricoeur The narrative function in Hermeneutics and the Human Sciences, p 293. ⁶Friedrich Nietzsche The Twilight of the Idols, p 40-41.

meaning rather than to the *effects* of events, and if this meaning is grounded in *action*, rather than transcendent *truth* even our world might hold a possibility for human interaction.⁷

This thesis might be considered a garden. Since the beginning of time, the garden has been the site for the encounter of man and nature; of man and his world. It was also the place where Adam got lonely and was given Eve for assistance and company. The garden is a site of interpretation and contemplation; whether intended as a lonely retreat from the city or as a lively pleasure garden, it was always a place of discourse, of confrontation. Enclosed, it was also protected from the evils of the world; the garden could be a site of dreams and utopian visions (fig.2). With our eyes the Renaissance garden might be a built work of fiction; to its creators it was a model of truth itself. Looking at the etymological origin of the word garden and the corresponding word in other languages, it becomes clear that the garden has always been defined by the enclosure, or the fence, both in terms of its real presence in the world and its semantic meaning⁸. Garden and jardin are connected to guarding, as far back as the Greek $\chi ortug$ and the Latin hortus. Hortus refers both to a garden and to a movable frame. Moreover it signifies a site used for teaching; a hortus can also in itself constitute a philosophical system.⁹ If this thesis is then indeed a garden, it has become so on these terms. The following pages are the result of an encounter of texts belonging to a world that no longer exists. The site of interpretation is the 17th century written garden of Salomon de Caus; what is offered here is yet another garden: a construction to fit the past into our present, and to make the past a bridge to the future.

What makes fiction different from life is its apparent completeness and the possibility of determining a pattern, however complex and obscure it is. When lived, life only exists in the present, and to position ourselves in it we depend on the creation of narratives to provide a ground for our actions, a view of ourselves and an outlook on the world. Our lives become inside ourselves a series of fictions, replacing each other as new experiences are gained.

⁷Paul Ricoeur The narrative function in Hermeneutics and the Human Sciences, p 292.

⁸Anne van Erp-Houtepen *The etymological origin of the garden*, Journal of Garden History 6, p ??9. The words she examines are: Garden, yard, town, court, *hof*, villa, park, paradise and curtain. She finds that they can all be connected to the idea of enclosure and garden.

Meaning never lies in life itself, but is created as the story of life unfolds. The enclosure thus constitutes the essential feature of a vork of fiction as well as of the idea of the garden. Moreover one could argue that both gardens and buildings are essentially built works of fiction, possible sites for dreams and utopias. The Renaissance garden functioned as a fictional representation of both an ideal world, absent outside the enclosure, and of the truth inherent in the existing present world; it referred both to the *possible* and to the *real*. Being a fiction physically constituted by reality, the garden could become a literal ground for intersubjective discourse. Unified by matter in space and time, the visitors to the Renaissance garden guided themselves into a fuller understanding of the significance of man, art and nature in their world. Architecture can also be argued to have the function of life which constructed it; it is the result of a temporarily defined language game. Buildings will always be read with an eye searching meaning, structure and the traces of a past; it is the architect's task to conduct the game which defines the building as a future ground for the human search of poetic meaning.

This study retraces the steps of a 17th century architect and engineer, Salomon de Caus, through his written and built works, in an attempt to understand the relation between what he made and the model by which his world was comprehended. The central questions examined in relation to his works have been: what relation do they reveal between language as a means of conveying knowledge, the world as the source of knowledge, the sum of beings, and God, the divine creator, source and eternal container of life; and whether "meaning" resides within or without this relation. Salomon de Caus' works act within this set of relations, where both his texts and constructions are means of conveying knowledge with the aim of making the Divine appear as mystery in the human world. Through interpreting these traces left to our time, an epistemological model of a world balancing on the threshold of the modern era of scientific discovery and technological progress is partially revealed. When put in contrast to the present dominating paradigm which comprehends the world reduced to a model of symbolic logic, some light might be shed on today's failure of fitting a poetic language and architecture within it. It must be emphasized that the point here is not at all to suggest the nostalgic reestablishment of an earlier model, even if this would be possible, but merely to seek an understanding of the way it operated. Apart from being

endowed with a God, the world of Salomon de Caus also recognized the essential difference between likeness and sameness in a representational relation and it is this latter point which might prove significant for our present situation. Even if, as Nietzsche declared, God has indeed been killed by man¹⁰, and we have lost the ethical ground which the "other-world" gave us, we might find a new ground, even though unstable and situational, in relating ourselves to the world and to the other.

This text is divided into four chapters. The first introduces Salomon de Caus and his work within its context; outlining the situation in which he worked and the different strains of thought which were present at the time and are likely to have affected his work. The second chapter outlines and interprets his four theoretical treatises on Perspective, Music theory, Mechanics and Sundials, with a specific view to the encyclopaedic structure of each individual treatise as well as De Caus' epistemological synthesis in the full body of written his work. In chapter three De Caus' treatise on music theory; Institution Harmonique, is taken as a point of departure for a discussion regarding the implications of the transformation of music theory in the late Renaissance to the theory of representation implied in Boethius' classical concepts, musica mundana, humana et instrumentalis. The last chapter concludes the thesis by presenting the garden De Caus created in Heidelberg for the Palatinate Elector Frederick V as the synthesis of his life-work. It interprets the garden within the context of the transition period between the Renaissance and the Baroque world views, here seen as a "Paradigm of Instruments", where the mediation through matter was regarded a prerequisite for the attainment of true knowledge. What I hope to clarify with this thesis is how it was possible that De Caus' garden, created within a cosmos of correspondence, could represent everything from the smallest detail to the most universal concept, and how ultimately the matter of the world could hold letters of the Divine word, possible to compose into a regained paradise on earth.

¹⁰Friedrich Nietzsche The Gay Science, p 181.

1. THE GARDEN OF A WORLD IN RETURN TO PROGRESS Introduction - Salomon de Caus in his time

Salomon de Caus was a French Huguenot who was born in Normandy in 1576 and died in Paris 1626.¹ His family appears to have moved, probably escaping Catholic prosecution, to England around 1590. He spent his life working in different European Courts as an architect and engineer, constructing garden machines, such as automata and water organs for grottoes and fountains. Not very much is known about his education. From references found in his texts it can be concluded that he had studied classical authors on Natural Philosophy and the Mechanical Arts, such as Hero of Alexandria, Vitruvius, Pliny and Euclid, as well as Boethius' music theory. He was also familiar with contemporary writers on mechanics, Jacob Besson and Augustin Ramelly; and on music theory, Pontus de Tyard and Gioseffi Zarlino.

In 1595 De Caus travelled to Italy, and experienced the magnificent gardens created there. He visited the gardens of Pratolino and Villa d'Este among others. Immediately following the trip he was employed by the Archduke Albert and his wife Isabella in Brussels where he designed new garden grottoes and other hydraulic inventions. Between 1607 to 1613 De Caus resided in England, where he was employed by the Royal Court. There he was responsible for the designs of the Somerset, Greenwich, Richmond and Hatfield House gardens; as well as being the drawing teacher of Prince Henry and Princess Elizabeth. After Prince Henry's unexpected death in 1612 De Caus moved to the court in Heidelberg, following Princess Elizabeth, now married to the Palatinate Elector Frederick V. Here he constructed the Palace gardens marvelled by visitors as "the eighth wonder of the world." In 1620 Salomon de Caus was required to move again, driven out by the Thirty Years War. He returned to France seeking employment at the court in Paris where he stayed until his death.

This brief sketch of Salomon de Caus life demonstrates the variety of influences he might have received from his surroundings. Apart from the Palace gardens in Heidelberg,

^{&#}x27;The biographical data are gathered from different secondary sources treating De Caus: mainly C.S. Maks Salomon de Caus, Frances Yates The Rosicrucian Enlightenment, pp 11-14, Roy Strong The Renaissance Garden in England pp 72-112 and Michel Conan Postface to "Le Jardin Palatin"

which were partially destroyed during the Thirty Years War immediately following its construction, nothing remains of his built work. What remains a testimony to his ideas and the grounds for his making are five published books and the beginning of a translation of Vitruvius' Ten Books of Architecture, still in manuscript form.² The nature of his written works presents Salomon de Caus as a Northern European Renaissance "artificer" grounded in a neoplatonic cosmological world view, as it was redefined in the Protestant courts of the late 16th century. Nevertheless it is not easy to place his ideas in any single strain of thought prevalent at this time; a difficulty which is also encountered in studies of contemporary characters, such as Francis Bacon, Johannes Kepler and Robert Fludd. The time and its characters carried a complex mixture of old and new thoughts that often resulted in evident contradictions in one and the same person.³ In the following I have focused on presenting Salomon de Caus' in his role as "artificer" in the courts, specifically the Protestant court where the King and Queen were regarded as earthly representatives of a divine higher truth, and mediators between heaven and earth; as well as his relation to emerging ideas of universal learning and religious and philosophical beliefs.

The Protestant Court and the Renaissance Magus Spectacular weddings of heaven and earth

In the beginning of the 17th century, the time of Salomon de Caus' work for Queen Anne of Denmark and Henry, Prince of Wales, Britain was solidifying its position as a leading Protestant nation under its new King, James I. In Europe there was a brief period of peace before the Thirty Years War broke out in 1618. Political efforts were being made to establish a Protestant alliance between the British Court and German Protestant Princes, in order to form a stronger defence from the Catholic forces. This period held a mixture of realistic, grim war games and equally strong religious faith; justifying actions of war with the belief in the power of mankind to make possible the return of the Golden Age. The Protestant church, embodied in the Regent, was hoping to regain the ancient, archaic

²On the Vitruvian translation see: C. S. Maks Salomon de Caus, pp 105-8 and Roy Strong The Renaissance Garden in Englund, p 112.

³Paolo Rossi Francis Bacon - From Magic to Science, p xii, and Thomas DaCosta Kaufmann The Mastery of Nature, p 190.

religion. The belief that this event would take place on British ground was reinforced during the Elizabethan Renaissance by the creation of a new national mythology⁴. Through mixing medieval legends with classical myth, and making them live through their enactment in court spectacles, such as Royal Processions and Masques, the British Isles became the literal grounds upon which a New Jerusalem would rise and the Golden Age return⁵. Edmund Spenser's *Faerie Queen* from 1589 exemplifies this revitalization of old myths. It employs the myth of King Arthur as its plot, whilst furnishing it with characters from classical mythology, based on readings of Homer and Virgil as well as the 16th century Italian poets Ariosto and Tasso.⁶ The nourishing of a religious/mythical cult around the Courts in Europe was an important feature of the Late Renaissance⁷. The Court of Rudolf II in Prague is another interesting example with regards to his Kunstkammer.⁸

De Caus moved to Heidelberg in 1613 as a result of the wedding between Princess Elizabeth and Frederick V of the Palatinate; a highly symbolic union, given both a political and an alchemical significance. It was hoped that Frederick V would be elected the new Emperor succeeding Rudolf II and his marriage union with England thus secured a strong Protestant alliance. Marriage and love had an important symbolic significance in alchemical and magical treatises of the time, following the principle that it was the union of opposites in harmony that generated transformation and life. The masques performed in celebration of Elizabeth and Frederick's wedding strengthened the image of a mythical union between England and Germany; the Thames and the Rhine.⁹ De Caus was appointed architect and engineer of his Royal Highness and the garden he created during the seven years to come should be regarded in this light. It represented a microcosmic paradise for the Adam and Eve

⁹Frances Yates The Rosicrucian Enlightenment, pp 5-6.

⁴Elizabeth I: 1558 - 1603.

⁵Vaughan Hart Art and Magic in the Court of the Stuarts, pp 29-33.

⁶Spenser explains the method of "construing" his allegories and reveals his main sources in A Letter of the Authors...To...Sir Walter Raleigh, Knight, published together with the book. (Spenser's Faerie Queen - Book I).

⁷See Frances Yates Astraea - The Imperial Theme in the Sixteenth Century.

⁸Rudolf II's Kunstkammer was greatly admired and, as Thomas DaCosta Kaufmann points out in his essay From Mastery of World to Mastery of Nature, had a very important symbolic significance in placing the Emperor as a Master of the Microcosm therein represented (The Mastery of Nature, p183). Rudolf II was an important patron for astronomers such as Johannes Kepler and Tycho Brahe, as well as practicioners of more occult activities such as John Dee, Giordano Bruno and the alchemist Oswald Croll.

4

of the new dawn.¹⁰

There was in the Protestant Renaissance a wide-spread faith in real and immanent change. The sensation of the responsibility of each man to play a role in a literal return to Eden was strong, and this goal was to be achieved within the realms of both politics and culture. Important for the belief in the individual man's capacity for active participation was the rise of hermetic-cabalistic magic and the hermetic reinterpretation of Genesis and the Fall. Man was now considered, despite his mortality, to carry the Divine spirit within him. With this he could make his own choice whether to strive upwards towards God and Paradise, or to cling onto the earth in the materiality of the world.¹¹ The idea of the individual ascent, which in Christian belief was equated with the process of redemption, encouraged aspirations for a universal learning. That is, it inspired both the seeking of knowledge of every *thing* and the spreading of it to every soul, both important factors in the early rise of modern science¹². The magic that was acknowledged by the Court in England, was officially distinguished from popular, often considered black, magic.¹³ Regarded as white and benign, natural magic was believed to operate via the interconnecting paths running between every part of the cosmos. There was a wide-spread belief in the power of hidden signs in nature and that sympathetic action could be invoked through distant operation. All products and performances of art were considered vehicles for magical processes with their potential power

¹⁰Ibid, pp 13-14. See also Chs. 3 and 5: *The Chemical Wedding of Christian Rosencreutz*, published in 1616 following the appearance of the Rosicrucian manifestoes makes implicit references to the Heidelberg Court. It is an alchemical romance about a married couple "who dwell in a wondrous castle full of marvels and images of Lions." The narrative also refers to Genesis in its division into seven parts. (p 60).

¹¹Frances Yates Giordano Bruno and the Hermetic Tradition, p 28 and John S. Mebane Renaissance Magic and the Return of the Golden Age p 10, 22,42.

¹²Paolo Rossi Philosophy, Technology and the Arts in the Early Modern Era, p 64. See below, on Bacon and Comenius.

¹³The witchhunts of the 16th and 17th centuries can be partially considered as a political recognition of the inherent danger lying beneath a popularly spread belief in the possibility that man might institute change through individual action. (Mebane *Renaissance Magic*, p 97; Yates *The Occult Philosophy*, pp 61-71). Only when the magician was kept within the court, and used his powers to the benefit of the King, nourishing the imperial myth surrounding him, and keeping the hierarchy in the interconnecting universe, was he regarded as benign. Magic was only to be used for a purpose outside of the individual self, in an ascent to the divine spirit. In this ascent the King was above his subjects and a step on the ladder towards God.

5

to connect the material with the Divine¹⁴.

Of importance for an understanding of Salomon de Caus' work is his role as a Court artist. As Vaughan Hart states in his book Art and Magic in the Court of the Stuarts the artist was considered a "magus" who made possible the illusionistic wonderworks which allowed for a temporary connection upwards to the macrocosmic spheres. Inigo Jones' masques and Salomon de Caus' garden grottoes held this power. They were magical wonders, and their poetic truth was indeed real. Through them a glimpse of platonic harmony was made perceptible via the forces of the elemental world.¹⁵ The presence of the King in these spectacles assured the connection; His Majesty, often allegorically portrayed as Mercurius, was the messenger between the macrocosm of the universe and the microcosm of man (fig.1).¹⁶ The whole structure of the Protestant court and its outlook on the world and its subjects was essentially neoplatonic. A neoplatonism grounded in the Italian Renaissance, adapted to a Protestant belief and mixed with elements of hermetic mysticism and Christian Cabala. It was mediated to the Court through the writings of Cornelius Agrippa, Francesco Giorgi and the Elizabethan mathematician, "conjurer" and alchemist John Dee. The status of the King as both divine and worldly, comparing himself to Adam, Solomon and Christ, was natural in the Protestant state where religious and worldly powers had been recently unified.17

Neoplatonic Genesis

The Divine spirit of fallen man

Familiarity with the nature of the myth of creation which dominates a particular culture is of essential importance for the understanding of its way of operating in and relating to the world in the present. During the Renaissance the creation of the world and its inhabitants was

¹⁴An important source for this conception was Ficino's *The Book of Life*, where, in the third book, is outlined the processes of natural magic both with reference to the making of talismans and the composition of music which imitates and thus affects the Heavenly constellations.

¹⁵Vaughan Hart Art and Magic in the Court of the Stuarts, p 33.

¹⁶Ibid, p 25.

¹⁷Ibid, p 25, and Frances Yates The Occult Philosophy in the Elizabethan Age, pp 23-48 and 79-108.



Fig. 1: The Messenger - the King. Mercury-Hermes hovering above London. Detail from Hollar's "long view" of London, 1647. (From Vaughan Hart *Art and Magic in the court of the Stuarts*, p 28).



Fig. 2: The "ideal" garden. Frontispiece to Henry Hawkin's *Partheneia Sacra*, 1633. (From W. A. McClung *The Architecture of Paradise*, p 22).



Fig. 3: Geometrical figures necessary to know the names of before learning the practice of perspective. (From Salomon de Caus La Perspective avec la raison des ombres et miroirs, Book I, fol. 7. Courtesy of the Canadian Center for Architecture).



Fig. 4: One of Salomon de Caus' fold-out figures demonstrating the effect of a *trompe l'oeil* painting doubling the length of a gallery. (From Salomon de Caus *La Perspective avec la raison des ombres et miroirs*, Book II, Ch. 10. Courtesy of the Canadian Center for Architecture).

PLAIE 2



Fig. 5: "An admirable machine at the feet of a figure making a sound when the sun rises." Based on the story of the Egyptian statue of Memnon, "dawn", Salomon de Caus in this machine employs ancient myth to call to the reader's attention the virtues of an active life. (From Salomon de Caus *Les Raisons des forces mouvantes*, Book I, Prob. 35).



Fig. 6: Placed at the top of a pyramidal mountain, the statue will be the first to be struck by the rays of the sun and announce the beginning of a new day. (From Salomon de Caus *Les Raisons des forces mouvantes*, Book II, Prob.10).

6

regarded as a process of *construction*, and the activities performed during the seven days of Genesis therefore held an important clue to the underlying permanent structure of the world. The conception of the world as a machine grew in the 16th century to become an important factor for the Baconian investigaton of the world in the 17th century.¹⁸ God was the *Supreme Architect* who designed and structured this world. Every existing particular species or thing in *this* world was regarded the product of those seven days. The mystery of creation was the *first cause*, the nature of which was beyond the reach of human knowledge. After that moment God left the world to be run by *second causes*, and to find the reasons behind these was, in principle, regarded as possible for the human mind. Man could never come closer to God than Adam and Eve had been in Eden. To them all second causes were evident, and when Adam named the creatures he could give each the name which truly corresponded to its nature, because he *knew* it. To recreate Paradise on earth meant the regaining of that lost knowledge.¹⁹ The following is an account of the view of Genesis which developed with the neoplatonic movement in 15th century Florence, and how it differs from the Biblical version.

"For god's purpose was to use as his model the highest and most perfect of intelligible things, and so he created a single visible living being, containing within itself all living beings of the same natural order. Are we then right to speak of one universe or would it be more correct to speak of a plurality or infinity? ONE is right, if it was manufactured according to its pattern; for that which comprises all intelligible beings cannot have a double."²⁰

This organic vision of the universe as a single living organism permeating the cosmos with its divine soul is taken from Timaeus' account of God's creation of the world and holds a key to the understanding of the Renaissance cosmos, built upon a long tradition of neoplatonism from Plotinus to its revitalization in the 15th century. The hermetic texts²¹

¹⁸Paolo Rossi Philosophy, Technology and the Arts in the Early Modern Era, App.I, pp 136-145.

¹⁹One interesting example of how the knowledge of the world was structured from Genesis is Giulio Camillo's Memory theatre as described in Frances Yates' *The Art of Memory*. The Art of Memory in the form, labeled "occult" by Yates, which developed during the Renaissance saw the classical *loci*, places for the particular words and things that should be remembered, as structured on the order of the world as imprinted in the faculty for reason in man, *mens*. Thus Giulio Camillo divided his theatre in seven sections, each signifying one day of Creation.

²⁰Plato Timaeus, p 43.

²¹The discussion of the hermetic texts relies mostly on Frances Yates' Giordano Bruno and the Hermetic Tradition, pp 1-62.

brought to Florence about 1460, and at that time believed to be more ancient than Plato,²² rely on *Timaeus* in the account of Genesis. In 1463 Ficino translated this body of texts, *The Pimander* and *Asclepius*. They were attributed to Hermes Trismegistus, Egyptian philosopher and prophet, sometimes considered an Egyptian Moses, to whom the accounted events had been revealed. The texts, parts of the gnostic gospel, were seen to prefigure Christianity. The immense impact they had on the rise of magic and the redefinition of the individual man, has to be viewed in the context of the general cult of ancient wisdom, the belief that through bringing to light that which was closer to the beginning of the world, fallen man could approach divine truth, holding the key to a regained paradise on earth. It is important to emphasize that this was true even for a "hero" of modern science such as Francis Bacon. As he regarded the reading of the signs of nature as the way back to truth, he saw the "wisdom of the ancients", recorded in myths and fables, as equally important to penetrate in order to achieve a true "advancement of learning".²³

There is a slight, but crucial difference between the platonic/hermetic account of the creation and fall of man and the Biblical, which lies in the relation between the Creator and the first man, His creation and image. In the Biblical version, man fell as a result of coming too close to God, he was supposed to have lived in happy ignorance and innocence, but opened his eyes when eating the forbidden fruit. The opening chapters of the Holy Bible, thus hold a curious celebration of ignorance, and the belief in these words has been used as a tool of authoritative suppression throughout the history of Christianity: "And the serpent said unto the woman, Ye shall not surely die: For God doth know that in the day ye eat thereof, then your eyes shall be opened, and ye shall be as gods, knowing good and evil."²⁴ The sin was to step over the invisible line of distinction between image and original. The Devil's vehicle was the evil serpent, playing with man's lack of resistance. The origin of man's difficulties and suffering is, in the Platonic tradition located in the same problematic distinction, but does not focus on the the burden of original sin, and the universal weight of eternal guilt.

²²This mistake was of vital importance for the justification of the worshipping of ancient myths and "pagan" religions. The Hermetic texts were believed to have prefigured both Christianity and Plato and thus seemed to hold a very archaic truth. Not until 1614 were they dated as having been written after the actual appearance of Christ. (Frances Yates *The Art of Memory*, p 321).

²³Paolo Rossi Francis Bacon - From Magic to Science, p 32, p 85.

²⁴The Holy Bible, Genesis 3:4-5.

In *Timaeus*, it is not man who is the direct image of God, but, as related in the quotation above, the whole universe. Man is created with the help of the immortal gods, and the human fate of material disorder, temporal flux and mortality is regarded as an inevitable effect of the fusion of the Divine spirit with matter. For the human soul this is a temporary state and "anyone who lived well for his appointed time would return home to his native star and tive an appropriately happy life."²⁵ The strong opposition between an allencompassing and frightening God and his subdued subject, mankind, is thus blurred in the Platonic Genesis. Man is not mortal as a result of punishment, but rather as a result of his place in the cosmos, holding the position between matter and spirit. He is part of the Divine One, and his soul has a home in his native star. Each man has inside himself the spirit of the cosmos, he carries the stars, the gods and the whole creation with him even in his wanderings as a mortal being in the elemental world.

In Pimander, the Egyptian Genesis as revealed to Hermes Trismegistus, this latter dimension is even more obvious and of crucial importance to Ficino's neoplatonic understanding of Christ and humanity. In the hermetic version²⁶ God falls in love with his own image and gives to man the power to also produce work; man receives the creative spirit. Man when seeing his reflection in Nature; Nature smiling when seeing in man the beauty of the Divine, falls in love with Nature. "[H]e loved her and wished to dwell with her. The moment he wished this he accomplished it and came to inhabit the irrational form. Then nature having received her loved one, embraced him, and they were united, for they burned with love."²⁷ So "falling" in love, not only made God give man a creative soul but it also made man the only being on earth to have a double nature; his spirit still has the power of Divine creation but his body is submitted to the condition of mortality.

In Ficino this model is carried over to his understanding of the incarnation of Christ in man. Christ is seen as the universal *Humanitas* which participates in all human beings and mediates between God and the lower cosmos. If individuals participate in Christ, in their part

²⁵Plato Timaeus, p 58.

²⁶Frances Yates Giordano Bruno and the Hermetic Tradition, pp 24-25.
²⁷Ibid, p 24.

of the universal humanity, they can themselves effect the redemption of the fallen world.²⁸ The humanist rereading of Genesis, merging *Timaeus*, *Pimander* and *The Holy Scriptures*, thus allowed a shift in emphasis from the sinful man, submissive to God, to a man of dignity who partakes in the Divine. Individual initiative and action is here reconciled with the true Christian mission to redeem the Fall - a keyfactor in the transformation of the world of the Renaissance pointing toward "the scientific revolution".²⁹

In order to properly grasp the significance of Salomon de Caus' work it is essential to keep in mind the view of nature and man as part of the same one-ness; that the rules which governed the stars were reflected in man and in society, and to see that the cosmos was a living being.³⁰ Moreover it is important to understand that the Renaissance cosmos was far from homogeneous. It had a clear hierarchical structure inside its primary unity which on one level is best pictured as a "ladder" and on another as a serie: of corresponding planes³¹. The steps on the ladder went from metals, plants and animals through man as a nodal point linking the the material with the spiritual, up to the fixed stars, the angelic regions and at last the supernatural spheres of the Divine. On this ladder man could choose to ascend or descend. The different planes that correspond in the complex mathematical network of the cosmos, both geometrically and numerologically ordered, are the divine and angelic, the universe or macrocosm, the commonwealth or body politic, man or the microcosm, and the lower creation.³² The most essential correspondence is that between microcosm and macrocosm, between the structure of man and the structure of the universe. It is a correspondence significant through the history of architectural theory in which the Vitruvian man, as microcosm, continues to be the principle from which architectural order and

³¹See E.M.W.Tillyard, *The Elizabethan World Picture*. Tillyard and C.S. Lewis in *The Discarded Image* both point to the fact that this world-picture essentially stemmed from a medieval tradition and that neoplatonism had been prevalent throughout the Middle ages in England, it was the emphasis on man's creative power that was new.



²⁸John S Mebane Renaissance Magic and the Return of the Golden Age, p 23.

²⁹The future development of modern science was not at all evident judging from this early state. As scholars such as Frances Yates, Paolo Rossi and Allen G. Debus have pointed out in their writings on the initial period of modern scientific development, there was a broad stream of parallel movements where alchemy and magic played a significant role and progress was not linear but still circular, oriented towards something outside of the individual; towards God.

³⁰Malgorzata Szafranska The Philosophy of nature and the grotto in the Renaissance garden.

proportions are derived, as a means to mirror the universe. Architecture stands here as the mediating structure mentioned above, between man and the Divine order. It is important to realize the absence of sharp boundaries in the cosmic order of the Renaissance. Each situation seems to have its own set of correspondences; definitions are situational not universal, which is difficult for a 20th century mind to comprehend. Microcosm reflects macrocosm, it *mirrors* it. The relation is not of sameness and identity but rather of likeness and difference; just as the image in the mirror only appears when the object is before it.

Calvinist Faith - Knowing God through the Word, the World and the Self "Nearly all wisdom we possess consists of two parts: the knowledge of God and of ourselves"³³

The Huguenots were Protestant believers, living mainly in France or the Low countries, who had followed John Calvin's movement from the earlier part of the 16th century.³⁴ Certain regions in France were entirely Protestant and autonomous from the Catholic Kings, and it seems as if the severe prosecution that the Huguenots underwent was due not only to a disagreement in religious belief, but a real fear on the part of the ruling powers that the control over the country might be lost. The extreme violence of the French Religious Wars, including massacres striking at random in the villages, solidified and strengthened the belief in those who survived. It contributed to the strong utopian dream that was ever present in the Calvinist's life, where the hardships and sufferings were seen as trials preparing them for the rise of the New Jerusalem. Bernand Palissy, a Huguenot potter and maker of garden grottoes as well as "experimental" natural philosopher, proposed in his *Recepte Veritable* of 1563 to construct a garden and a fortified city as a utopian dream of a place of refuge from the prosecution. In this work Palissy thus combined the two visionary goals of the Reformed Church; the recreation of Paradise on earth and the rise of the New Jerusalem. He wrote:

³³John Calvin Institutes of the Christian Religion, quoted in The Encyclopaedia of Philosophy, Vol 2, p 7.

³⁴The general history of the reformation movement is taken from *Encyclopaedia Brittannica*, Macropaedia; Vol 15, p 547-563.

"...I have found nothing better than to fly the neighbourhood and ... to withdraw myself to labor on the earth, which is a thing just before God, and a great recreation to those who will contemplate admiringly the wondrous works of nature. But I have found in the world no pleasure greater than to have a beautiful garden. So God having created the earth for man's service, placed him in a garden which contained several kinds of fruit;"³⁵

It is also in nature that Palissy finds the model for his fortified town. In the shells of otherwise weak and unprotected creatures as shells and certain fish:

"...as for the weak, I found that God had given to them industry to know how to construct fortresses marvellously excellent against the designs of their enemies... Behold now an admirable thing, which is that God has had so great care for them, that he has given them industry to know how to make, each for himself, a house, constructed and smoothed by such a system of geometry and Architecture, that never Solomon in all his wisdom could have made the like, and if even all human intellects could be assembled into one, they would not know how to produce the faintest trace of it."³⁶

Nature, for Palissy, was thus the model to work on and study. In using it with industry and intelligence, the weak, i.e. the Huguenots, would gain the power to conquer the strong and evil. Salomon de Caus was brought up in this tradition. Though the worst prosecutions took place before his life-time, the culture that they created remained strong. Devoting his life to the addition and assistance of *art* to *nature*, De Caus can be viewed as such an ingenious "David", fighting Goliath with the cunning intelligence of the engineer rather than the force of sheer muscle. His works, as did Palissy's, all reveal a great concern with the study of nature as a way to reach God, and also the importance of spreading this knowledge to a wider audience. Even though he was brought up a Calvinist, and forced to flee France with his family in 1590, he later married a Catholic while in Belgium. After moving to England he probably reconverted to Calvinism and was apparently buried a Protestant.³⁷ In spite of these fluctuations in his officially declared religion, a religious and pious conviction shines through De Caus' writing. It places him as a faithful believer in the Reformed Church; emphasizing man's humble role on earth to cultivate the garden God gave us; to make the best possible use of the gifts of God in mortal life.

³⁵Bernard Palissy *Recepte Veritable*. Translation in *Palissy the Potter* by Henry Morley, p 236. ³⁶Ibid, p 284-85.

³⁷C.S. Maks Salomon de Caus, p 31-32.

The Protestant movement of the 16th century, with its implications of criticism of authoritative structures and belief in the individual man, carried the spirit of the Humanist Renaissance. It stressed the importance of the lay-man's understanding of Christian theology. Sermons were no longer given in Latin but in the language of the church community. Bibles were translated and studied secretly in the houses of the reformed followers. In Huguenot circles the singing of psalms was promoted, as they efficiently transmitted the message of the Bible. Individual faith and pious worship of God as revealed in the body of Christ, was the first and most important principle to follow on the path towards an afterlife in paradisical heaven.

John Calvin published his *Institutes of Christian Religion* in 1536 where he emphasized the demand for the individual to seek knowledge of God and of himself. God and self were interrelated and the knowledge of the two, if sought for in all spheres of life, brought man to stronger faith in seeing God's benevolence and love and saved his soul from corruption and sin. In this aspect Calvin's theology echoes the Ficinian understanding of Christ as God's *Humanitas* in man. Through finding God within himself man could ascend up towards the Divine and reach knowledge of Him even as outside of the self. As long as the vision was double, relating the individual ascent with the universal spirit *within* each human being but also *outside* of man immersed in cosmos, Ficino's magician was benevolent. In a similar way Calvin's Christian believer could be saved from corruption. *Know Thyself*, the wisdom of the Delphian Oracle, was treated as a First Commandment in Calvinist faith. The desire for knowledge was here, if kept within safe limits, a way towards redemption rather than in itself the origin of sin. This was, as will be shown, an important question for Salomon de Caus, which he returns to in all his works.

"God has not only sowed in men's minds that seed of religion of which we have spoken but revealed himself and daily discloses himself in the whole workmanship of the universe. As a consequence, men cannot open their eyes without being compelled to see him."³⁸

³⁸John Calvin Institutes of the Christian Religion, quoted in The Encyclopaedia of Philosophy, Vol. 2, p 8.

The truth and being of God could be revealed through the signs of his presence that were imprinted on earth: in his image, man, in his creation, nature and in his text, the scriptures. In the Calvinist doctrine these three spheres were equally emphasized. As will be seen when looking into Salomon de Caus' works these could also be considered the essential motives behind his writing and making in the world. The mode through which one comprehended and synthesized the signs spread out in the creation was, in the 17th century, one of reading. The text was the paradigm for the understanding of the world, or rather, the word was not yet separated from the world; the linguistic structure was one of the corresponding planes. Spatially distributed words on paper could hold a magical key to the world and truth before the Fall. In searching for the uncorrupted truth of God's creation through His words and seeking the unification of mankind through one single language, the quest for a universal and original language had an upswing in the early 17th century.³⁹ With the northern European combination of the Protestant emphasis on the "word"; the utopian dream of a reformed advancement back to Eden; and the presence of a Christian Cabala from Pico della Mirandola, Francesco di Giorgio, Johannes Reuchlin and Cornelius Agrippa:⁴⁰ there was a firm ground for the pursuit of this ambition in the context where Salomon de Caus created his garden.

Universal Learning and the Mediation of Knowledge Bacon, Comenius and Campanella

"For if all men were to learn all things in all ways, all men would be wise and the world would be full of order, light and peace."⁴¹

The quest for a universal language was intimately bound together with the 17th century projects for a universal learning. Francis Bacon is an excellent example of this as well as his contemporaries Johann Amos Comenius and Tommaso Campanella. The utopian projects of these men all served to enlighten mankind and can be seen as both the beginning of a process which ultimately lead to the annihilation of the divine mystery, and as the end of an era

³⁹George Steiner After Babel, p 208 see also Introduction to John Wilkins Mercury or the Swift Messenger, p x. ⁴⁰Frances Yates The Occult Philosophy in the Elizabethan Age and Giordano Bruno and the Hermetic Tradition. ⁴¹Johann Amos Comenius Pampaedia in Selections, p 100.

where knowledge was mediated through matter, myths, metaphors and allegories.

Comenius' educational projects outlined in *The Great Didactic* of 1627 and the *Pampaedia* of 1650 express a belief in the possibility of attaining the universal knowledge and to bring it to all men. Even if Comenius' aspiration, in contrast with his time, appears as astonishingly humanistic and democratic, it must be considered that it was based on the principle of religious belief, and the principal purpose behind the project was to make all men as like God as possible. It was to the glory of God that men should be educated, and not for the sake of the individual man. Comenius wished "that all men should be educated fully to full humanity...in order to make men as like as possible to the image of God...to unite them with God by true religion."⁴² The idea was to restore to mankind its true essence, *humanitas*, uniting all men in their common origin.

Tommaso Campanella had put forward a similar utopian dream before Comenius in his *Civitas Solis - Idea Reipublicae Philosphicae* of 1623. In the "City of the Sun" lived a people who were governed by wisdom and who were raised to attain their full *humonitas*. The city was organised as a model of the whole world and universe, with seven circular walls named after the planets, and images painted on these walls, depicting all things and notions that were to be known in the world.⁴³ In this city teaching was an easy task and learning a playful occupation.⁴⁴ If this utopian city was to be realised, something which Comenius certainly had in mind, the knowledge of the world which it should convey through its structure, its walls and its paintings, would first have to be "mapped out". "For," Comenius wrote, "if the laws be rigorously observed, it is beyond question that any man who is once admitted into the royal palace [the city of the sun] can easily and without any trouble master its whole contents, its pictures, statues, carpets, and other ornaments; and just as easy will it be for a youth who is admitted to the theatre of this world to penetrate with his mental vision the secrets of nature, and from the time forward to move among the works of God and of man

⁴²Ibid, p 98.

⁴³Frances Yates The Art of Memory, p 298.

[&]quot;Giacomo Oreglia Tommaso Campanella, p 94.

with his eyes open."⁴⁵ Comenius brought Campanella's utopian dream one step further to reality in outlining the method by which the eyes of man might be opened in order to read the signs of nature directly, rather than mediated through the encyclopaedic structure of the "City of the Sun".

The principle of mediation was essential to the understanding of knowledge at this time, which will be clear in the example of Salomon de Caus. Every sensible thing that *appeared* in the world of human experience was a valid source of truth and knowledge. In the experience of nature, as well as in the experience of myth, it was hoped that an original truth might be encountered. Even though Francis Bacon was consistent in his criticism of ancient philosophers, and called for a general reconsideration of science, demanding it to be "sought from the light of nature, not from the darkness of antiquity"⁴⁶; he nevertheless considered ancient myths and fables to be valid sources of truth:

"I do certainly for my own part (I freely and candidly confess/incline to this opinion;) - that beneath no small number of these fables of ancient poets there lay from the very beginning a mystery and an allegory. It may be that my reverence for the primitive time carries me too far, but the truth is that in some of these fables, as well as in the very frame and texture of the story as in the propriety of the names by which the persons that figure in it are distinguished, I find a conformity and connexion with the thing signified, so close and so evident, that one cannot help believing such a signification to have been designed and meditated from the first, and purposedly shadowed out."⁴⁷

It is important to consider that when mythological characters were included in a Renaissance work of art or literature, they had the explicit role of bringing to experience an original truth. As hieroglyphs were before letters, Bacon considered parables and fables as being before arguments.⁴⁸ With this statement Bacon acknowledged the double function of *revealing* and *veiling* of the truth that both hieroglyphs and allegories had. The ancient myths were regarded as material remains of the ancient times, otherwise "buried into oblivion and silence". In the *Wisdom of the Ancients* from 1609 Bacon wrote: "Thus between the hidden

⁴⁵Johann Amos Comenius The Great Didactic in Selections, p 87.

^{*}Francis Bacon The Masculine Birth of Time, p 69.

⁴⁷Francis Bacon The Wisdom of the Ancients quoted in Paolo Rossi Francis Bacon - From magic to Science, p 86. See further ch. 3 of this book, The Classical Fable (pp 73-134).
⁴⁴Ibid, p 84.

depths of antiquity and the days of tradition and evidence that followed there is drawn a veil, as it were, of fables, which come in and occupy the middle region that separates what has perished from what survives."⁴⁹ Here, somewhere in the middle region, a connection might be searched for and loosely established between the temporal, perishable, material world of humanity, and the eternal, immaterial truth of the Divine original creation. Myths and fables were of no time, they existed on a higher plane out of temporality and specificity, as would be true for all traces that God left of his presence in the physical world. "The fable", Bacon claimed, "must be regarded as neither being the invention nor belonging to the age of the poets themselves, but as sacred relics and light airs breathing out better times, that were caught from the tradition of more ancient nations and so received into the flutes and trumpets of the Greeks."⁵⁰

Vitruvian Architect and Deean Archemaster Expounding on the doctrines of Vitruvian Architecture

"Architecture, is a Science garnished with many doctrines & diverse instructions by whose Judgement all workes, by other workmen finished, are judged.... Architecture groweth of Framing and Reasoning &c. Reasoning, is that, which of thinges framed, with forecast, and proportion: can make demonstration, and manifest declaration."⁵¹

Architecture in the Vitruvian context of Salomon de Caus and his colleagues in the artisan class of the beginning of the 17th century was understood to include a wide range of interrelated topics.⁵² Only with John Dee's preface to the 1570 edition of Euclid's Geometry were Vitruvius and Alberti brought into the English language and the foundations established for the delayed Renaissance architecture of Inigo Jones and his contemporaries. John Dee was responsible for giving this complex marriage of different streams of thought essentially rooted in his own Elizabethan world view a strong ingredient of Renaissance magic of the

⁴⁹Ibid, p 85. Quoted from the preface to The Wisdom of the Ancients.

⁵⁰Ibid, p 87. Quoted from The Wisdom of the Ancients.

⁵¹John Dee's translation of Vitruvius' opening passage in the Ten books of Architecture. In *The Mathematicall Praeface* 1570, section on *Architecture*.

⁵²Frances Yates *Theatre of the World*, p 40. On pp 20-41 Yates analyses Dee's *Praeface* and its significance for the Vitruvian Renaissance of 17th century England.

cabalistic kind;⁵³ giving the Vitruvian basis a quite mystical slant in England. Dee's *Mathematicall Praeface* had a large impact in being so evidently directed toward putting into practice the abstract art of mathematics through the hands of the artificer. The ideas were worked into consciousness during a time of low building activity. The main occupation for practical men like Salomon de Caus and Inigo Jones was to provide spectacles, in Court Masques and Garden Grottoes. It was a time period of essentially ephemeral building activities where the focus was on the moment of performance rather than the timeless presence of solid stone. Not until the 1630s could Inigo Jones put his transformative experience into a more solid practice when the Royal Court commissioned a series of renovation projects as part of a permanent processional route from Whitehall to St Paul's Cathedral.⁵⁴ He had by then developed a firm foundation in thinking of architecture in its essential role of bringing forward in matter the heavenly spheres.

Salomon de Caus lived in England for a long period just before writing three of his major works. Euclid's Geometry was essential for his texts, as is evident both from the composition he gave them and his references to the Euclidean definitions and propositions. It is not known which edition he relied on, but an assumption that he was familiar with the very thorough Dee/Billingsdale edition can be made, considering that the only French translations that existed before 1615 only contained the first nine books.⁵⁵ France developed an independent Renaissance culture earlier than England, especially in Architecture where translations had been published of both Vitruvius and Alberti's treatises as well as the *Dream of Poliphilo* by Francesco Colonna as early as 1555.⁵⁶ There were also in the 16th century influential philosophers, writing in the French language such as Pontus de Tyard. Tyard

⁵³The Elizabethan neoplatonism of the 16th century was as Eustace Tillyard points out in *The Elizabethan World Picture* a mixture between medieval and renaissance elements. Frances Yates in *The Occult Philosophy in the Elizabethan Age* and *Theatre of the World* presents John Dee as a Christian Cabalist relying on works by Pico della Mirandola, Francesco di Giorgio, Johannes Reuchlin and Cornelius Agrippa. The emphasis on Pythagorean numbers is very strong in his *Mathematicall Praeface* as well as in the commentaries to Euclid's texts.

⁵⁴Vaughan Hart Art and magic in the Court of the Stuarts, pp 8-9 and pp 158-173.

⁵⁵In 1615 the 15 books were published, translated by Denis Henrion. It became the major edition during the 17th century. (Introduction by Thomas L. Heath to *The Thirteen books of Euclid's Elements*. Vol I, p 108).

⁵⁶Joseph Rykwert, *The First Moderns*, p 121 and p 198 n.6. Rykwert discusses the delay of the isolation of the "Architect" as a separate profession in England. He dates this as taking place in Italy around 1450, in France 1550 and in England not until the beginning of the 1600s.

advocated a neoplatonism in which religious and encyclopaedic ambitions were incorporated and unified.⁵⁷ Salomon de Caus was rooted in both these cultures. He gives detailed references to Vitruvius in his perspective treatise of 1612, and his terminology seems to indicate that he used the French translation by Jean Martin, which will also be used in the following. As mentioned above, De Caus would later in his life attempt a new translation of Vitruvius' treatise, which unfortunately was never published. For the theoretical part of his music treatise De Caus depended heavily on the influence of Gioseffo Zarlino, an Italian 16th century humanist, but his reading of Pontus de Tyard probably played an important role for his understanding of the spiritual significance of music.

For Salomon de Caus, knowing his Vitruvius well, the significance for architecture of John Dee's classification of the nineteen *mathematicall artes* must have appeared as obvious. Even though John Dee does not appoint architecture as the collective term for his encyclopaedia of the arts it is included among them and defined according to Vitruvian and Albertian terminology. Moreover, in his definition of the last art, Archemastrie, John Dee outlines something which appears as the ultimate essence of architecture, in its most Vitruvian sense, and he asks the reader to remember "how we considered Architecture, in respect of all common handworkes" in order to better understand "the Souverainty and propertie of this Science."58 Dee defines an Arte Mathematicall Derivative as: "An Arte to be a Methodicall coplete doctrine, having abundancy of sufficient, and peculier matter to deale with, by the allowance of the Metaphisicall philosopher: the knowledge whereof, to human state is necessarye. And that I account, An Art Mathematicall derivative, which by Mathematicall demonstrative Method, in Numbers, or Magnitudes, ordreth and confirmeth his doctrine, as much & as perfectly, as the matter subject will admit.⁵⁹" The subjects of Salomon de Caus' treatises all lived up to Dee's definition, and, as will be discussed in the next chapter, De Caus also used a Mathematicall demonstrative Method, Euclidean geometry, as the structural principle for all his works.

⁵⁷Frances Yates The French Academies of the Sixteenth Century, p 4.

⁵⁸John Dee The Mathematicall Praeface, section on Archemastrie.

⁵⁹Tbid, introducing the Mathematicall Artes.

The art and science of Archemastrie appears to hold the most appropriate description of the occupation of such artificers as Salomon de Caus and Inigo Jones. Dee's definition is: "This Arte, teacheth to bryng to actuall experience sensible, all worthy conclusions by all the Artes Mathematicall purposed, & by true Naturall Philosophie concluded: & both addeth to them a farther scope, in the termes of the same Artes, & also by hys propre Method, and in Peculier termes, procedeth, with helpe of the foresayd Artes, to the performance of complet Experiences, which of no particular Art are hable (Formally) to be chalenged."60 Dee, saw Archemastrie as the ultimate experimental science, which was in his understanding something quite different from what would later develop in the 17th century.⁶¹ In Dee's, as well as in De Caus', understanding, absolute knowledge and truth could never be truly achieved in its ideal state in the corruptible world of man. Therefore the scientific search for it could not be considered as separate from the field of human experience. Only if brought to man through his senses, could knowledge and truth gain a real existence as embodied in the human mind. Words, arguments and demonstration were thus never enough; they "are no sensible certifying: nor the full and finall frute of sciences practisable."62 As an Archemaster De Caus not only examined the world as it lay before him; it was his primary task to make possible the experiences which allowed truth to be reflected in matter and embodied in man.

"There, then, the Archemaster steppeth in, and leadeth forth on, the *Experiences*, by order of his doctrine *Experimentali*, to the chief and final power of Naturall and Mathematicall Artes."⁶³

As the momentary performances of the Court spectacle, and the magical experience of the recreated myths in the garden grottoes; architecture in itself was to bring forward a reflection of the macrocosm, to make the full reality of cosmos appear for human experience.⁶⁴ Architecture traditionally had its principal justification in this mediating role,

⁶⁰Ibid, section on Archemastrie.

⁶¹Ibid, Introduction by Allen G. Debus, p 20-21.

⁶²Ibid, section on Archemastrie.

⁶³Ibid, section on Archemastrie.

⁶⁴In her article *Instrumentality and the Organic assistance of Looms* Indra Kagis McEwen discusses this essential role of architecture in terms of enabling "the corporeal world of appearance to appear." (Chora 1, p128).

a being of matter built to contain universal ideas. As much as man inhabited two worlds, carrying the world soul with him; a building, or a human artifact, was situated, married to a place in the material world, while holding the spirit of its creator - God through man. In his preface John Dee points this out when justifying his counting Architecture, a *Materiall and corruptible thing*, among the *Artes Mathematicall*: Even if it is true that the Architect guides mechanical handwork and is the chief judge of the actual building, "yet, with him selfe...remaineth the Demonstrative reason and cause, of the Mechaniciens worke: in Lyne, plaine, and Solid: by Geometricall, Opticall, Musicall, Astronomicall, and other Naturall Artes, hable to be confirmed and stablished."⁶⁵ The architect is both within the material corruptible world of production and steps outside in order to judge with reason all *Artificiall thynges*. He acts with *reason* in order to *frame*, or in modern terminology, it is with *theory* that the architect guides his *practice*.⁶⁶ With a view to this continuous flux between *production* and *prediction* Salomon de Caus' works may now be considered.

⁴⁵The Mathematicall Praeface 1570. Section on Architecture.

⁶⁶I refer here to the difference between Dee's translation of the first lines of Vitruvius first chapter as quoted above, and the early 20th century Morris Hicky Morgan translation in *The Ten Books of Architecture*, p 5.

Salomon de Caus published four theoretical works between 1612 and 1624 on Perspective (1612); Music theory and practice (1615); Hydraulics and Mechanics (1615); and Solar clocks (1624)¹. The wide scope of De Caus' writing fits very well within the framework of Vitruvius' *Ten Books of Architecture* and Dee's *Mathematicall Praeface*; though in its application his own emphasis was primarily on the practice of gardening. De Caus' texts all focus on arts which made the underlying, God-given, order of nature appear to the human senses and understanding through wonder, mystery and beauty. Through perspective the reasons behind the visible thing appeared; through music the divine harmony was made sensible; through machines the elements of which the world was composed were put into work and displayed; and with solar clocks man was finally given a possibility to displace himself for a moment outside of the earth and regard the traces that the paths of the sun and stars left on it. With his theoretical works De Caus wished to pass on the knowledge he had built up from his own experience as a maker in fields requiring as much theoretical knowledge as practical skills. He acted as a "framer of reason", both literally in his constructed works, and figuratively here, in his writing of these texts.

This chapter considers these four treatises with a specific view to the compositional pattern that runs through all of them. De Caus organised his discourses according to firm spatial and geometrical principles, presenting his knowledge in the way he believed it to fit into the larger structure of the world. In the 17th century, encyclopaedic works were often referred to as "gardens" or "theatres".² It was considered appropriate and efficient and in accordance with the principles of the art of memory to use the space of a built structure as a ground for the conveyance of knowledge. In order to gain knowledge what was learnt had also to be remembered. This is evidently a general principle of all learning, but of significance for us is that in the Renaissance the structure which framed the different things to be learned was intended in itself to reflect the ultimate truth of the world. Frances Yates' *The Art of Memory* provides a very thorough history and explains the operation of these

^{&#}x27;He wrote his last book in Paris where he was also working on a new French translation of Vitruvius to replace Jean Martin's of 1547.

³John Dixon Hunt Garden and Grove, p 67 and Frances Yates Theatre of the World, p 165.
memory structures as explicit means for the conveyance of knowledge. The selection of places (*loci*) within real structures, buildings or cities, was essential for the art of memory, as well as the placing of images, (*imagines*), representing what was to be remembered in these places. In order to later "recollect" what had once been organised in this artificial memory system, which was always personal, one simply had to retrace the steps in the memorised building of one's mind. Yates puts forwards Giulio Camillo's memory theatre, constructed in the middle of the 16th century, as an example of how the traditional art of memory was transformed from being a useful tool in rhetoric, using real places devoid of a metaphysical structure, into an instrument of hermetic magic that used a reflection of the Divine mind and order, as a house for the *imagines*.³ Camillo uses the metaphor of a forest and a hill to describe how his theatre works:

"This high and incomparable placing not only performs the office of conserving for us the things, words, and arts which we confide to it, so that we may find them at once whenever we need them, but also gives us true wisdom from whose founts we come to the knowledge of things from their causes and not from their effects. This may be more clearly expressed from the following illustration. If we were to find ourselves in a vast forest and desired to see its whole extent we should not be able to do this from our position within it...But if, near to this forest, there were a slope leading up to a high hill, on coming out of the forest and ascending the slope we should begin to see a large part of the form of the forest, and from the top of the hill we should see the whole of it. The wood is our inferior world; the slope is our heavens; the hill is the supercelestial world. And in order to understand the things of the lower world it is necessary to ascend to superior things, from whence, looking down from on high, we may have a more certain knowledge of the inferior things."⁴

What the encyclopaedic treatise thus provided, seen through the eyes of Camillo and his theatre, was an external point of reference for man; the possibility of seeing clearly from above, what man normally was bound to live within. It is interesting to compare this attitude; that the knowledge of things should be sought from "their causes and not from their effects", with the deductive principle for the seeking of knowledge that Francis Bacon propounded with his work on the *Sylva Sylvarum*, "The forest of the forests", published posthumously in 1627. The intention of the work, which was not completed, was "to write such a Naturall

³Frances Yates The Art of Memory, p 172.

^{&#}x27;Giulio Camillo L'idea del Theatro quoted in Frances Yates The Art of Memory, p 143.

History, as may be Fundamentall to the Erecting and Building of a true *Philosophy*: For the Illumination of the Understanding; the extracting of Axiomes; and the producing of many Noble *Works*, and *Effects*.¹⁵ In opposition to Camillo's emphasis on the necessity of seeing the fundamental structure before ordering our experience of the particulars within it, Bacon seemed to argue for the much more tiresome project of actually working oneself up the mountain through counting all the trees in the forest. He writes in the third "century" of the *Sylva Sylvarum*: "For we desire that Men should learne and perceive, how severe a Thing the true *Inquisition* of *Nature* is; And should accustome themselves, by the light of particulars, to enlarge their Mindes, to the Amplitude of the World; And not reduce the World to the Narrowness of the Mindes.¹⁶

What Giulio Camillo had made with his own memory theatre was actually a literal "reduction" of the world to the "narrowness of the mind." And for him, with his neoplatonic and hermetic viewpoint, this was the actual purpose and the very greatness of his invention. What Camillo believed, and what Bacon seems not to have believed, was that the human mind, nous, was a reflection of the Divine mens. The "narrowness of the mind" inevitably held the principle of the whole world hidden within it and the purpose of Camillo's memory theatre was to externalise this in a visible structure. An essential component of the theatre was the use of images, representing myths of the beginning of the world. The structure was based on the hermetic genesis, having seven aisles in the theatre, emanating from the seven pillars of wisdom in the temple of Solomon, and seven levels indicating the days of the world's creation. Images and myths were essential features used to heighten the power of the imagination. Yates proposes that the images in Camillo's system were supposed to operate as "inner talismans"; magical vehicles to elevate the human mind to the Divine mens⁷. Through the joint effort of memory and imagination, assisted by a reflection of the Divine order and illustrations of ancient myths, man would have the power to ascend the hill and grasp the greater world of God.

⁵W. Rawley, in Francis Bacon Sylva Sylvarum or a Naturall History In Ten Centuries, To the Reader. ⁶Francis Bacon Sylva Sylvarum or a Naturall History In Ten Centuries, p 74. ⁷Frances Yates The Art of Memory, p 154-55.

While Camillo's spatial structure was in itself quite simple, and he seemed to emphasize the importance of the myths he used to heighten the power of the imagination. other systems of learning developed during the 16th century which shifted the emphasis away from the images towards the structure itself. Peter Ramus was one of the most prominent reformers of educational methods in the 16th century. Frances Yates argues that Ramus' system can be viewed within the tradition of artificial memory, even if it was an extreme instance since in his work the fundamental principle of Loci and Imagines had been abolished in favour of an abstract dialectic scheme.⁸ Like Salomon de Caus, Peter Ramus was a French Huguenot. He became a martyr after being killed in the St Bartholomew massacre in 1572. His emphasis on an imageless dialectical order fits into Calvinist theology, and his system spread very quickly, becoming the dominant method of education in England.⁹ The basic principle was that every subject should be arranged in a schematic form where the general came first and the particular, or special aspects of the subject came after. Obviously, even Ramus stands in opposition to Bacon on this point. For Ramus, as for Camillo, the system was a natural given, a Divine order reflected in the human mind. Ramus saw his mission as being the restoration of the dialectical art to its pristine nature. "This natural dialectic is the image in the mens of the eternal divine light. The return to dialectic is a return to light from shadows."10

Although very different both Camillo and Ramus thus founded their systems in an intrinsic, immaterial and eternal order of Divine origin. They both supposed that it was possible for man to ascend to the universal and thereby grasp the particular through employing this order, which was present in his own mind. Bacon also believed in the existence of a Divine order and truth, even for him there was a clear structure to the world. But in his view, revealing that structure was a great cooperative project for the "advancement of learning", and not the matter of any single individual, who by gazing inwards would be able to ascend and see the structure for himself. To the King, Bacon defended his project with the following words: "when all other Miracles and Wonders shall cease, by reason that

⁸Ibid, p 236.

⁹Ibid, p 237.

¹⁰Ibid, p 240. Yates paraphrases Ramus' philosophical view as expressed in his Aristotelicae animadversiones and Dialecticae institutiones.

You shall have discovered their natural causes, your self shall be left the only Miracle and Wonder of the World.¹¹ In Bacon's vision, it was possible to find all causes, to count all trees in the forest. Through experience of nature, rather than through reason dwelling in the soul, the pattern of the creation was to be discerned.

Even if these three epistemological systems seem to be radically different from each other on the surface, they are part of the same general discourse of the 16th and early 17th centuries, in which Salomon de Caus' treatises should also be placed. At the bottom, beneath the particular disagreements, lies the unifying goal; to reveal and recapture the presence of the Divine order in the material world.

The compositional pattern of Salomon de Caus' treatises relates to the principles of both Ramus' and Camillo's systems respectively. To Ramus', in its use of an abstract discursive frame, based on the logic of Euclid's geometry; to Camillo's in its conscious application of myths woven into the main text in illustrations and examples. The structures work together as a whole and may be viewed as different layers of meaning, not contradicting but enhancing each other. When regarded as a whole body of work, Salomon de Caus' treatises form a larger encyclopaedic structure, in which the sciences he treats have different positions depending on whether their foundation is to be found in human invention, human reason or in the Divine.

This chapter is divided into three sections; examining first the two interrelating structures, what has been called the "Euclidean framework" and the "Melodic web". In the last section the different works are viewed in relation to each other in their role as representatives of different fields of human knowledge as an encyclopaedical whole.

[&]quot;Francis Bacon Gesta Grayorum, 1594. Quoted in Thomas DaCosta Kaufmann The Mastery of Nature, p 185.

Four Euclidean Compositions Ordering knowledge with the natural reason of geometry

La Pratique et demonstration des horloges solaires, published in Paris 1624 and dedicated to Monseigneur Richelieu, opens with a discourse on proportions and ratios drawn from Geometry, Mechanics, Musical harmony and the movement of the sun. Herein Salomon de Caus claims to prove that all proportions in Geometry, Arithmetics and Perpective can be derived from one specific proposition in the first book of Euclid, the 35th.¹² Mechanics has its own rules, but the proportions c_{-1} t can still be determined exactly as with the other three arts. Musical proportion and the proportions of the motions in heavens are in this respect different. They are works that have descended directly from God; they do not follow human reason, but are rational only from the point of view of God. Salomon de Caus makes this distinction in the dedication after having said that it would be impossible to claim that the course of the sun could be demonstrable as are the proportions of geometry in Euclid:

"Et la difference qu'il y a entre les raisons & proportions naturelles, & celles inventées pour nostre commodité (Je nōme, MONSEIGNEUR, les raisons & proportions naturelles, celles qui ont esté ordonné de Dieu) comme le mouvement des Astres & de la mer, comme aussi les intervales qui sont entre les sons graves & aigus des consonnantes de la Musique: toutes lesquelles oeuvres de Dieu se sont avec des raisons qui nous sont irrationelles."¹³

This differentiation between divine and human sciences and arts, establishing a limit to human endeavour and knowledge, was essential for De Caus. With this view it was possible for him to frame his works and display their underlying reasons without revealing the mystery and strangeness of the wonders. It did not matter to him if the audience knew the trick, since behind all human invention something much greater was momentarily made sensible. The making of automata was considered a practice of natural magic.¹⁴ The art of

¹²This proposition states: "Parallellogrammes consisting uppon one and the same base and in the selfe same parallel lines, are equal the one to the other." (Euclid *The Elements*, Book I, Prop. 35).

¹³La Pratique et Demonstration des Horloges Solaires, in Dedication: "And the difference that there is between natural proportions and ratios, and those invented for our commodity (I call, MILORD, natural proportions and ratios those that that have been prescribed by God) as the movement of the Stars and of the sea, as also is the case with the intervals between low and high sounds of the consonants of Music: all those works of God are ef ratios that are irrational to us."

¹⁴This is the art of *Thaumaturgike* in Dee's preface amongst which he counts both selfmoving statues and "strange thinges done with Perspective" (which sounds anamorphic in his description).

magic was traditionally a secretive practice. Since it was a dangerous undertaking which had an evil as well as a benign side, only the initiated were supposed to share the knowledge. To display the reasons behind such wonders as anamorphic perspectives and speaking statues in a plain language with the explicit intention of spreading the knowledge openly as Salomon de Caus did, was a quite daring venture at the time. In this aspect he relates to his older contemporary Francis Bacon, whose dream of the "Advancement of Learning" distinguished him from other Natural Philosophers of the age. In Bacon's thought magic and science were still united but he nevertheless explicitly abandoned the hermetic practice of writing in "riddles", of intentional mystification.¹⁵

It is not known if Francis Bacon had any direct influence on Salomon de Caus, but in the educational ambitions De Caus declared in the prefaces and in his struggle to clearly reveal the reasons behind his art, he appears to be a good disciple of Bacon. He also ventured to refute the "Ancients" when demanded, something which was also an important part of Bacon's thought.¹⁶ Knowledge, for De Caus, should primarily be useful. He considered it a mere waste of valuable time to thoroughly explain ancient techniques that were neither in use, nor would serve anything if in use. "Useful", in his sense, was anything that contributed to the advancement of the particular science or art; that is, the making of more marvellous machines or more perfect harmonies. De Caus based his arguments on several grounds: experience, which he considered the ultimate test; theology, which allowed certain necessary limits; and a compound of principles drawn from traditional natural philosophy, Pythagorean numerology and Euclidean geometry.

De Caus borrowed the structure for his treatises from the geometrical discourse. He laid out each area which he wished to elucidate with necessary *definitions* of terminology, followed by *propositions*, *theorems*, *problems* or simply *chapters*. The only passages that slipped out of this framework were the Dedications and the Addresses to the Reader as well

¹³Paolo Rossi, Francis Bacon - From magic to Science, p 34, and Frances Yates The Rosicrucian Enlightenment, p 119-121.

¹⁶Ibid, Ch. 2. For example in the New Organon and The Masculine Birth of Time. In the first part of Institution Harmonique, Ch 40-44, Salomon de Caus argues against the Greek enharmonic and chromatic scales, something which was in clear opposition to the main trend of the humanist movement of the Renaissance in France and Italy. (See also D.P. Walker Musical Humanism in the 16th and early 17th centuries).

as the above-cited discourse on proportions introducing the treatise on solar clocks. The implications of De Caus thus applying an explanatory structure, aimed at disclosing evident truths from orginal axioms, to divine as well as human sciences and arts, are interesting for our understanding of his view of his own practice, especially when later considering the design for his garden in Heidelberg. Before further discussing his specific application of the structure we will take a closer look at its source: *The Elements of Euclid*, as translated here by H. Billingsley and prefaced by John Dee in 1570.

The ambition of the publisher of the 1570 edition of Euclid was clearly to spread essential knowledge outside the closed circle of learned humanists, and to put geometry into the practice of mathematical and mechanical arts. The didactic intention is disclosed in the words of the title: "The Elements of the most auncient Philosopher EUCLIDE of Megara. Faithfully (now first) translated into the English Toung,... Whereunto are annexed certaine Scholies, Annotations and Inventions, of the best Mathematiciens, both of time past and in this our age. With a very fruitfull Praeface made by M.I. Dee specifying the chiefe Mathematicall Sciences, what they are, and wherunto commodious: where, also, are disclosed certaine new Secrets Mathematicall and mechanicall, untill these our daies greatly missed." The books are filled with commentaries, first those of the translator and then selected earlier discourses on the different propositions. The overall structure is explained in the first book, defining terms as "proposition", "theorem" and "problem", and explaining how the different propositions can interrelate. In the eleventh book, where solid bodies are introduced, special pedagogical fold-out figures have been fabricated to, in Dee's words; "bryng to actuall experience" the third dimension. De Caus might have followed this example when he also applied this type of foldout figures in La Perspective and more elaborately in the later La Pratique et demon-stration des horloges solaires, to help the reader more easily grasp the propositions (fig.4).¹⁷

¹⁷In his M.Arch Theses *Stars, Stones and Architecture - An Episode in John Dee's Natural Philosophy*, p 34, Brent Wagler connects the art of *Archemastrie* discussed above with the foldout figures in Book XI of the 1570 edition of Euclid. Book XI is also the one where Dee himself is consulted to make commentaries and supply extra propositions.

Truth was always present within Euclidean geometry, simply because this discipline was a closed universe that grew out from axioms to a boundary defined by the system:

"the compiler of elements in geometry must give separately the principles of the science, and after that the conclusions from those principles, not giving any account of the principles but only of their consequences. No science proves its own principles or even discourses about them, they are treated as self-evident...Thus the first essential was to distinguish the principles from their consequences."¹⁸

Euclid's geometrical elements are structured after a logical pattern which has a number of definitions in its core, limiting the meaning of terms and postulating the existence of things to be examined. From this core propositions grow out in layers to simplify the application of the given definitions. Within the limits of the natural world this pattern could grow; layer after layer moving to less and less abstract truths about the world. In this system every proposition can be brought back to its beginning in the original definitions, the first principles. In Posterior Analytics Aristotle discusses the nature of these first principles as a basis from which every science must begin.¹⁹ The truths of the first principles are not possible to prove, they are assumptions of the existence of things and the establishment of the meaning of a certain term. Geometry was just one of the sciences to which this system could be applied, maybe the most successfully, but essentially every investigation into the world had to be structured in this way. The belief that any transcendent truth could emanate from within such a system is of course quite impossible to hold in a relativistic culture such as our own. It has to be regarded as a closed system where truths are only valid when kept inside. But for Aristotle, and probably for Salomon de Caus, the status of such truths was quite different. 'Demonstration' had to do with reason dwelling in the soul, as Aristotle put it. Reason was believed to be God-given, for man's use on earth, and effectively a reflection of Divine reason. In seeing the logic of Euclidean geometry as a result of this natural reason, De Caus could explain the link between the human sciences and their truths and God. Truth was mediated indirectly through God's spirit in the human soul.

"The principles thus placed & ended, now follow the propositions, which are sentences set forth to be proved by reasoning and demonstrations, and therefore 29

¹⁴Proclus, quoted in Introduction to The Thirteen Books of Euclids' Elements, p 121.

¹⁹On Posterior Analytics from introduction to The Thirteen Books of Euclid's Elements, Vol I, p 117-124.

they are agayne repeated in the end of the demonstration. For the proposition is ever the conclusion, and that which ought to be proved"²⁰

There are two different kinds of propositions: problems and theorems, which require different operations in order to be proven. While "A Probleme, is a proposition which requireth some action and doing: as the making of some figure, or to divide a figure or line...where besides the demonstration and contemplation of the mynde, is requireth something to be done" a theorem on the other hand "is a proposition, which requiret the searching out and demonstration of some propertie or passion of some figure: Wherin is onely speculation and contemplation of minde, without doing or working of anything."²¹ When Proclus discussed this distinction he brought up arguments against the application of "problems" to geometry or theoretical sciences. Since the objects of these sciences are eternal, and not subject to becoming, the operations involved in them should not require human action. Instead, goes the argument, all propositions should be considered of one kind "and that we regard the generation that takes place in them as referring not to actual *making* but to *knowledge*."²²

This distinction between making and knowledge, and the suspicion that is raised against the former, is interesting in relation to De Caus' works. He does not seem to be of the opinion that making and knowledge should be regarded as separate notions, on the contrary, I would argue, he saw them as of necessity linked; human knowledge had to be gained through making. In the fall man lost the ability for immediate apprehension, and thus he became dependent on mediation in order to reach understanding. This process of mediation was placed in focus in the 16th and early 17th century, in the search for appropriate methods of gaining knowledge of the world. Human practice and experience became acknowledged as an important step towards theoretical understanding, which was reflected in the increase of technical treatises published at this time.²³ The form and the subject-matter of De Caus' treatises fit well into this pattern.

²⁰Euclid The Elements, Fol 7.

²¹Ibid, fol 7-8.

²²Proclus quoted in introduction to The Thirteen books of Euclides' Elements, Vol I, p 125. ²³Paolo Rossi Philosophy, Technology and the Arts in the Early Modern Era, p 41-44.

Nevertheless De Caus appears to be conscious of Proclus' distinction in his use of the terms "Problem", "Theorem" and "Proposition". In the two treatises on the divine sciences of music theory and the sun's shadows; *Institution Harmonique* and *La Pratique et demonstration des horloges solaires*, the initial definitions are followed only by *propositions*, while in the two more practical treatises, *La Perspective avec la raison des ombres et miroirs* and *Les Raisons des forces mouvantes*, he consequently uses *theoremes* followed by *problems*, demonstrating the construction of diverse machines in *Les Raisons*. He also uses the neutral term *chapters*, when he demonstrates the practical applications of perspective theory in drawing, or of music theory in composition, the latter in the second part of *Institution Harmonique*. Since De Caus admitted that neither the proportions of music nor those of the sun's movements could be fully demonstrated within Euclidean geometry, his choice of the more neutral term *proposition* for the demonstration of those sciences seems natural. Moreover his concern might have been to clarify for the reader, that knowledge of these sciences could never be acquired through study and practice alone; but that the musician was also dependent on the divine spark of genius, the inspiration of the muses.

In Salomon de Caus' application of the principles of geometric discourse, the tightness, beauty and sense of completeness that characterize the *Elements of Euclid* could not be fully achieved. This was probably of no great concern to De Caus, whose primary intention appears to have been rather to frame worldly production and art in discursive reason and logic than to construct a complete system. The movement was not, in his case, from first principles to practical problems, reasoning a priori. Rather he went a posteriori from what he knew through making, back to the first principles, in order to lay them out clearly to the understanding. One important inspiration for him was probably the didactic aspirations that he had in common with the publisher of the 1570 edition of Euclid. A logical system like Euclid's would be most certain to open up and make clear to the understanding the reasons that he wished to disclose on printed pages. For this purpose it was not required that he laid out the whole truth of the science. Even though his use of the structure implies a belief in the possibility of tying the natural world together in a closed system, I would argue that this was not his primary concern. When he also applied the system to the sciences which he explicitly claims not to be subjected to human reason and the limits of the natural world, Music and Astronomy, it seems more likely that he was conscious that what he produced was

merely a frame through which to watch and marvel at a mystery. It was the aspiration to knowledge of this humble kind that would bring mankind closer to God without allowing it to transgress the line of Divine origin.

Between Pythagorean numbers and transcendental geometry

"Agayne the matter or subject where about Geometrie is occupied, which are lines, figures, and bodyes, are such as offer themselves to the sences, as triangles, squares, circles and cubes, and other are sene & judged to be such as they are, by the sight: but nomber, which is the subject and matter of Arithmeticke, falleth under no sence, nor is represented by any shape, form of figure: and there fore cannot be judged by any sence, but only by consideration of the minde, and understanding. Now things sensible are farre under in degree than are things intellectuall: and are of nature much more grosse than they."²⁴

This passage from Book VII in the 1570 edition of Euclid, the first of three books treating numbers, displays an interpretation of Pythagorean numerology where the senses were placed below reason, and thus Geometry below Arithmetics. It is interesting to observe that De Caus actually seems to reverse this relation. This is most explicit in the discourse on proportions in the solar clock treatise quoted above, where both Arithmetics and Perspective is proven to be lower in rank than, subalterné de, Geometry since they both depend on the latter. He also states that the harmonic proportions in music cannot be perfectly described by our human numbers. The harmonic scale has to be adapted with the help of the hearing sense, which is what music serves to please. Proposition 23 in Institution Harmonique says: "The motions and intervals which are proportioned by nature, are of a proportion unknown to us". In the explanation De Caus says that it is true that we can calculate quite accurately the revolutions of the stars etc, "but to know them exactly, that would not be possible for man, because when we want to attain knowledge of a proportion we have to use numbers and measures invented for our necessity, but God, who does not use those numbers, wished that all he had ordered, should be proportioned without being subjected to our numbers."25 Salomon de Caus thus assumes; first that our numbers do not have any transcendental value,

²⁴Euclid The Elements, fol 183.

²⁵Institution Harmonique, p 14: "...mais de lavoir au certain, il n'est possible à l'homme, d'autant que quand nous voulons avoir la congnoissance de quelques proportions, il nous faut servir de nobres & mesures inventées pour nostre necessité, mais Dieu qui ne se sert desdits nombres, a voulu que tout ce qu'il a ordonné, fut proportionné sans asubiectir a nos nobres, "

and secondly he argues that God has his *own* numbers, of which we cannot have any knowledge. This qualification is interesting. De Caus apparently thought that "numbers" could be of different kinds, that there could exist one human kind and another divine kind; maybe in the same manner as there was a human mind which was a reflection of the Divine.

De Caus position toward the Pythagorean claim that "All thinges (which from the very first original being of thinges, have bene framed and made) do appear to be formed by the reason of Numbers. For this was the principall example or patterne in the minde of the Creator",²⁶ thus appears to be somewhat ambiguous. De Caus operated within the process of transformation from the essentially Pythagorean framework of Renaissance metaphysics to the Baroque metaphysics of trancendental geometry²⁷. He still saw numbers as having a divine significance, but he chose geometrical operation as a model for the conveyance of knowledge to human reason. Not yet directly, but indirectly, Geometry was for De Caus a source of Divine wisdom. Also in his emphasis on sensual experience De Caus appears to approach a Baroque understanding of the world, but in many respects he never actually reached it. For De Caus neither numbers, nor geometry could ever hold the direct, trancendental truth of God in themselves. The principle of mediation through the senses was a condition man had to live with. God made his presence clear through traces; He was never present in the world itself. The senses were recognized by De Caus as being at least on equal footing to *reason*, especially with regard to music, which was of Divine inspiration. The senses were the foundational ground for establishing the musical scale in the "Harmonic Institution" of Salomon de Caus.

"Mais quelques pedant de Musicien pourra dire que les nombres sont justes & l'aureille fautive: car ce qui est d'accord au jugement de l'oüye à l'un ne l'est pas à l'autre. Ce qui est tres-vray: Mais il faudroit doncques qu'il trouvast des nombres autres que les nostres, car il est impossible d'en donner les proportions justes les unes avec les autres. Ce qui demonstre ... que la nature ne se sert point de nos nombres en ce qu'elle ordonne, & qu'elle en a d'autres dont nous

²⁶Boethius quoted and translated by John Dee in The Mathematicall Praeface 1570.

²⁷For the understanding of Geometry as a source of transcendental truth, see Alberto Pérez-Gómez Architecture and the Crisis of Modern Science, Ch. 3, pp 87-127.

n'avons nulle cognoissanse."28

Using the deductive principle of Euclid's *Elements* Salomon de Caus managed to convey his view of human practice, in which the natural world became the frame onto which knowledge could be fastened and through which, in contrast, the great mystery of the Divine be experienced. His use of it demonstrates both his belief in the possibility of truth in the world; in the importance of spreading this truth, and in the existence of a transcendent dimension, a Divine being, which man could only strive toward but never reach. It is interesting that his construction of a rigorous deductive system mainly works to make visible the necessary deviation from it and the very significance of this deviation.

For Salomon de Caus, the recognition of the divine limit to human knowledge was a matter of faith. To disclose the workings of matter was a most appropriate act of faith for a good Calvinist. As mentioned in the introduction above, the reading of the book of nature was one of the principal ways the faithful could acquire the knowledge of God. This religious conviction became an incitement to a thorough examination of nature and was thus an important factor for the rise of modern science⁷⁹. However an important distinction must be made in relation to the limit which De Caus pointed out, and which was a significant feature of his time. Simultaneously with being the ultimate goal of human endeavour God was kept at a safe distance from the world. Progress in De Caus', Bacon's and their contemporaries' sense was not yet at all linear. The goal was to travel closer and closer to the original state whilst realising the impossibility of reaching the destination. To polish and perfect the human frame of the world meant that God would be seen more and more clearly, but also that the imperfections in man and the natural world would appear evident to God's advantage.

²⁸La Pratique et demonstration des horloges solaires, in Discourse on proportions section on musical proportion: "But some pedant of a musician could say that numbers are just and the ear faulty: because what is right to the judgement of one's ear is not right to another's. Which is very true: But he would have to then find other numbers than ours, since it is impossible to give right proportions with them so that one correspond to another. Which demonstrates ... that Nature does not at all use our numbers in what she prescribes, and that she has other [numbers] of which we have no knowledge."

²⁹Richard Patterson The 'Hortus Palatinus at Heidelberg and the Reformation of the World, Part I, p 76 and Part II, p 181, 187.

PLATE 4







Fig. 8: Optical correction of inscription on a long wall. Songe in the 17th century meant both dream and contemplation. If Narcissus had only spoken he might have broken the spell of his songe. (From Salomon de Caus La Perspective avec la raison des ombres et miroirs, Book I, Ch. 31. Courtesy of the Canadian Center for Architecture).



Fig. 9: Demonstration of how to "foreshorten a head so that one cannot recognise it unless one does not see it from its point of view." In Salomon de Caus *La Perspective avec la raison des ombres et miroirs*, Book I, Ch. 28. (From Jurgis Baltrušaitis *Anamorphic Art*, p 43).





Fig. 10: Demonstration of how to "foreshorten a figure so that if seen from outside its point of view one cannot know it." In Salomon de Caus La Perspective avec la raison des ombres et miroirs, Book I, Ch. 29. (From Jurgis Baltrušaitis Anamorphic Art, p 44).



Fig. 14: Demonstration of how to "foreshorten a frontispiece with its shadow" alongside a gallerywall. The story of Apollo and Phaeton. (From Salomon de Caus *La Perspective avec la raison des ombres et miroirs*. Book II, Ch. 10, Courtesy of the Canadian Center for Architecture).

When later this enclosure, defining and defending the garden of the world, gradually broke down and brought God to man; the human world became the whole world and the whole truth was presented within man's reach. In the 18th century God and Nature were marvelled at as One, and the discoveries of man served to praise the Lord, as he was *present* in the world, constituting the world³⁰; rather than as the earlier transcendent, unattainable mystery, who left His signature all over the world. God, in the 16th and early 17th century, stayed on the outside; he was the generator and the essence, but he was not the present *existence* of the world. This shift is interesting to notice in the view of the quest for an original langage as the ambition changes during the 17th century, where John Wilkins and Leibniz stand as good examples of the latter instant.³¹ It is here that the shift from seeing progress and enlightenment as a *limited* movement back to Eden, or as a preparation for the second coming of Christ and the rise of the New Jerusalem; into believing in progress as force transporting humanity into an enlightened and infinite *future*, takes place.

Secondary Layers of Meaning Melodic variations woven into the primary framework

Having established a simple structure as a constitutive element of Salomon de Caus' treatises, one can now step back for a moment and notice the secondary layers of meaning that appear between the lines of the principal framework. These layers could be described as "narrative threads" enriching and adding to the meanings that are conveyed in the works. What would have been a reductive spatially abstract system without them, now becomes a rich and imaginative work graspable to human experience and understanding. In the demonstrations De Caus adds different dimensions to the subject-matter of each book. In *Les Raisons des forces mouvantes* the "problems" mainly teach how to construct garden automata; such as singing birds and satyrs and nymphs playing instruments or singing, and to make grottoes for them to inhabit. Each problem gives an opportunity to add a mythological layer to the text, contributing new themes to the work. While the "architect-engineer" De Caus is

³⁰Alberto Pérez-Gómez Architecture and the Crisis of Modern Science, p 80-81.

³¹John Wilkins and Leibniz will be discussed in the conclusive chapter, where De Caus' garden is put in the context of the quest for the Ursprache.

busy explaining the mechanical and hydraulic workings behind his inventions, carefully chosen scenes take over the deeper conveyance of meaning in the work. The stories that De Caus employs are mainly based on Ovid's metamorphoses, as was most garden imagery inspired from Italian Renaissance models,³² focusing on themes emphasizing music and the transformative forces of the material elements.

In the very first grotto of Les Raisons the reader is presented with the sea-nymph Galatea riding on dolphins in the water while the cyclops Polyphemus plays on his pan-pipe for her. The contemporary reader was likely to know that Polyphemus played on his pipe in order to seduce Galatea. Since Polyphemus knew that he was ugly and repulsive he was hoping that his music and song would change Galatea's perception of him. She on the other hand transformed her true love. Acis, into water so that she could be with him forever, fearing that Polyphemus would harm him.³³ This scene conveyed to the reader a reflection on the power of love and of music; that the immateriality of music could sometimes reach deep into the heart, with dangerous effects. This is also the significance of Orpheus' appearance towards the end of the second book³⁴, but while Orpheus signified the safe control over these musical effects, the satyrs' and cyclops' use of it was more ambiguous (fig.25). This was a crucial theme for De Caus, prevalent in 16th century musical humanism in Italy and France. If used with care and intelligence, music was considered a very important vehicle for the transformation of souls, turning them upwards to God.³⁵ Through the presence of the stories of Galatea, Orpheus, the competition between Apollo and Pan at Mount Tmollus³⁶ and many others, De Caus shows his concern for the necessity of balancing the human faculties of senses and of reason, both affected by the power of music. Not reason alone, but Divine inspiration, guided man in his way of life.

³²John Dixon Hunt Garden and Grove, p 42 and Elisabeth MacDougall Ars Horticulorum.

³³Les Raisons des forces mouvantes, Book I, Problem XXIII. Ovid Metamorphoses, p 305-309.

³⁴Ibid, Book II, Problem XVII.

³⁵Frances Yates The French Academies of the Sixteenth century, p 36-42. See also D.P. Walker Musical Humanism in the 16th and Early 17th Centuries, Music Review, Vol 2, p 9.

³⁶Les Raisons des forces mouvantes, Book II, Problem XV. See Ovid Metamorphoses, p 250-51.

Another essential theme conveyed through this secondary layer of meaning in the problems is the symbolic importance attributed to the sun. The last problem of the first book in the first edition teaches how to make "an admirable machine, which is at the base of a statue, sounding when the sun rises or when the sun sets so that it seems as if the statue made the sound."³⁷ In the text De Caus refers to the statue of Memnon in Egypt, said to have sounded at dawn (Memnon was the son of Eos or Aurora, dawn), but the figure that he presents to the reader is a man wearing a loin-cloth and holding a club in his right hand, most likely intended to be Hercules (pl.3). It is the virtuous hero of the twelve labours who, strengthened from the first rays of the sun and aroused by the sounds of a tambourine, goes out to wage war against evil.³⁸ Later on, in the second book, this statue can be seen positioned on the top of an artificial mountain, constructed to allow "a better view of the parterres."³⁹ The shape of the mountain is pyramidal, with a "rustic" touch.

In making the automaton a marker of dawn at the top of an Egyptian pyramid, transforming the heat of the sun through art into music, Salomon de Caus not only made visible the Divine source of his marvels but also demonstrated that this Divine gift, if wisely used, could act as a guiding principle to a virtuous life. In displaying the strength of the sun to the senses with visual, aural and tactile means, De Caus' inventions served this guiding force. They were also momentarily the man-made "incarnation" of this principle. In the automata man could see himself reflected, and marvel at the forces on which his life depended. As in the experience of the anamorphic perspective, which will be returned to later, this was a means by which man could momentarily displace himself and imagine seeing the world through God's eyes, as well as seeing God through this comprehensible frame. Similarly, climbing the mountain provided an overview, a place from which to see "the most beautiful aspect of the garden", its form and parterres; a man-made imitation of God's creation.

³⁹Les Raisons des forces mouvantes, Book II, Problem X.

³⁷Ibid, Book I, Problem XXXV.

³⁸Hercules was often used to personify the virtue of physical strength, his complementary figure being Minerva or Orpheus, representing the virtue of moral strength, or wisdom. He had to go through twelve labours, triumphing over evil against all odds, as a punishment for having slayed his own children. (*Hall's Dictionary of Subjects and Symbols in Art*, p147-53). The sound that De Caus says that the machine will produce is one of a tambourine, a typical instrument for military purposes.

The use of Narcissus in a grotto, first published as part of the designs for the garden in Heidelberg, and later in additions to *Les Raisons* in its second Parisian edition⁴⁰, further implies a concern with the question of the original and its copy, of natural objects and their reflections, of God in relation to his creation, man and the natural world.⁴¹ Narcissus sits quietly gazing at his own image in a grotto, or in the end of a gallery (fig.7). Having fallen in love with his own image, but unable to reach and touch it, his love was unproductive and led only to starvation and death. The first man, in the hermetic genesis, also fell in love with his own reflection, but saw further to the reasons beneath the reflective surface being Nature, and embraced her as the source of his love. Thus the love of the first man produced the manmade world of material procreation. The presence of the starving Narcissus reminded the reader or garden visitor of the necessity of material involvement in life, the result of which was displayed all around him. Moreover it emphasized the unbridgeable distance between image and original, between man and God. Only through working with matter, with the elemental world, could man indirectly approach his Divine origin.

According to Alberti, Narcissus was the inventor of painting: "What else can you call painting but a similar embracing with art of what is presented on the surface of the water in the fountain."⁴² To represent natural objects on a flat surface was in itself a reproductive act, using the geometrical order God had implemented in human reason. Salomon de Caus' perpective treatise was published in England in 1612. It was his first book, based on the drawing lessons he had given Prince Henry and Princess Elizabeth. In the Dedication and Address to the reader he tried to explain the nature of presentive primarily in its relation to architecture, but also to painting. Architecture, wrote De Caus, paraphrasing Vitruvius'

⁴²Leon Battista Alberti On Painting, p 64.

⁴⁰Le Jardin Palatin, fol. 29. Les raisons des forces mouvantes 1624, Book II, Problem XXVI.

⁴¹Les Raisons des forces mouvantes 1624, Book II, Froblem XXVI. Ovid Metamorphoses, pp 83-87. Richard Patterson The 'Hortus Palatinus' at Heidelberg and the Reformation of the World, Part I, p 74-75. Patterson argues that De Caus did not intend his Narcissus to be read in the Neoplatonic way, with reference to the Hermetic Genesis where God falls in love with his image, man, and man falls in love with his reflection in material Nature. On the basis of Francis Bacon's interpretation of the myth, as analysed by Paolo Rossi in his Francis Bacon - From Magic to Science, p 112-13, Patterson instead reads De Caus' intention as displaying a preference for action over contemplation in life, and the necessity of connecting to material necessities. Even if the latter interpretation seems to fit well into De Caus' ideas I would not discount the former since it is equally interesting; and they both work in combination with the overall theme likely to have been present in the contemporary readers' imagination, side by side with other significations.

definition of it,⁴³ is: "une disposition de bonnes convenances des parties d'un bastiment de proportion, mesure, distribution & decoration." He introduced Ichnography, Orthography and Scenography as the three "ideas" that had to correspond well in order to give grace to a building. De Caus understood "scenography" as "perspective" within the general Renaissance interpretation of the word.⁴⁴ The plan, elevation and the foreshortened image itself were the three necessary parts of a perspectival "reproduction". In referring to these concepts as "ideas", inserted in a quite obscure sense, De Caus followed the Jean Martin translation of Vitruvius closely. *Idea* in the original Greek sense "refers to the three aspects of a mental image," allowing the architect to "imagine the disposition of a project's parts"⁴⁵. The use of drawing and perspective by De Caus was a means by which to externalise these mental images. As Vitruvius he wrote: "In these three kinds..., born from the imagination and invention of the engineer or architect, eurythmy will be observed."⁴⁶ This qualification is important because it establishes the transient nature of the drawing as an instrument of representation, a vehicle for truth, and never a presentation of truth itself.

Salomon de Caus emphasizes the usefulness of the science of perspective for architects and engineers, in providing the means to view the thing designed "in effect" before it is built, and for painters whose task it was to represent natural objects and "make them appear as to the sight."⁴⁷ Perspective is also the most pleasurable of all mathematical arts, "since after

⁴³Marc Vitruve Pollion Architecture ou Art de bien bastir, Ch. IIII.

⁴⁴La Perspective avec la raison des ombres et miroirs, Dedication. Ichnography, Orthography and Scenography are here introduced in their Vitruvian context but reappear in the definitions of necessary concepts for the construction of perspective. (Def: IX, X and XI).

⁴⁵Alberto Pérez-Gómez and Louise Pelletier Architectural Representation beyond Perspectivism, p 28. Perspecta 27.

⁴⁶La Perspective avec la raison des ombres et miroirs, Dedication: "En ses trois especes dessus declarées naisantes de l'imaginatiõ & de l'invention de l'ingenieur ou Architecte, est observée l'Eurythmie des Grecs:" It is worth noting that Vitruvius is more general in this statement saying that these three kinds are born of the imagination and invention of man.

⁴⁷Ibid, Address to the reader: "L'Architecte en peut tirer ceste commodité, c'est que ayants faicts quelque plan de bastiment portique ou autre chose que ce soyt, et qu'il desire en voir comme une peinture parfaicte comme s'il voyoit la chose en effect, il le pourrafaire selon les raisons qui sont icy demonstrees, quand l'Ingenieur il en peut tirer la mesme commodité et ayant prins quelque plan que ce soit, comme de Jardin chasteau forteresse ou autre chose, il pourra en faire la demonstration par la perspective et monstrer ce qui est haut et bas, long et large, les peintres ne s'en sauraient passer s'ils veulent bien representer ce qu'ils font d'autant que l'art de peinture consiste à representer une chose naturelle et la faire paroistre telle à la vue, ce qui ne peult estre bien faict sans user de vrayes raisons propre en ceste science..."

one has worked on the speculation and the practice, which is a contentment that could be that of Geometry, one has also the pleasure of seeing that which is made, because of all Mathematics, there is none but perspective which gives pleasure to the sight."⁴⁸ The primary advantage of this science and art thus appears to be the marriage between reason and senses; an advantage which all the sciences De Caus treated have in common. The recognition of the importance of simultaneously appealing to both reason and sensuous experience in man, is characteristic of De Caus. The role of the arts was to make reason appear through the senses. In the "embracing" act of painting, the geometrical order present in human reason was put into work and made visible outside ourselves. When the reason that "dwells in the soul", as Aristotle wrote, was applied to imitate a natural object, the traces of its operations equally affirmed the Divine order of the human mind.

The first part of *La Perspective* demonstrates the construction of perspective, the second how to construct shadows and the third provides the reader with six theorems on the representation of objects in mirrors. As in *Les Raisons* a second layer of meaning appears in the applications. The sequence of objects in the first book goes from abstract geometrical figures; planes and solids, to their application in man-made objects or structures, defined by the sciences/arts of geography, fortification, music, architecture and gardening. After this panoramic view of the art's usefulness the reader is ready to be taught another method of foreshortening which makes it appear as being "out of its nature [*hors de sa nature*]...and nevertheless if seen from its point of view it represents the foreshortened thing as natural."⁴⁹ Salomon de Caus was among the earliest to present this technique of constructing the perspective with a vantage point in an extreme position; a form of anamorphosis. It had been used by painters in the 16th century, but had not been included as part of the teachings of *perspectiva artificialis* before the 17th century.⁵⁰

⁴⁴Ibid, Address to the Reader: "car apres que l'on travaille à la speculation et pratique qui est un contentement comme pourroit estre celuy de la Geometrie, l'on aura de plus le plaisir de voir ce qu'on aura faict, car de toutes les Mathematiques, il n'y a que la perspective qui donne plaisir à la veue..."

[&]quot;Ibid, Chap.26: "Il y a une autre facon de mettre en racourcissement de sorte que ledict racourcissement semblera estre hors de sa nature & extravagant & neaumoins estans veu de son poinct de veue il representera la chose racourcie en son naturel..."

⁵⁰Hans Holbein's painting *The Ambassadors* is a well known example from the 16th century in which a curious shape appears as a skull if seen from the right point. See Jurgis Baltrušaitis *Anamorphic Art*, pp 37-60 and Ernest B. Gilman *Curious Perspective*, pp 16-66.

In the text two figures are foreshortened with this "other method", the anamorphic perspective. The first is a face of a man, the second a man holding a theatre mask and a spade, possibly signifying the theatricality of the act of representation, the hiding of the real behind the mask, and the possibility of man's transformation of nature with art (pl.5). It is interesting to observe this linking of theatre and garden. At the specific time and place this book was produced, the connection was most present through Inigo Jones' masques and Salomon de Caus' gardens, probably wondered at in combination. The scenes of the garden grotto was a more permanent form of the ephemeral scenes performed in the masques, using the same *thaumaturgicall* technology of the "marvel-producing" industry, of which perspective of this kind was also a part.⁵¹ John Dee included Perspective in his section on *Thaumaturgike*; the art that gave "certaine order to make straunge workes, of the senses to be perceived: and of men greatly to be wondered at":

"And by *Perspective* also straunge thinges, are done...As, to see in the Ayre, a loft, the lively Image of an other man, either walking to and fro: or standing still. Likewise, to come into an house, and there to see the lively shew of Gold, Silver or precious stones: and commyng to take them in your hand, to find nought but ayre..."

"Straunge, this is, to heare of: but more mervailous to behold, then these my words can signifie: And neverthelesse by demonstration Opticall, the order and cause thereof, is certified: even so as the effect is consequent."⁵²

Now, as both John Dee and De Caus were aware, these wonderworks could lead man to think that these marvels were "above the power of Nature"; a potentially dangerous and undesired effect. An anamorphic painting could act as a metaphor for how, even in the apparent disorder of experience there always was an order to be found, and this order was divine and precise. To find the correct viewpoint could be a revelatory experience of, for a brief moment, being placed in God's heavenly throne. It displayed the mystery and marvel of Divine creation, and strengthened the faith in the underlying order of nature. But Salomon de Caus was also conscious of the balancing act required when having the means at one's disposal to construct these marvels in order to retain one's rightful place and not step over the fine line, imagining oneself as God. As with the automaton, the anamorphic image could

⁵¹See Roy Strong The Renaissance Garden in England, p 83, and Vaughan Hart Art and Magic in the Court of the Stuarts, p 94.

³²John Dee The Mathematicall Praeface (1570) from sections on Thaumaturgy and Perspective.

be both a mediating means through which to view God's creation and a way of imagining oneself in God's position.

The first book ends with two incriptions illustrating the art of optical correction as applied to inscriptions on large monuments. They strike the reader as powerful words of wisdom: COGNOIS TOY-MESME and SONGE AVANT QUE DE PARLER;53 "Know Thyself" and "Think [twice] before speaking". While the first is a familiar proverb, originating from the inscription on Apollo's temple in Delphi, and an important principle for the faithful Calvinist; the second is more mysterious. Songer was, in the 17th century, primarily related to dreaming, or to represent something to oneself while asleep.⁵⁴ Moreover it signified thinking, but in the sense of meditative pondering or contemplation, an intense application to some profound matter, and imagination.⁵⁵ As a man who sleeps is oblivious to his real surroundings, so is the meditating man caught in his songe. When De Caus asked his readers to Songe avant que de parler, he probably wished that they would reflect deeply before making visible the fruits of his lessons. Placed after the disclosure of the principles behind the anamorphic perspective, these words of the Delphian oracle, were provided in order to prevent the reader from using his newly gained knowledge for any other purpose than this: To look into the self through viewing the world, with the aim to better understand God and his creation but never to surpass him (fig.8).

This message is rephrased as a warning in the end of the book on shadows where there occurs another instructive example of how double messages are conveyed in different layers in the description of how to "foreshorten a frontespiece with its shadow".⁵⁶ An architectural "frame" is to be painted around a series of painted scenes longside a gallery wall telling the "story of Phaeton when he asks his father, Apollo, for the chariot of the sun...the cause of his ruin." This story, as told in Ovid, recounts how Phaeton asks the Sun for proof that he is his father. As a proof the Sun grants him any wish, whereupon Phaeton wishes to drive

⁵³La Perspective avec la raison des ombres et miroirs, Chapter 30 and 31.

³⁴Antoine Furetiere Dictionaire Universal, contenant generalment tous les mots François.

³⁵Dictionnaire Étymologique de la Lague française.

⁵⁶La Perspective avec la raison des oribres et miroirs, Book II, Ch. 9.

his chariot across the heavens. It ends in disaster, as the sun had foreseen. Phaeton falls down, to be found and mourned by his mother and four sisters whose bodies turn into trees by his grave.⁵⁷ All this is illustrated in the six scenes framed by the four seasons on the upper level, representing the heavens, and the times of the day on the lower level, representing the earth. The imagery is quite literally Christian with an interesting confusion appearing between Apollo or Phoebus as God and Christ; and his son Phaeton whose representation also alludes to the earthly Christ (fig.11). To see the sun as Christ was not uncommon in the 16th and 17th centuries; Giulio Camillo placed the sun in the center of his memory theatre and saw the spiritus proceeding from the sun as the spirit of Christ.⁵⁸ Pierre de Bérulle, a writer on Theology and a contemporary of De Caus wrote:

"But Jesus is the true Sun who looks upon us with the rays of His light, who blesses us with His countenance, who rules us by his motions: Sun that we must always keep our sight fixed upon and always worship....Jesus is the only Son, and the visible Son of the invisible Father...He is the Sun...of Christians instructed in the school of truth and born of the light of that Sun...For the Sun is the image of God, the Father of Nature, the universal Principle of life..."⁵⁹

Seen in this context, Salomon de Caus' illustration of this Ovidian fable can be interpreted as a theological commentary on the complex relation between God, his son and man. While all mankind are in one sense God's children, only Christ was His true son and could fully return to his origin. However the principal theme of the fable is *hybris*. De Caus' choice of it and the redressing of it in Christian clothes, appears an efficient warning to the reader that he should not try to do God's work. He should be content with receiving God's light in Christ on earth and stay there to work with what had been given him. The location of the story is very well chosen. It is close to the end of the first two perspective books where the reader had gained insight of the reason behind the visible thing, how to represent it naturally, but also how to hide it in an anamorphic projection which allows it to be seen only from one specific viewpoint. Therefore, through this woven-in story, chapter nine in the book of shadows, told the reader to not misuse what he just learned but to treat it with care

⁵⁷Ovid Metamorphoses, pp 50-60

⁵⁸Frances Yates The Art of Memory, pp 153-54.

⁵⁹Quoted in Fernand Hallyn The Poetic Structure of the World, p 141.

within our "worldly garden".

"And in the second of the orbits from the earth god lit a light, which we now call the sun, to provide a clear measure of the relative speeds of the eight revolutions, to enable the appropriate living creatures to gain a knowledge of numbers from the uniform movements of the same."⁶⁰

In both Les Raisons and La Perspective the sun thus appears "between the lines" with a very strong symbolic significance, as being first source of both movement and light. As seen in Camillo and Bérulle, the identification of God and the Creator with light and the sun was very common in the Renaissance. It had its most obvious source in the Ficinian neoplatonism of 15th century Florence. The sun could indeed be seen as the crown of Divine creation, to which man could turn in search of truth and knowledge. The sun was the elementary fire, which nourished all material fire on earth.⁶¹ Fire was the only one of the four elements that had this immaterial dimension, and the light of the sun therefore appeared as the one and only opening to the incorruptible sphere of the Divine. On the beams of light travelled God's wisdom and man's aspirations to reach him. Salomon de Caus praised the sun with these words: "The sun is the point of light and...all which he regards receive light and opposedly what he cannot see receive shadow, now, this light coming from the Sun, is the first and principal light of all that is natural, always shining with the same [strength], because the sun does not receive any alteration... The Sun thus is the one light which illuminates the whole world, that is the earth and the sky, because the world is all."⁶² Through letting the sun shine and work its way through a man-made frame, having its significance on many different planes, mythological as well as metaphorical; De Caus filtered the blending light and allowed the individual man to see more clearly what was before him. In constructing automata and drawing perspectives according to the rules of reason, De Caus allowed Art to appear as a frame to Nature.

⁶⁰Plato Timaeus, p 54.

⁶¹Salomon de Caus Les Raisons des forces mouvantes, Book I, Def. I.

⁶³La Perspective avec la raison des ombres et miroirs, Book II, introduction: "Or ces raisons me donneront licence de dire que le soleil est le poinct de lumière, & que tout ce qu'il regarde, reçoyt lumière, & au contraire ce qui ne peut voir reçoyt ombre, or, ceste lumière procedante du Soleil, est la premiere & principalle lumiere de toutes laquelle est naturelle toisiours luisant esgalement, car le soleil ne reçoit aucune alteracion,...Le Soleil donc est la seule lumiere qui esclaire tout le monde, cest à dire la terre & le ciel, car le mond comprend tout, "

"For when Archimedes...did fasten in a Sphaere, the mouynges of the Sonne, Mone, and of the five other Planets, he did, as the God, which (in Timaeus of Plato) did make the world"⁶³

That Salomon de Caus last published work would be on Solar Clocks seems in this perspective significant. In this treatise none of the narrative dimensions woven into his previous works are present. It appears on the surface as the dryest and most matter of fact sample of his writings, teaching the art of constructing different kinds of solar clocks showing both the present time of the day and sign of the zodiac. It is very thorough and instructive, using fold-out figures to clarify for the understanding the geometrical operations.⁶⁴ When reading this text today, with primary concerns other than learning how to make solar clocks, the most striking aspect is that this whole art appears as an exercise in moving the self up to an exterior viewpoint of the world. The solar clock had to be imagined as being the universe; and at the same time it was used as a vehicle to find the exact position in space and time of the body on the surface of the earth. In the first definition De Caus demonstrated what the "Centre of the World" was for the practice of making solar clocks:

"[H]ere it is necessary to show that even if all the clocks that exists in the whole world each has a center of the world, each of those centers is imagined to be in the middle of the firmament: which is not so [in reality], because the true center of the firmament is a point in the center of the earth, as apprehended by the intellect; but, whereever we are on earth, by the apprehension of our senses, it always seems to us as if we were just in the middle of the firmament."⁶⁵

With this passage De Caus prepared the reader for the exercise his imagination would have to go through in order to understand the operation and reason behind solar clocks. In its essence this practice of making solar clocks encompassed exactly what Salomon de Caus was striving for in all his other creations. What in his gardens and his other treatises had been veiled in mythological narratives for the sake of human comprehension and identification, was present here on the surface as the necessary principle of the whole science.

⁶³Cicero quoted in John Dee The Mathematicall Praeface (1570) section on Thaumaturgy.

⁶⁴See above, footnote 17, on the fold-out figures of the 1570 Euclid edition.

⁶⁵La Pratique et demonstration des horloges solaires, Def. I: "icy il est necessaire de monstrer qu'encore que toutes les horloges qui sont sur la terre universelle ont chacune un centre du monde, ce neantmoins chacun desdits centres est imaginé estre justement au milieu dudit firmament: ce qui n'est pourtant, car le vray centre du firmament est un point au centre de la terre, ainsi apprehendé par l'intellect, mais par l'apprehension de nos sens quelque part que nous soyons il nous semble que nous soyons justement au milieu dudit firmament..."

There was no need for secondary layers of meaning when dealing with the sun itself. The solar clock demonstrated the unalterability of the sun and the eternal cycle of changes on earth. It was an instrument which planted man as a body on earth but lent him an eye in heaven; if he listened carefully he would hear the heavenly tones.

Music was the only other science which could provide such an unmediated connection to the Divine. It had an important role in the themes of De Caus' grottoes and many of his automata were represented as either singing or playing an instrument. As with *La Pratique des horloges solaires* the treatise on music theory, *Institution Harmonique*, also provided less occasions for mythological narrative as a means of mediation. Except for the anecdotes relating to the history of music and its effects, not much was provided to help the reader digest the abstract science of musical proportions. Salomon de Caus probably thought that the only way to truly comprehend it would be through the making of the experiments he suggested, and thus reaching an understanding of the theory through practice. Nevertheless the discourse is not entirely straightforward and there are instances where a secondary layer of meaning appears to be consciously inserted.

In the practical part of *Institution harmonique*, teaching the art of composing music, the melodies demonstrating the musical modes are accompanied with carefully selected psalms, David's songs, reminding the reader of God's presence in the work, and the overall moral justification of the musical science.⁶⁶ The overall theme of the psalms is a praise of "Almighty God", how man is small and God is limitless. Many of them specifically points to his presence in the heavens, and the fact that the unchanging movement of the heavens are his creation, that his most worthy abode is there, and that his force is spread throughout the universe. They also stress the connection between God and King, which was of essential significance in the Protestant kingdoms where the political and religious powers were joined in the one King, mediator between heaven and earth. Finally in the lyrics man assures God of his eternal desire for him as the only God, that he fears him, that he feels safe under his protective wings and that God is his true foundation, fortress and rock. It appears as an obvious undertone that the essential aim with this Musical science was, ultimately, the

praising of "our Lord" and the raising of our souls towards Him.

The musical modes, which the psalms demonstrated, were differently defined characters of songs: sad or gay, lamentative or active. They assisted the composer in finding an appropriate expression to his work, or to help him fit words to a song. The modes had a similar role as the architectural orders in that they each had an appropriate application which the good composer should be able to judge, and in that the choice of mode as well as order affected the entire composition, pervading the whole essence of the work. The choice of mode was the most important since it decided the particular *ethos* of the piece, the moral effect it would have on the listener. But the modes were not so well defined. Even if there were rules applicable to their respective identity, they were very vague and difficult for the composer to put into practice.⁶⁷ The discussion of the modes remained mostly theoretical, reflecting a wish to organize and gain some control over the strong and mysterious powers of music.

Having now gone through Salomon de Caus treatises with a special view to what has been termed a secondary layer of meaning; there appears a clear compositional pattern of his own making, possibly guided by a particular way of viewing the text as a constructed work, an artefact. The insertion of myths from Ovid's Metamorphoses was in itself nothing unique or surprising, even if it has a curious effect for the modern reader, seeming a juxtaposition of a strictly organized "scientific" work with illustrations from pagan mythology. But upon a closer look, and keeping in mind the contemporary significance of these fables, as veiled original truth, it becomes evident that these figures and grottoes are not at all mere illustrations, removed from the actual meaning of the work. In themselves they constitute part of the work's meaning; rather than being a decorative surplus they are a synthetic part of its totality. The themes that emerged from Salomon de Caus' choice of stories and psalms helped him to qualify specific aspects of his views on the relations between man, nature and divinity; as well as to communicate warnings and advice regarding the appropriate use of these sciences.

⁶⁷D.P. Walker Musical Humanism in the 16th and Early 17th Centuries, Music Review Vol 2, pp 220-26. On the musical modes see also Frances Yates The French Academies of the Sixteenth Century, pp 47-48.

It is worth noting that this overlaying of "melodies" also could be used as a technique for conveying secret information and of spreading obscure messages to the already initiated in a closed circle. On the surface, Salomon de Caus appears a Baconian disciple with aspirations to the advancement of democratic learning for all, and this is probably a correct picture. But even for him, living between national and religious boundaries in a time of extensive suppression of thought from both worldly and religious powers, a more oblique system of conveying meaning was likely to be of use. For example; De Caus does not openly disclose any direct connections to the magico-mystical strands of the Protestant movement of which his patrons (particularly Frederick V) were a part, but nevertheless he refers to it in the themes and imagery in the grottoes.⁶⁸ In the same way the psalms in *Institution Harmonique*, which seem harmless to our eyes, were at the time a feature specific to Protestants and for that reason also considered heretic among Catholics in France⁶⁹. The establishment of secret societies, such as the Rosicrucians, took place in the midst of this time of suppression. In silence, and hidden from prosecution, the grounds for the reformation of the world had to be laid out.⁷⁰

The compositional pattern that has been disclosed in Salomon de Caus' treatises is quite consistent with the general way in which knowledge was structured in the late 16th and early 17th centuries. A similar pattern is found in the contemporary curiosity cabinets which were organised according to an overall cosmological structure at this time⁷¹ as well as in the constructions of artificial memory systems and the principles for new methods of learning mentioned above. De Caus presented the constituents of the topic in question as points

⁶⁸In the Postface to Le Jardin Palatin (1981) Michel Conan makes a connection between emblems in Michel Maïer's Atalanta Fugiens and details of the grottoes in Hortus Palatinus suggesting a link to the Rosicrucian athmosphere of the Court and Heidelberg at the time.

⁶⁹Frances Yates *The French Academies of the Sixteenth Century*, p 70. As part of the counter-reformation movement, the Baïf Academy in Paris, worked on new Catholic psalms. The idea that poetry and music were a most efficient conjunction was inspired from Ficino's Neoplatonic concept of Orphic chants.

⁷⁰See Frances Yates The Rosicrucian Enlightenment, pp 220-33.

⁷¹Thomas DaCosta Kaufmann *The Mastery of Nature*, p 181. In this essay; *From Mastery of the World to Mastery of Nature*, Kaufmann discusses the change that takes place in the beginning of the 17th century in the symbolic significance of the Princely *Kunstkammer*. He takes the collections of Rudolf II in Prague as an example. As the title implies, Kaufmann argues that while the *kunstkammer* in the earlier period symbolically represented the microcosm, and the ruler's possession of it signified his supreme mastery of the "lower" world; it gradually became in the 17th century a scientific collection serving to assist the larger quest for the mastery of nature.

carefully positioned within a larger metaphysical structure. From each point layers of deeper meaning were conveyed, often by the use of narrative or metaphorical mediation. This "collaboration" between the structure, in itself carrying the essential meaning of the work, and the particular examples, making the structure meaningful for human understanding; suggests an interesting relation between text, structure and matter. Structurally, one can see a parallel in this compositional pattern with a polyphonic symphony where some voices define the rhythm and overall structure of the piece, and other voices add themes and variations. Melodies appearing as stories allow the unsayable "beauty" of the structure, or what is behind it, to appear to the hearing sense. The stories, the melodic variations, the singing of the psalms, were all tools to "dress" reason and divine truth in visible clothes. To make the divine mystery present in the structured world of natural reason and open to human experience appears to have been the overriding intention of and driving force behind Salomon de Caus' works; a mission to reform mankind through sensual experience, relying on the hidden truth in ancient myths and the order with which God had endowed the world.

De Caus' Epistemological Synthesis

The Order in which the sciences are placed with respect to the World and to the Divine

The topics of De Caus' four treatises interrelate in such a way as to form a true "Vitruvian" encyclopaedia, and his works have, in our time, been referred to as "a vast treatise on the wonders of the world."⁷² It seems likely that De Caus thought of his works as parts in a larger structure. He treated the sciences which he himself made use of in his practice, but went deep enough in each treatise so as to make sure he conveyed not only the practice but the reasons behind the art. His treatises were addressed primarily to aspiring engineers and architects but were also valuable for anyone specializing in a specific subject which he treated. They constituted a body of knowledge that could either be possessed as a whole or used as a source for the learning of particular applications. As Vitruvius had explained in his first book, the Architect had to be in command of many arts and sciences, and Architecture was a profession which could not be attained hastily. The disciple must begin from "childhood and mount step by step the levels of these disciplines, acquiring the

⁷⁷Jurgis Baltrušiaitis Anamorphic Art, p 37.

intelligence of many arts and sciences, if at last, he should arrive at the sovereign temple of Architecture."⁷³ Vitruvius quickly assured the reader that it was not an impossible task to learn and keep in one's memory this vast field of knowledge, because all the different topics were interconnected in the "Encyclopaedia", which made the process of learning easier. Here in Jean Martin's 16th century rendering:

"Mais (a mon advis) il pourra sembler estrange & merveilleux aux gens peu experimentez, qu'un home naturel puisse apprendre & retenir en sa memoire un si grād nombre de doctrines. Toutesfois quand ilz viendront a considerer que tous les artz ont certaine affinité & communication par ensemble, lors pourront facilement croire que cela est faisable & possible, veu mesmement que l'Encyclopaedie (ou doctrine circulaire) est ne plus ne moins comme un corps compose de tous ses membres: & de la vient que ceulx qui sont de leur ieune aage instruictz en sciences diverses, cognoissent plus aisément a l'intelligence des choses."⁷⁴

This holistic view of knowledge, where all parts were connected in a "circular doctrine," appears to have been behind the larger structure of De Caus' works. In themselves, his treatises were bricks which contributed to their respective "wall" in the encyclopaedic construction, and had well defined relations between them. The most important factor that defined their interrelation was the location of the source of truth, whether it was to be found in God, in Nature or in man. In the treatises on music and on solar clocks, Salomon de Caus maintained a division between human and Divine sciences as discussed above in connection to the Euclidean framework. What was regulated from forces outside of the human world, was deemed as Divine and irrational from the point of view of human reason and understanding. Geometry, on the other hand, as revealed by Euclid and other ancient philosophers, was grounded in human reason. It was thus only indirectly linked back to the truth of the Divine creation. A third category of sciences were the ones invented by

۰.

¹³Marc Vitruve Pollio Architecture ou Art de bien bastir, Book III, fol 4: "si n'est que des son enfance il soit allé montant l'un apres l'autre, par les degrez de ces disciplines, acquerant l'intelligence de plusieurs sciences & artz, si bien, qu'il ayt peu parvenir au souverain temple d'Architecture."

⁷⁴Ibid, Book I, Ch. III, fol 4: "But (in my opinion) it could seem strange and marvellous, to people with little experience, that a normal man could learn and keep in his memory such a large number of doctrines. Nevertheless, when they come to consider that all the arts have a certain affinity and communication between each other, they can easily believe that it is feasible and possible; and also seeing that the Encyclopaedia (or the circular doctrine) is neither more nor less than than a body, composed of all its members: and from this follows that those who are instructed in diverse sciences from a young age, recognise from only a few characters the elements of all the doctrines, and through this more easily reach the understanding of things."

man out of necessity, to make possible the construction of tools and the erection of shelter to assist man in his inhabitation of the world; to this category belonged mechanics and hydraulics. Since the two latter sciences were grounded in human invention and reason, they were of a limited and finite nature, and the knowledge contained within them was thus attainable. The opposite was true for what belonged to the spheres of the Divine. In his dedication of *Institution Harmonique* to Queen Anne, Salomon de Caus established this significant structure opening with the following words:

"L'honneur & amour que vostre Maiesté porte à ceste divine science de Musique, ma fait penser, que peut estre auriez aggreable de voir ce mien petit oeuvre, ou sont demonstrées brievement en la premiere partie, les proportions de toutes les consonnantes Musicalles, autant que l'humaine nature nous en peu donner congnoissance, car à dire vray puis que ladite science est recongnue estre divine, ce seroit trop de presomption à nous d'en penser limiter les justes proportions, la Geometrie, Arithmetique & perspective, sont sciences certaines, ou les demonstrations sont tant evidentes, par la raison, comme aussi par le sens, qu'il ny peut avoir aucunes controverses aux demonstrations faites par icelles, aussi se sont sciences inventées par les hommes, pour leurs necessitez, mais ceste science de Musique ne vient d'aucune invention humaine, car chacun sçait, que les consonnantes de la⁄lite Musique, sont naturelles, & non de nostre invention."⁷⁵

Underlying this qualification of music as Divine, and essentially unknowable, were a series of considerations deriving from recent development in music theory as well as a theological concern with the limits of human knowledge. These aspects will be more closely examined in the following chapter entirely devoted to the discussion of *Institution Harmonique*. In Salomon de Caus' publications three different frontispieces were used, which had originally been designed for his first three books on perspective, music and machines (pl.7). It might prove fruitful to look closely at these since they represent the three different sciences that Salomon de Caus classified in the music and solar clock treatises. Even if De Caus saw a hierarchy between these sciences, depending on the nature of truth in each; it is

¹⁵Istitution Harmonique, Dedication: "The respect and love which your Majesty holds toward this Divine science of Music, made me consider that it could be agreeable to see this little work of mine, where, in brief terms, in the first part, the proportions of all musical consonants are demonstrated, as well as human nature could ever know them. For, to tell the truth, since the said science is recognized as divine, it would be presumptuous of us to think of limiting the right proportions. Geometry, Arithmetics and perspective, are exact sciences, where the demonstrations are evident through reason as well as sense, which is also true of the sciences invented by man out of his necessities, but this science of Music springs from no human invention, as everyone knows that the consonants of Music, are natural, and not of our invention."

important to emphasize that he nevertheless considered them all as essential parts of his own practice. Knowledge of them all was necessary in order to successfully make the Divine sensible on earth in *thaumaturgicall* performances. The different spheres of knowledge were inseparable in a complex totality, but ordered in an hierarchical fashion. Since the making of machines was based on the principles of the four elements, thus tied to matter and the lower part of the universe, the mechanical and hydraulic sciences were regarded the lowest. Perspective, depending on the divine implementation of *human* reason was naturally one step higher, but for its intelligibility it still depended on material sensibility. As De Caus says above, music was not dependent on any human or material quality; it was given to man from God, and its principles were never to be completely disclosed by man.

When the three frontispieces are studied with this order in mind a simple interrelating pattern appears. Going from machines, through perspective to music, the viewpoints shift from looking down from above to looking up from below. The reader's vision is already directed towards the "site" of the subsequent studies, the surface of the earth or the spheres of the heavens. Also the patron gods reoccur so that Mercury is present as a mediator between machines and perspective, and Minerva between perpective and music. The succession of the gods thus becomes, starting from below: Vulcan, god of fire and a blacksmith, Mercury, chief messenger and ingenuous trickster, Minerva, patron god of the arts and sciences, and Apollo, the sungod. Being the Divine light and origin of reason Apollo governed the nine muses, together holding the inspiration for an encyclopaedic comprehension of the totality of the world. Salomon de Caus comments on the connection between music and muses in his first definition: "With this word music has earlier, by Pythagoras and Plato, been understood the universal science of the world and its part, and this word could have been drawn from the Muses, or the Muses from it."⁷⁶ Thus Apollo, the sun, in the Renaissance at times read as Christ, the son, shines on earth, descends to fuel the elements of matter, to nourish the fire of Vulcan's forge.

¹⁶Institution harmonique, First Definition: "Ce mot de Musique a esté autrefois entendu par Pythagoras & Platon l'universelle science de monde, & de ses parties, & peut estre ce mot tiré des Muses, ou bien les Muses de luy..."





Fig. 12: Frontispiece to Les Raisons des forces mouvantes.

Fig. 13: Frontispiece to La Perspective avec la raison des ombres et miroirs. (Courtesy of the Canadian Center for Architecture).
PLATE 7



Fig. 13: Frontispiece to La Perspective avec la raison des ombres et miroirs. (Courtesy of the Canadian Center for Architecture).

Fig. 14: Frontispiece to Institution Harmonique.

a contraine : de successione, in taur que tautre cau tont fretchea controntaine : de succession qu'elle ett dedans ; fair bien boae, au hour de quinze iours ou vn Moys findra temetite d'aurre cau cique parter de fachir cau resalle ; qui fersit caufe que ladire machites sucment.



Fig. 15: "A machine that moves on its own." A demonstration of how a seemingly "perpetual" motion can be created by a clever use of the four elements. (From Salomon de Caus *Les Raisons des forces mouvantes*. Book I, Prob. 12).



Fig. 16: The dodecahedron; the geometrical body representing the fifth essence. (From Salomon de Caus *La Perspective avec la raison des ombres et miroirs*, Last page. Courtesy of the Canadian Center for Architecture).



Fig. 17: Demonstration of how to foreshorten a sphere. Points had to be defined in order to geometrically determine the outline of a curved shape. After being transferred to the perspectival plane the points were to be reconnected into the spherical form by the judgement of the eye of the painter. (From Salomon de Caus *La Perspective avec la raison des ombres et miroirs*, Book I, Ch. 18. Courtesy of the Canadian Center for Architecture).



Fig. 18: Figure demonstrating how to determine which surfaces that will be hidden from the "cone" of light in order to paint an extension of a room, including figures. (From Salomon de Caus La Perspective avec la raison des ombres et miroirs, Book II, Ch. 8. Courtesy of the Canadian Center for Architecture).

PLATE 10



Fig. 19: Demonstration of the theorem stating that the visible thing appears as far behind the mirrorplane as it actually is before it. Representing the conditions of representation, the relation between the image and its original. (From Salonton de Caus *La Perspective avec la raison des ombres et miroirs*, Book III, Theoreme I. Courtesy of the Canadian Center for Architecture).

In the "laboratory" for mechanical and hydraulical sciences, Archimedes and Hero of Alexandria are encountered sitting on the floor. Around them are all kinds of tools and inventions spread out, most significant might be the golden crown floating in a basin, giving the reader an alchemical hint. The title is inscribed on a hinged surface, half opened giving a view of the outside world; held open and lit by the inventions of two putti using a spurt of water and a magnifying glass. The four putti play with the four elements; water to hold open the title surface, *air* filling soapbubbles, *earth* allowing flowers to grow if the spade is used well, and *fire* from the sun shining on the title. In the upper centre stands a globe with the planetary movements and the zodiac, reminding the reader of that the earth is the point at the centre of the universe. The only definitions needed for the disclosure of this science were those of the four elements; Fire, Air, Water and Earth. These were the "first principles" which in themselves could not be questioned. In this coherent fourfold unity, fire occupied a double position; one "material" where it was part of the quadruple on equal level with the others, but through its second, "elementary" kind, it also stood above the others as the nourishment of all activity. Fire was what heated up and dried out, it was the absence of it that gave to an element the quality of damp and cold. Salomon de Caus believed, he wrote, that the elemental fire "is the heat of the Sun, since all other fire or heat are subjected to nourishment and perishing, thus the heat coming from the body of the Sun is the only elemental fire...The Sun...is the true natural light."⁷⁷ Second came *air* which also reached high up, it was the medium of spirits, and effected the qualities of water and earth.

"C'est chose assez cogneüe, que tout ce qui a esté cree par la providence divine, est composee & mixtionnee des elemens, comme aussi toutes les fabriques & compositions que l'homme peut effectuer, comme par exemple, le bois & tout autre chose que la terre procrea, sont mixtionees du sec, & de l'humide, & mesmement sont devenus tels, par le moyen du feu & de l'air, car nous savons par l'experience, que la terre ne produiroit aucune chose, si elle n'estoit eschauffee du Soleil, & ce qui poussé hors d'icelle prend accroissance par le

^{TT}Les Raisons des forces mouvantes, Part I, Def I: "Il y a deux especes de feu, l'un eslementaire, lequel n'est subject à corruption, lequel je croy estre la chaleur du Soleil, car tout autre feu ou chaleur est subiet à nourriture, & ce qui est subiet à perir, donques la chaleur procedante du corps du Soleil, est le seul feu eslementaire..."

moyen de l'aer,... "78

This introduction to the first theorem, explaining the interaction of the elements, defined the structure in which De Caus saw the underlying order of the natural world and the sources of its maintenance. The theorem stated that "The parts of the elements mix together, for a while, then each return to its place"; a principle necessary to comprehend in order to make use of the four elements in human inventions. This underlying elemental structure was significant for De Caus. Besides explaining the cyclical transformation of decay and growth in nature, it allowed him to emphasize and justify the dependency of a continuous "nursing" of the material world. Fire and light had to be provided from the sun and ethereal air for "spiritual" as well as "material" growth. God had not only put the world into order, he was continuously watching it and maintaining its function. However marvellous the world could appear and become under the hands of inventive men, God could never be "abandoned"; thanks to Him it continued to work.

The second theorem emphasized this general structure through proving that there is no void that we know of, since "all which is known to man is filled of the four elements." De Caus argues against arguments for the existence of void as well as proposals that there would be air above all the elements, using both "theological" and experimental proofs. "To say that all this vast space would be filled with air; does not at all appear likely. Because the divine providence has made nothing that is useless, and if the said space between the firmament and the element of air would be filled with air it would be useless, because there is no creature which needs air [there]... and in order to avoid any mistakes on this point it is better to say that this vast space is filled with a fifth essence of which we do not know [its nature]."⁷⁹

⁷⁸Ibid, Part I, Theoreme I: "It is a rather well known thing, that all which has been created by the Divine providence, is composed and mixed of the elements, as also all artifacts and compositions that man can make, as for example, wood and all other things that the earth procreates are mixtures of dry and humid and even have become thus through the means of fire and air, because we know from experience that the earth does not produce anything if it were not heated by the sun, and what grows out of it takes the growth from the means of the air,..."

⁷⁹Ibid, Part I, Theoreme II: "Tout ce qui est congneu à l'homme est remply des quatre elements c'est pourquoy il ne peut rien avoir de vuide à nous congneu, & de penser (comme ont voulu dire aucuns) qu'il y a une vacuité au dessus des elemens, c'est une opinion sans preuve ny demonstration, & de dire aussi, que tout ce grand espace est rempli d'air, il n y a nulle apparence, car la divine providence n'a rien fait d'inutile, & si ledit espace entre le firmament & l'eslement de l'air estoit rempli d'air, il seroit inutile, car il n y a aucune creature qui aye à faire d'air au dessus de la moyenne region, & pour ne point errer en ceste opinion, il vaudra mieux dire que ce grand espace est rempli d'une cinqiesme essence à nous incongneue."

The crucial point for De Caus was to keep all that is below the firmament - that is, within the natural world - within a closed system with only transformative interaction. To allow void or vacuum to enter the natural world would challenge the principle stating that God was the only source of the truly unknown, the one who controlled real change in the substantial structure of the world. Void on earth would leave room for unpredictable chance, and thereby question the possibility of attaining truth in all sciences of the natural world. After having established these fundamental applications of the four elements, the rest of the eighteen theorems provided the reader with the basic principles of hydraulic and mechanical forces.

"Il y a eu plusieurs hommes lesquels se sont travaillez à la recherche d'un mouvement qu'ils ont appellé (sans le congnoistre) perpetuel, ou sans fin, chose assez mal consideree & mal entendue, d'autant que tout ce qui a commencement, est subiect à avoir une fin, & faut appliquer ce mot de perpetuel ou sans fin à Dieu seul, lequel comme il n'a eu commencement, ne pourra aussi avoir fin, tellement que ceste follie & orgueil aux hommes, de se vouloir faire acroire de faire des ouvres perpetuelles, veu que eux mesmes sont mortels, & subiets à une fin, ainsy seront toutes leurs ouvres, tellement que je laisseray ces mots de perpetuel ou sans fin, & monstreray icy la fabrique d'une machine qui s'agist de soy-mesme, pourveu qu'elle soit entretenue des quatre eslements dont elle est composee."⁸⁰

The question of the possibility of constructing a perpetual motion brings De Caus back to the initial two theorems. The argument he gives against it is in its essence theological. Man, mortal and corruptible, cannot create anything which would work forever out of the four corruptible elements alone. Nevertheless, De Caus demonstrates how to make a machine which actually moves on its own, but he makes a point of emphasizing its dependance on maintenance to function properly. The machine makes use of all four elements to function as an instrument to measure the outdoor temperature, but the water has to be changed every fortnight (fig.15). This simple little machine works as a metaphorical demonstration of the overall theological argument. In using the cooperative action between the four elements an

¹⁰Ibid, Part I, Prob. XII: "There are many men who have worked on the search for a movement which they have called (without knowing [its nature]) perpetual, or with no end. A thing quite badly thought through and understood; since all that has a beginning is subjected to have an end, and one can only apply this word perpetual or with no end to God, who since he has no beginning cannot have an end. So that this folly and orgie of men, to make themselves grow from making perpetual works, seeing that they are themselves mortal and subjected to an end, so will all their works be; so I leave here these words perpetual or with no end, and show the making of a machine that acts on its own, provided that the four elements of which it is composed are entertained."

autonomous motion is created that might appear to be perpetual to the casual observer. After having more thoroughly considered the machine, it would appear as evident to anyone that the motion is not at all perpetual; it depends on maintenance to continue working. The maintenance has to come from outside the system; a fuelling force must be present. This view of the humble role of the artificer as an assistant to nature, only bringing forth what already is, relates to old alchemical wisdom:

"Neither art nor the alchemist can produce gold but only nature prepared and assisted by the alchemist and by art, just as health cannot be restored to ailing body either by drugs or by doctors but by nature prepared and assisted by doctors and by drugs...the alchemist first purifies a substance...and then lets nature follow its course. Therefore it is clear that art alone cannot transmute metal but that nature is at least as instrumental as art."⁸¹

As much as the true alchemist should never compare his creative powers with God's; the engineer instructed by De Caus should never believe himself to be in a position independent of God. The example of the perpetual machine which De Caus used as a vehicle for the understanding of this crucial argument has a double nature. The automata and anamorphoses were above noted to operate as instruments for the obtaining both of knowledge and of faith. They were both "filters" to see through and "mirrors" in which to regard the reflection as God himself would see man. Similarly, this machine was both a model of the world where man could see himself as the creator nourishing the transformative process and a vehicle for man to understand his and the natural world's ultimate dependency on God's benevolence and nourishing force. Salomon de Caus saw this as an essential lesson to include in his teachings on the understanding and use of the underlying principles of the material world. The mystery of this science was located behind its first four principles. If these were accepted, as they should be, the rest of the science would be fully comprehensible and its knowledge obtainable. As the frontispiece seems to tell the reader: - Look down on the earth through the workings of the elements and employ them to make marvellous and useful machines, but do not forget that as you are without the machine, so God must be without you. The sun shines from the upper right.

⁴Benedict Varchi Questione sull'alchimia, quoted in Paolo Rossi Francis Bacon - From Magic to Science, p 20.

The entry into the perspective practice is performed through the theatrical scene, inviting the reader to learn the means by which the appearance of reality could be represented. Between Minerva and Mercury are the five solid bodies, taken from Plato's Timaeus to signify the four elements and the fifth essence, the cosmos. Flanking the title are two satyrs, a male and a female. On top sit four putti. As in Les Raisons two of them use the practice of the book to light up the title through the means of a torch and a mirror. They are each holding tools, one of drafting and painting and the other optical instruments such as mirrors and glasses. Centered here is the dodecahedron, the "fifth construction, which the god used for embroidering the constellations on the whole heaven".⁸² The frontispiece conveys the essential aspects of the art which the reader is going to be taught. The presence of the four elements anchors the practice in the natural world, but instead of being represented in their natural appearance, as they were in the frontispiece of *Les Raisons*, it is their ideal Platonic form that is displayed. Rather than employing the *effects* of the four elements, the science of perspective utilizes their ideal nature as comprehended by human reason in geometry. The figure of the fifth essence, the dodecahedron, appears twice, as a solid among the four elements centered below; and as a spatial structure alone, centered above the title. One possible interpretation of the double appearance of the dodecahedron, could be that De Caus implied the connection between the geometry of human reason, implanted in the mind by God, and the order of the cosmos, which in its essence was the Divine mens.

The principal allusion to the theatrical scene is significant. It indicates De Caus' awareness of the illusionary and deceptive aspect of the perspective practice, and it also puts scene-painting, one of the important applications of the art, in focus. In the text he never mentions the actual practice of perspective in the theatre, but the allusion returns with the anamorphic man, discussed above, who holds a mask and a spade. Perspective as scene-painting and as architectural drawing were two distinctly different applications of the art. While the first was concerned with achieving an external effect through the resulting image, the latter, as was discussed above, aimed at externalising a mental idea in order to better understand the effect of the idea on the world. The first aimed at direct experiential impact;

¹²Plato Timaeus, p 78.

the latter was a vehicle for the mind.⁸³ The meaning of the Vitruvian term *Scenographia* had since Barbaro's commentary in 1556 been interpreted literally as primarily scene-painting, not necessarily implying its use in architectural drawing.⁸⁴ Apart from the initial definition of scenography, as one of the three "ideas" necessary to render a building good *eurythmie*, De Caus only refers to Vitruvius' discussion of it in relation to the painting of scenes on walls, and not to its use in the theatre.⁸⁵

In the text De Caus distinguished the use of perspective as an instrument for architecture, gardening and fortification from its use in painting. While for the former, perspective was the means by which the design was viewed as it would appear before its actual construction, for the painter it was the tool by which he could achieve the closest imitation of nature "as it appeared to the sight."⁸⁶ Both had to apply the same method which was deduced from a theory of vision, allowing points in space to be defined from the principles of Euclidean geometry and transferred to the two-dimensional plane. This method is what was taught in the first book of La Perspective. The result of the perspectival operation was a figure constituted by the lines drawn between the geometrically defined points (fig.17). This mere "outline" of the object was enough for the architect whose only interest was to make visible his "idea" of the design. For the painter, however, it was necessary to understand the effects of light and of colour if he was to live up to his task; to render as clear as possible a reflection of nature. For their sake De Caus included a book on shadows providing the painter with rules for their construction, but when it came to the application of colour, he admitted that no demonstration could be made.⁸⁷ The third book on mirrors was not justified as being useful for either of the two applications of the art. De Caus simply stated that it was something that had seldom been treated, and that, given time, he would have augmented this section.⁸⁸ The mirror was to play an important role in the

⁸³Werner Oechslin Between Painting and Architecture, Daidalos 14, p 26.

^MIbid, p 21, and Alberto Pérez-Gómez and Louise Pelletier Architectural Representation beyond Perspectivism, Perpecta 27, p 28.

¹⁵Marc Vitruve Pollio Architecture ou Art de bien bastir, Book VII, Ch. V, fol. 105.

⁸⁶La Perspective avec la raison des ombres et miroirs. To the Reader.

⁸⁷Ibid, Book I, Ch. XXV.

¹⁰Ibid, Dedication.

treatises on anamorphic representations that appeared just after De Caus' later in the 17th century.⁸⁹

"Comme toutes choses visibles prennent leurs origine de l'oeil aussi est il le centre de ce qu'on void."⁹⁰

The structure of the first book of *La Perspective* is essentially the same as that of *Les Raisons* with the difference that the "problems" here are named "chapters." There are eleven definitions setting out the first principles of the science as well as naming the necessary lines and drawings - the thought-models required for the geometrical operation. The first three definitions established the relation between the eye and the thing imagined in terms of "visual rays" going from the thing to the eye. Essential with this relation is that the lines are straight and terminate in one point which is the eye, from which, as quoted above, "all visible things have their origin". The eyes were considered in *Timaeus* to be "organs for the soul's forethought...that give us light." Through the eyes flows a stream of internal fire that meets with the fire of daylight to "penetrate right through the body and produce in the soul a sensation called sight."⁹¹ Sight was also the sense most closely connected to intellect and reason, the fire that dwelled within man: "the cause and purpose of god's invention and gift to us of sight was that we should see the revolutions of intelligence in the heavens and use their untroubled course to guide the troubled revolutions in our own understanding."⁹² Seeing was then the primary sense, forming the basis for the operations of human reason.

Having established the existence of the eye as the center of sight, and entrance to reason; and the visible thing as the material object which can be either *straight* or *curved*; and the invisible lines running straight between them, the rest of the art depended solely on geometry. The remaining eight definitions are concerned with naming the vehicles necessary to perform the operations according to the particular method taught in this book. The last definition establishes that De Caus saw the Vitruvian concept of Scenography as the actual

⁸⁹Jurgis Baltrušaitis Anamorphic Art, p 2. I am referring to Jean-François Niceron's Curious Perspective (1636) and Fr. Du Breuil's La Perspective pratique (1649).

⁹⁰La Perspective avec la raison des ombres et miroirs, Book I, Def. I: "As all visible things have their origin in the eye, the eye is also the centre of what one sees."

⁹¹Ibid, p 62.

⁹²Ibid, p 65.

foreshortening of the visible thing, the perspectival image. The first book takes the method of the pictorial recreation of the visible world, constituted by the geometrical rules inherent in human reason to its extreme limits. Reason determined the way the world was seen, and perspective was not yet an instrument by which to put man in command of nature; rather it was a tool for "Narcissistic" self-reflection aiming at the representation of the *appearance* of the world and never of the world as it *was*. The first book ends with the practice of anamorphosis; a method of representation which put human perception in focus and emphasized the distinction between what *is* and what *appears*. The second book deals with the representation of shadows; the obscure regions hidden to the light of reason.

The method of shadow projection was not at all as systematized as the science of perspective. In his essay The Perspective of Shadows⁹³, Thomas DaCosta Kaufmann gives an account of its development from the Renaissance to the final mathematization of Desargues in the 17th century. Its use was primarily for painters; Leonardo da Vinci paid extensive attention to the question even if he never conveyed his systematization as a method useful for other painters.⁹⁴ The science of shadow projection was primarily developed in the field of astronomy and of use for the construction of sundials; a science which De Caus was to disclose twelve years after his perspective treatise in La Pratique et demonstration des horloges solaires. In the address to the reader of this work, De Caus explained his undertaking as primarily to demonstrate the proportions of shadows, inspired by Vitruvius' ninth book, which De Caus claimed to have reached in his diligent work on the translation of the ten books⁹⁵. While the construction of sundials required an exact knowledge of the outline of the shadows cast by the sun, the representation of them on a pictorial plane required that they be put under the laws of perspective. As Kaufmann points out, it took a long time before any serious attempt was made to combine these two aspects in an exact method of shadow projection. Kaufmann sees one of the causes of this in the focusing of the science of *Perspectiva artificialis* on the relation between the eye and the object, a heritage

⁹³In Thomas DaCosta Kaufmann The Mastery of Nature, pp 49-78.

⁹⁴Ibid, p 62.

⁹⁸Unfortunately De Caus' manuscript, if he had indeed come so far in his translation, seems to be lost. What exists is a translation of Vitruvius first book, with commentaries by De Caus in the form of a dialogue between an Architect, an Engineer and a Mathematician. (C.S. Maks Salomon de Caus, pp 105-7).

from its origin in the science of optics. The intrusion of a third point in this dualistic relationship, the sun as the source of light, meant a serious disturbance to the method.⁹⁶ The object had been considered a given; itself being the source of light which met with the "internal fire" of sight. What created the most difficulty anyhow, was the difference between the spreading of daylight and torchlight. While the light from a candle was observed to spread radially, and could be compared to the cone of vision; the light from the sun appeared to spread with parallel rays, something which was observed in practice but generally not accounted for in theory.

De Caus' second book of *La Perspective*, *Des Ombres*, opens with a long praise of the sun as "the one light which illuminates the whole world." In this context this appears as a conscious reminder that even if marvellous things could be made through the reason based in the "internal fire" of sight; the true origin of all reason was the sun. Only the sun was neither subjected to alteration nor adumbration, which De Caus emphasized in explaining the causes behind a solar eclipse. He was aware that his method of shadow projections was not as exact and mathematical as that the representation of the geometrical outline of the visible object. However, since the source of the shadow was the sun, whose light was a gift of God and the visible sign of Divine reason; the science of shadows was, as the other Divine sciences, not intended to be entirely known to man. The method De Caus advised the painters to follow, was to choose one point of light, the selection of which was up to the judgement of the painter, rather than postulated according to any necessary reason. From the point of light the painter should construct a cone and see what would be hidden behind its rays and cast in shade (fig.18). De Caus saw each window in a room as a separate point of light, and he also said that there was a method by which they could all be considered in the same picture; nevertheless he admitted "that it could not be made without great difficulty, which I would prefer to avoid."97 What De Caus did not account for was that the light from the sun did not spread radially from a point but with parallel rays. After having determined the areas of light and shadow the painter was instructed to follow the method of perspective demonstrated in the first book. When it came to shadow projection the first stroke had to be

61

[%]Thomas DaCosta Kaufmann The Mastery of Nature, p 55.

⁹⁷La Perspective avec la raison des ombres et miroirs, Book II, Introduction.

guided by inspiration, rather than reason, the source of which was not human but Divine.

"tout ce qui est imité de la nature avec la raison ne peut estre autre [que excellent]"98

The last book of *La Perspective* is on mirrors or "Of things that appear in flat mirrors and the reason behind such apparitions." Unfortunately it seems largely unfinished, including only six theorems and no demonstrations. De Caus mentioned that he had more figures in mind which he had no time to include. Whether he implied here demonstrations of the more advanced form of anamorphic projections which were made with mirrors remains unknown. Nevertheless the inclusion in the book and in the title of mirrors is significant in itself. As I have discussed above in relation to the Narcissus myth, reflection was an important concept for the understanding of the representational act. In the theorems, De Caus used the analogy of a "pane of glass" being the mirror, and in the imagination the reflected thing would be behind the glass, as much as it in reality was in front. This analogy is identical to that used in the first book to explain what the pictureplane was, which was demonstrated through literal devices such as Dürer's perspective machine, referred to by De Caus.⁹⁹ The difference between the perspectival representation of a visible object and an object's reflection in a mirror was that while the visible thing in perspectival representation actually existed behind the imagined pane of glass; the image appearing in the mirror could only be of an object thought to be behind it, while actually not existing at all, an effigy. The demonstration of how to construct an image representing both a visible object and the object's reflection in the mirror provided the reader with an external viewpoint to the representative act similar to that of the figure of Narcissus gazing at his reflection in the water. The recreational act in itself was opened up for critical contemplation. As the reflection in the mirror was dependent on the object having been put before it by an *external* force, the man-made image of reality had only a situational recreative power. A painting which imitated nature would be excellent if made according to reason; but the act of imitation in itself required Divine inspiration, an exterior force breaking the straight line of the "dialogue" established between the eye and the visible world. A clarification of the indirect dependency upon the divine was given to the

⁹⁸Ibid, Book II, Ch. 9: "all what is imitated from nature cannot be other [than excellent]." ⁹⁷Ibid, part I, Theoreme X.

reader in this last book of *La Perspective avec la raison des ombres et miroirs*, in which he could see both the object and its effigy outside of himself.

Entering the world of the true divine science of music, the eye is immediately drawn upwards to the shining sum on which COELO MUSA BEAT is written. There, in heaven, the "blessed" muses are demonstrating their individual fields of arts and sciences. The title below is flanked by columns ornamented with instruments and significant elements pertaining to Apollo and Minerva standing in front of them. Lastly the eye reaches Pythagoras, sitting by a table oblivious of his surroundings and listening for harmonies on his monochord, prepared to measure and take note. Acknowledging that De Caus was essentially critical of the kind of music that Pythagoras stood for, since it refused the senses as a source of judgement and basing all consonances and intervals in numbers,¹⁰⁰ his appearance on the frontispiece seems a little surprising. However, the Pythagorean principles, originating from human reason, could not be discarded in the application of the Divine science on earth, and the presence of reason and number in the lower part of the picture was an important counterpoint to the heavenly muses above. The combination of sense and reason was essential for the practice of all the sciences De Caus treated, but the emphasis had to be shifted away from human reason to heavenly inspiration as the science of music approached God. While reason based on experiential data had to be strictly employed in the construction of machines, with only a hint of its dependence on the sun; and reason was the foundational principle for a good imitation in making perspectives, and senses only the additional judge; music depended throughout on divine inspiration. Without the divine spark the music performed on earth would not achieve any of its desired effects, it would fail to echo the heavenly spheres.

¹⁰⁰Institution harmonique, Part I,p 1. This will be extensively discussed in the next chapter. According to De Caus' account of the "Origins of music", the musicians stemming from Pythagoras theory were called "canonical". After him came Aristoxenes who on the contrary wanted the ear to be the sole judge, giving rise to musicians called "harmonic". After these two came Ptolemy who followed the established canonical harmonies, but allowed adaptions where it was needed to please the hearing sense.

The sequence of frontispieces leads us into essential aspects of Salomon de Caus' philosophy, in each work as well their structure as a whole. His hierarchical ordering of the sciences is clarified as a quite intricate consideration on the relations between God and man. the human senses and reason and moreover the relations of these sciences to man; that they were all intended for the practice and experience of man. A frontispiece was designed to be the entry into a body of text and as such it was meant to reflect the totality the work in a single image. It was essential for De Caus to capture the principal question on an immediate level and place man, the reader, in relation to the science disclosed. In Les Raisons des forces mouvantes the reader found himself looking at the sunlit world through the frame of the four elements personified by the putti. In La Perspective avec la raison des ombres et miroirs the reader was invited to enter onto the stage and by means of the order of geometry learn the art of representation, having the natural world as his model and the eye as judge. In Institution Harmonique the reader was at last invited to admire and faithfully worship the original force behind the heavenly music, and to open nimself up for the inspiration of the muses so that, with the help of reason, a glimpse of what the inspired ear could hear would reach down to earth.

Before entering the more thorough reading of De Caus' theory of music that the next chapter will provide, this chapter has now presented De Caus' encyclopaedic project as a whole. In the work of De Caus has been observed his concerns with conveying knowledge through a comprehensible framework, and his view of this framework as an earthly reflection of the Divine order, in accordance with the contemporary understanding of human reason as a reflection of the Divine mind. De Caus put a strong emphasis on human experience. Both his treatises and the projects that they taught one to realize, were constructed so as to make a most lasting impression on the human soul. The universal science of De Caus taught the principles of *appearance*, utilizing the immutable principles of nature, the nature of human perception and the eternal provider of light and movement, God. In this he was a true *archemaster*. Through bringing truth *to actuall experience sensible*, as John Dee put it in his *Mathematicall Praeface¹⁰¹*, De Caus himself acted as God's instrument, on a mission to prepare the world for the rise of the New Jerusalem. It was the duty of man to polish the

¹⁰¹John Dee The Mathematicall Praeface, section on Archemastrie.

mirror of God so that His reflection in it would be as accurate as it could ever be. In honour of God, man should strive for becoming as much like him as he could.¹⁰² Salomon de Caus' works; the treatises, automata, perspectives and the music performed with his instruments; were all essentially instruments of learning. They helped man to see, from the "backside of the mirror", more clearly the ultimate goal which he knew he was never to reach.



1

3. DIVINE HARMONY - MUSIC AND THE SPHERES Institution Harmonique

Music held the highest position among the sciences treated by Salomon de Caus due to its traditional correspondence with the harmony of the heavenly spheres, and the medium in which it opened itself to the senses, air. Anything brought to man through air was believed to be very effective on the human soul, since air also was the medium of the spirits. In *Timaeus* both the elemental, visible, world and the invisible world soul were structured according to geometrical proportions which also were the basis for the musical consonances discovered by Pythagoras. The soul was the structure in which the visible world moved, an invisible outline "woven right through the center to the outermost heavens, which it enveloped from the outside and, revolving on itself provided a divine source of unending and rational life for all time."¹

The structural analogy between the human body and soul, the microcosm; and the material world and its soul, the macrocosm; gave music the role as spiritual messenger from the celestial sphere. Music was believed to have the power of both affecting the individual soul and attracting benign influences from the stars, thus operating as a kind of magic through sympathetic attraction.² In the third book of his *Book of Life* Ficino discusses the magical power of astral music and emphasizes that "we are [not] talking here about adoring the stars, but rather about imitating them, and seizing them by imitation...we fit ourselves to the open light and heat of the Sun. To fit oneself to his occult and wonderful gifts is the duty of a wise man."³ The underlying principle was that since like attracts like, man would, by imitating the stars, move closer to his native star and make the stars shine brighter down on earth. Music was the "spiritual outline" which permeated the whole cosmos, being the soul through the human senses. Human music was experienced as a reenactment of the Divine creation.

¹Plato Timaeus, p 50.

²Vaughan Hart Art and magic in the Court of the Stuarts, p 138. ³Marsilio Ficino The Book of Life, p 160.

This correspondence between musical and heavenly harmony fitted very well into the overall Renaissance view of the structure of the world. The musical proportions of the consonances were all composed from the four elemental numbers, constituting also the material world, the elements of geometry⁴ and the four humours of the body (pl.11). The balancing of these, bodily as well as physical elements of the world was a question of well-being, health and essentially of establishing harmony as a link to the celestial spheres. According to Vitruvius the first principle to observe when founding a city was the "choice of a healthy site. Such a site will be high, neither misty nor frosty, and in a climate neither hot nor cold, but temperate."⁵ Vitruvius further explains the importance of having a balanced climate harmonious with the specific mixture of elemental qualities suitable for man:

"For while all bodies are composed of the four elements....of heat, moisture, the earthy, and air, yet there are mixtures according to natural temperament which make up the natures of all the different animals of the world, each after its kind."⁶

Vitruvius describes a dynamic concept of material harmony, where the number of components is fixed, the total sum is always the same but the internal relations change. Through choosing the right site for his city, the architect could moderate these fluctuations and provide for man the basis of a physical harmony; the first requisite for a good and virtuous life. Harmony was thus, for Vitruvius as well as for the Renaissance man, a quality that should permeate all artificial creations, all human assemblages; whether they be of material pieces, geometrical lines or musical sounds. Of these, music was regarded the most powerful medium. Human music had the most potential to closely imitate the harmony of the world soul, and was regarded a Divine gift. Whereas the other arts originated from human necessity, the very purpose of music was to elevate the human soul to the heavenly spheres.

This chapter will examine Salomon de Caus' treatise on musical theory and practice; Institution Harmonique published in the same year as Les Raisons des forces mouvantes,

⁴Carl Dahlhaus On the Historicity of a Metaphysical Principle, p 18. In Plato's Timaeus the need for four constitutive elements is explained through the need for two middle terms in order to create proportion in solids (p 44). The four geometrical elements are point, line, plane and solid; see also George L. Hersey Pythagorean Palaces, p 19.

⁵Vitruvius The Ten books on Architecture, Book I, Ch. IV, p 17.

^{&#}x27;Ibid, Book I, Ch. IV, p 18.

1615. The treatise will be considered specifically in its relation to 16th century musical theory of Gioseffo Zarlino and the humanist movement. Two representational aspects of music are emphasized; first its relation to the harmonic proportions of the universe, the *harmonia mundi*; then its capacity to directly present certain characters or *ethos*, which gave music an important role as an influence on moral virtue. Finally the function of music as a mediator between man and cosmos, or God, will be considered in the light of the wider implication of the notions of instrument and organ, as necessary vehicles through which to seek understanding of the world.

Institution harmonique and the Music Theory of the 16th century The Pythagorean outline and the "aural correction" of human proportions

The Pythagorean musical model, where all consonances⁷ were generated from the four elemental numbers, proved less and less tenable when confronted with practical experience in the 15th century. Music as a mathematical science had in the Middle Ages been studied in the universities, separate from musical practice. It was one of the exact sciences in the *Quadrivium* alongside Arithmetic, Geometry and Astronomy. In the Renaissance the musical humanists sought to recover the music of the Ancients, i.e. the Greeks. They saw in Pythagorean philosophy a much closer union between musical theory and practice which they sought to revive. For the Pythagorean follower the study of nature through geometrical and arithmetical proportions was equally important as the elevation of the soul through singing songs accompanied by the lyre as means to live a virtuous life. Pontus de Tyard describes Pythagoreas in his *Solitaire Second* from 1552:

"...Pythagore est nommé le premier, qui est avec la plus belle diligence qu'on pourroit imaginer, recherchoit en toutes choses, autant que leur matiere le permettoit, la purité simple et la stable eternité. Pythagore...n'eut autre chose en plus affectueuse recommandation que d'arracher l'inconstance et la fortune des oeuvres de nature, des actions, contemplations, et mesme de la vie des hommes, pour leur assigner un ordre certain, et un fondement non fortuit ou à

⁷The harmonious intervals of the musical scale constitute the musical consonances. Salomon de Caus defined the term in Institution Harmonique, Part I, Def. VI: "Consonnante est dite ainsi, quand deux differens sons, savoir l'un grave, & l'autre aigu, se meslent en l'air par quelque bonne proportion ensemble, & raportent à l'ouye une douce confusion l'un avec l'autre."

l'adventure, mais ferme en un certaine et constante raison, dont entre autre choses tascha de monstrer que le jugement des consonances des voix ne devoit estre mis en l'arbitre des oreilles, desquelles le sentiment (ainsi que des autres sens) est peu asseuré, ains aisé à decevoir. Mais plustost appartenoit à l'entendement duquel les discours aquierent, par la raison, une certitude asseurée. "⁸

Pythagoras was thus a model in the Renaissance for both the humanists, in his seeking a rational order behind the phenomena of the experienced world and a virtuous life of ascetic moderation; and the neoplatonists, in his emphasis on the soul's ascent to its divine origin. It was in this character that musical theory and practice were seen as joined. The aim of Pythagoras' study of nature was to find, through the search for eternal truths, the means by which to designate a way of life which would ultimately relieve the soul from its mortal body. The aim with the theoretical aspect of Pythagoras' philosophy, as Tyard and other humanists understood it, was moral action. It is then slightly ironic that, when the story of Pythagoras' discovery of harmonic proportions were subjected to experiments by Vincenzo Galileo in the latter part of the 16th century, they were proven to be quite mistaken.⁹ In practice this had been known for a long time and adjusted for by the instrument makers and musicians, without having any effect on the musical science of harmonic proportions.

The marriage of musical theory and practice had interesting implications for the 16th and 17th century debates on the theory of representation in music. The main question was what the harmonic proportions and the musical scale could be seen to really reflect. On one level the unification of theory and practice was a straight consequence of the humanist agenda to regain classical virtues.¹⁰ However, probably of equal importance was the contemporary

⁸Pontus de Tyard Solitaire Second, p 115-6: "Pythagoras is told to be the first, who with the most pretty and curious diligence one could imagine, searched in everything, as far as their matter permitted, for the simple purity and stable eternity. Pythagoras...[extracted] the inconstancy and fortune of the works of nature, the actions, contemplations, and even of the life of men; in order to give them a specific order and a foundation not [subjected to] fortune or adventure, but firm with a certain and constant reason; where, among other things, he attempted to demonstrate that the judgement of the consonances of the voice do not have to be put under judgement of the ears, of which the sentiment (as also with other senses) is very little assured and thus easy to deceive."

⁹Claude V. Palisca Humanism in Italian Renaissance Musical Thought, pp 275-76. What V. Galileo proved incorrect was the assumption that the proportion of 2:1, that is of Diapason, was universally valid. He demonstrated that it was only valid for strings, but not for weights or volumes.

¹⁰Claude V. Palisca Scientific Empirism in Musical Thought, p 92. In this essay Palisca discusses the transformation from a mathematically based music theory, with metaphysical implications, to one essentially considered as based in the laws of physics where the qualitative distinction between consonance and dissonance

transformation of musical practice, specifically the development of polyphony. The practising composers who focused on the more complex harmonic structure of counterpoint rather than the Gregorian tradition of *plain chant* melodies demanded a firmer theoretical foundation. In polyphonic compositions the consonances were represented not only through the temporal interrelation of the tones of the melody, but also in the simultaneously sounding chords. A new and richer field of harmonic representation was opened up which demanded more exact definitions of the consonances in use on one hand, and on the other of their contrasting counterpart, the dissonances. These were now consciously integrated with the compositions in order to make the harmonic outline appear more clearly to the senses; but for this the practicioner needed a well defined field of action.¹¹ Salomon de Caus explains the reasons behind this practice as follows:

"Il n'y a pas fort long temps que nous avons commencé à user de secondes, septiesmes, neufiesmes, & quatorziesmes, en nos Compositions, à cause que comme elles sont Dissonantes, elles avoient esté estimées inutiles au dites Compositions, & mesmement defendues. Mais nous avons recogneu, que encores que lesdites Dissonantes ne peuvent rendre aucuns bons effects d'eux mesmes, sy est ce qu'estans meslées ensemble à propos, comme sera enseigné, ils font sembler les Consonnantes qui les suivent tresharmonieuses. Ce qui se fait par ceste raison, d'autant que nos sentiments sont de telle nature, qu'ils ne peuvent biensentir un bon effect, qu'il ne soit opposé à son contraire. Le blanc semblera encores plus blanc, s'il l'on aproche du noir aupres...Aussy pour faire trouver les consonnantes tresagreables à l'ouye, il sera besoing un peu auparavant de mesler quelque dissonante à propos, & peu à peu la faire perdre pour venir à tomber sur l'accord desiré."

While the theory behind the use of dissonances appealed to the rules guiding sensual experience, rather than the intellectual perfection of cosmic harmony as represented in purely harmonious music, the definitions of harmonious consonances were still sought in

was no longer visible other than as degrees on a scale of measurable frequencies.

¹¹Claude V. Palisca Humanism in Italian Renaissance Musical Thought, p 20.

¹²Institution harmonique, Part II, Ch.IV: "It is not long since we began to use seconds, sevenths. . in our Compositions. The reason for this is that as they are Dissonances, they had been judged as useless in the Compositions and even prohibited. But we have recognized that even if those Dissonances cannot give any good effects in themselves, they can be mixed together, as will be taught later, and make the consonances that follow appear very harmonious. Which is explained by the reason that our senses are of such a nature that they cannot well perceive a good effect if it isn't opposed to its contrary. The white seems more white if one approaches it with black afterwards...Likewise, to find the consonances very agreeable to the ear, one must mix in some dissonance before it, and little by little let it go to reach the desired accord."

mathematical proportions. In order to "deviate" cleverly and maximize the enhancement of the harmonious outline, the composer needed a well defined field of action. First of all the consonances in use could not be correctly defined using only the four Pythagorean numbers, the Tetrachord. A model which attempted to solve this was the Hexachord. All consonances were claimed by Gioseffo Zarlino to be possible to define by the six first numbers. Zarlino illustrated this "new" model, the *senario*, with a diagram in his *Istitutioni Harmoniche* of 1558.¹³ It shows a circle with the six numbers on its outline and the proportions designated by a pattern of semicircles connecting all numbers with each other (fig.22). This figure was an image of the sphere of consonances in which the musician could operate safely, knowing that the dissonances he wished to use would all have to be consciously selected from outside.¹⁴

Zarlino's model of the *senario* was an attempt to save the principle of the old Pythagorean structure. While the abandonment of the elemental number four as the basis for the sphere of consonances could be expected to have large metaphysical consequences, Zarlino argued in his *Istitutioni* that also the number six had its sacred qualities and was an important foundational number.¹⁵ The number six represented for Zarlino: the visible signs of the Zodiac, the errant bodies in the sky, the substantial qualities of the elements, the circumstances necessary for existence, the species of movement, the number of spatial directions according to Plato, the types of musical intervals and the two species of modern musical modes. Moreover six was the first perfect number $(1+2+3=6 \text{ and } 1\times 2\times 3=6)$.¹⁶ Gioseffo Zarlino was one of the last musical theorists who was seriously influenced by Pythagorean and Neoplatonist thought and his *Le Istitutioni Harmoniche* appears to have been a very important role in verifying the truth of the harmonic proportions; but it was nevertheless *reason* which sought and defined the rules behind the art of music.¹⁷ His

¹³Claude V. Palisca Humanism in Italian Renaissance Musical Thought, p 23. Gioseffo Zarlin Le Istitutioni Harmoniche, Ch. 15, p 25.

¹⁴Claude V. Palisca Scientific Empirism in Musical Thought, p 103.

¹⁵Ibid, p 102.

¹⁶Claude V. Palisca Humanism in Italian Renaissance Musical Thought, p 247. ¹⁷Ibid, p 244.

principle was one of balance between reason and sense, but he asked the reader not to forget that the senses were fallible:

"But those who believe that the senses cannot err are really very far from the truth, for although it is true that every science has had its beginning in the senses, nevertheless it is not through them that science has aquired its name, and it is not through them that it is gained the certainty sought in science, but rather it is through reasoning and through demonstrations made by way of the internal senses, that is through the work of the intellect, which is reasoning... In order to have perfect knowledge concerning music, it does not suffice to appeal to the sense of hearing, even if it is most keen, but rather one should seek to investigate and know the whole, so that reason is not discordant with sense, nor sense with reason; and then everything will be well."¹⁸

Even if Salomon de Caus probably agreed on the need for a mutual dependence on sense and reason for finding and describing musical proportions, he tended to emphasize the role of sensuous experience more firmly and also, as will be shown, provided an explanation as to why sense and reason do not actually always concur in musical theory. De Caus also differed from Zarlino in his relation to the ancients. Zarlino's treatise contained long passages reciting ancient authorities without having any direct significance for the argument of modern practice. Salomon de Caus observes this, finding it curious and quite unnecessary. It is especially the attempts to recover the ancient musical scales (chromatic and enharmonic) in detail which De Caus deems strange since those scales are impractical and useless for modern practice. He agrees that it could be of some interest to know more about them, but advises his student to consider that his life is short and that he should concentrate on working with the true proportions instead; moreover he asked his student to believe only in those stories about ancient practice of which he could verify the truth himself.¹⁹

In the field of music theory the Renaissance was a time of debate and confusion, where the fusion of theory and practice eventually resulted in the breakdown of its traditional metaphysical foundations as experience proved the Pythagorean system untenable. Lodovico Fogliano challenged the supremacy of mathematical reason as early as 1529 when he redefined consonances and dissonances on the basis of what was sensed, rather than absolute

¹⁸Gioseffo Zarlino On the Modes - Part Four of Le Istitutioni Harmonichi, p 105-6. ¹⁹Salomon de Caus Institution Harmonique, Part I, Prop. XXXXIIII.

numerical proportions;²⁰ a definition which De Caus would later acknowledge (see fn. 7). Another challenge to tradition was based in empirical natural philosophy, explaining sounds as a physical property where there was no true difference between consonances and dissonances. This latter opinion is ascribed to, among others, Vincenzo Galileo, who argued with Zarlino on this matter, Marin Mersenne, who also entered into a discussion with Descartes, and Francis Bacon, who wrote on the subject in his *Sylva Sylvarum* (1627).²¹ The argument thus spans between the supreme primacy of reason and the complete submission to direct experience involving no judgement. As shown above, Zarlino placed himself in the middle between the two extremes, even if he favoured reason above the senses as a guide to truth. Descartes put his finger on the problematic point in a letter to Mersenne in 1629:

"As for your manner of determining the goodness of consonances,... it is too subtle, if I dare say, to be distinguished by the ear, without which it is impossible to judge the goodness of any consonance, and if we judge by reason, this reason must always consider the capacity of the ear."²²

These arguments had their origin in the classical distinction between the Pythagorean, the Aristoxenian and the Ptolemean musical scales. Salomon de Caus qualifies these distinctions in the following manner: While the Pythagorean, "canonic" musicians "were sure that the consonances and intervals had their origin in numbers, and refused to judge [them]...with the hearing sense, since that was regadred an uncertain and doubtful sense", the Aristoxenian, "harmonic" musicians "on the contrary wanted the hearing sense to be the arbiter of the said consonances without bothering at all with numbers or measures." Ptolemy afterwards entered the scene and suggested a reformation establishing a scale accepting the reason inherent in numbers and measures, but adjusted the intervals so that they fully "satisfied the hearing sense."²³ The modern equivalents of the Canonic, Harmonic and

²⁰Claude V. Palisca Humanism in Italian Renaissance Musical Thought, pp 20-1.

²¹D.P. Walker Studies in Musical Science in the Renaissance, pp 14-26, and Claude V. Palisca Scientific Empiricism in Musical Thought, p 109-113.

²²Quoted in Claude V. Palisca Scientific Empirism in Musical Thought, p 111.

²³Salomon de Caus Institution Harmonique; On the Origin of Music, p1: "de luy [Pitagoras] vint une sorte de Musiciens nommez canoniques ou regulier, lesquels asseuroient que les consonnantes & intervalles tiroyent leurs origine des nombres, & refusoient le sens de louye pour juge desdites consonantes & intervalles, disans que cest un sentiment doubteux & non asseuré, & quelque temps apres vint Aristoxene, lequel au contraire vouloit que l'ouye fut l'arbitre desdites consonnantes, sans se soucier autrement des nombres ny mesures, & de cestuy-cy

Ptolemean scales were called Pythagorean, mean-tone or equal scale, and just intonation. Just intonation made room for even the imperfect consonances and attempted to aproach as close as possible the natural consonances of the human voice. This is the issue of the great debate between Zarlino and V. Galileo; whether or not these adjustments to the harmonic scale imply a destruction of its Pythagorean foundation.²⁴ While Zarlino makes a distinction between natural and artificial scales, meaning that through the adjustments the artificial scale approaches the natural; V. Galileo argues that all is natural, and that the original Pythagorean proportions are thus without value since they have to be altered.²⁵

It is in the midst of this debate that Salomon de Caus' placed his musical theory. A practicing musician known to be a very skilled instrument maker, he could not fail to recognise how the numerical proportions did not entirely represent all the tones harmonious to the ear. For Salomon de Caus there existed in theory no well-established sphere of arithmetic harmonic proportions for the musician to move within, at least not one that truly presented the ultimate and Divine truth. In practice one could define certain proportions and intervals with the help of reason and numbers, but the musician also had to rely on his senses to discover the true richness of God's gift of music. In the first part of *Institution Harmonique* Salomon de Caus explains why not all intervals and consonances in use can be arithmetically described and how one adds "artificial" intervals to the "natural" scale, because they are "necessary in order to accomplish a smooth harmony."²⁶ The addition of artificial intervals and imperfect consonances was required for polyphonic compositions and had already been given a theoretical framework by the 15th century. Ugolino of Orvieto established the theoretical notions of *musica recta* and *musica ficta* in his *Declaratio Musicae Discipline*, in order to differentiate between "correct" music, using the consonants of the

sourdit une autre sorte de Musiciens nommez Harmoniques, apres vint Ptolemee...lequel disoit bien qu'entre les sons graves & aigus, il y eut quelques intervalles accordantes avec le nombres & mesures, si est-ce qu'il faloit que le jugement de louye fut satisfait, & reforma quelques intervalles...à celle fin que louye fut mieux satisfaite, laquelle reformation a esté approuvee de beaucoup d'excellents Musiciens, lesquels sont venus du depuis, & entre autres de Zarlin moderne autheur." See also D.P. Walker Studies in Musical Science in the Renaissance, p 111-13.

²⁴Claude V. Palisca Humanism in Italian Renaissance Musical Thought, pp 272-97.

²⁵Ibid, pp 272-74.

²⁶Institution Harmonique, Part I, Prop. XXIIII: Text in illustration: "De ce costé icy sont toutes les feintes necessaires, pour accomplir une bonne harmonie."

hexachordical scale, and "feigned" music, using consonants "found" between the ones of the correct scale.²⁷

In the 18th proposition Salomon de Caus introduces the Ottonario to replace Zarlino's earlier Senario which failed to express one of the consonances; the Hexacorde minor (fig.23). Zarlino had been aware of this problem, that this consonance was of the proportion 3 to 8, but he consciously chose to exclude it, arguing that it could be expressed through adding the proportions of two other consonances. The reason why Zarlino had been reluctant to use the Ottonario instead was that the figure would then include the superfluous number 7. In this context the implications of including an extra number were serious. With 7 in the diagram, a whole new set of proportions would be possible to designate, and these would not be harmonious at all. The safe field of action provided with the Senario would then become a mine field filled with explosive dissonances.²⁸ Salomon de Caus however, does not seem to be afraid of this instability. Even if the number 6, "in truth is very excellent, ... it is certain that the Hexachord minor is not to be found anwhere in that number....and when it comes to the number 7 I like it rather to be superfluous, than to leave out 8 which is necessary."²⁹ De Caus' more pragmatic attitude might indicate his decreasing respect for the magical power of static numbers and numerical proportions and his recognition of the inevitably imperfect nature of human attempts to frame the divine music. However, the number 7 was not at all a bad number to include. In representing God, the days of the creation, the planets, the pillars of wisdom and much more of a divine and benevolent nature, the presence of the number 7 in the Ottonario actually brought the Divine and unknowable into the frame of human reason.

²⁷T.A. Anstey Feigned music: The Composition of Alberti's facades for the Tempio Malatestiano (pp 47-49). In this thesis are discussed the concepts of musica recta and musica ficta in relation to Alberti's use of music theory in his architectural practice. The exact nature of this theoretical transformation is very complex and a full understanding of its implications requires a much more elaborate discussion than is possible in this context. For further reading see D.P Walker Studies in Musical Science in the Renaissance and Claude V. Palisca Humanism in Italian Renaissance Musical Thought.

²⁸Claude V. Palisca Humanism in Italian Renaissance Musical Thought, p 248.

²⁹Institutition Harmonique, prop. XVIII.

After establishing the proportions of the consonances, Salomon de Caus takes the reader through a series of propositions which are lessons in the art of adjusting the musical scale so that it approaches nature and becomes fully pleasing to the ear. He first demonstrates Ptolemy's "correction" of Pythagoras' scale and then the more modern scales by Fogliano, Zarlino and himself. Here Salomon de Caus enters the debate on natural and artificial tones, that Zarlino and V. Galileo had earlier engaged in. While he admits that the intervals and consonances in Foliano and Zarlino's institutions "are the closest to nature, nevertheless they do not agree in all, with this nature."³⁰ Nature must have its own order, because if "our" proportions were natural, the voice would agree in all with it, which it does not: "The nature of the voice does not in all agree with the artifice,"³¹ which he promises to further demonstrate in the following proposition. In his defense against V. Galileo's attacks, Zarlino explained the relation between natural and artificial in musical composition:

"The forms and consonances and other intervals that we use in our tunes in vocal and natural compositions are not products of art nor inventions of man but primarily of nature itself, collocated and registered among many things and especially among the parts of the perfect number, which is the *senario*, as I declared in the *Istitutioni*, in which they find their true forms. They are then ordered and rediscovered by art in the species that I call and shall always call natural, named Syntonic Diatonic by Ptolemy."³²

The distinction between art and nature was crucial for both Zarlino and De Caus. For them art was all that was man-made; it did not stand in a simple opposition to nature, but nature was both its model and provided its material. Art could assist nature, but it could never be superior to it, an opinion which is very frequently expressed by De Caus in *Les Raisons*, for example in his arguments against perpetual machines. Nature, understood in this wider sense, as untamed matter, untouched by human hands; must be ultimately subjected to Divine and not human rules, as was man himself. What V. Galileo challenged by declaring that "all is natural" was, if art is viewed as a form of knowledge, the idea that man's ordering of nature according to human reason constitutes a model differentiated from nature

³²Ouoted in Claude V. Palisca Humanism in Italian Renaissance Musical Thought, p 272.

³⁰Institution harmonique, prop. XXI: "nous conclurrons doncques, que les consonnantes & intervalles, selon qu'elles sont divisées au Monochorde, sont les plus approchantes de la nature, neantmoins elles ne s'accordes du tout, avec icelle nature."

³¹Ibid, Prop. XXII: "voyla doncques comme la nature de la voix, ne s'accordent du tout avec l'artifice."

itself; an instrument by which to comprehend the world. In De Caus' mind, artifice, as well as the figures describing the musical proportions, was acknowledged as a *vehicle* for understanding the truth, and never as a replacement of the truth itself. This distinction between the representation of truth in art and the direct presence of it in God and Nature is something which Salomon de Caus emphasized strongly, maybe as a last defence against the separation of human interpretation in art from the "true" method of science.

"La Divine puissance ayant crée le monde, & tout ce qu'il contient, a voulu qu'il se fit une varieté de mouvements proportionnez en iceluy, tant du firmament & des Planettes, comme aussi de la mer par son flus & reflus...Or pour revenir à nos proportions harmonique, je dis, que les consonnantes & intervalles naturelles, selon que la providence divine les a ordonnées, ne nous sont congneues non plus precisément, que les mouvemens celestes, & mesme ment ne peuvent estre comprises soubs nos nombres, comme il se peut voir en la precedent proposition, & la faute vient comme j'ay dit, que Dieu ne veut pas permettre à l'homme, de cognoistre ses ouvres parfaittement, d'autant qu'il n'y a rien de parfait en nous, aussi veriteblement ceste science ne pourroit pas estre divine, comme elle est estimee, si nous avions la congnoissance parfaite de ses proportions."⁶³

This divine justification De Caus gave as an explanation as to why the natural tones did not agree with the artifice, was based on the traditional analogy between celestial movements and harmonic proportions, but it seems to have been turned inside out. It is no longer the simple regularity of planetary motion that attracts De Caus' attention, but its complexity. The unattainability of the numbers and measures underlying heavenly as well as musical order, is what renders the sciences of music and astronomy of transcendental value. As he states: "truly, this science could not be called divine, as it is, if we could have a perfect knowledge of its proportions."³⁴ Thus, when the absence of apparent order in the divine science had to be defended Salomon de Caus managed to elegantly turn the argument around without harming the essential cosmological order of corresponding planes. That is,

³⁴Ibid, part of the abovequotation.

¹³Ibid, prop. XXIII: "The Divine power, having created the world, and all which it contained, wished that there would be a variety of movements proportioned on him, as much in the firmament and the planets, as in the sea with its ebb and flow...Now to return to our harmonic proportions, I say, that the natural consonances and intervals, as the divine providence has ordered them, are not more precisely known to us than the celestial movements, and similarly cannot be comprehended with our numbers, as can be seen in the preceding proposition, and the fault comes as I have said, from that God does not want to allow man the knowledge of his perfect works, as there is nothing perfect in us, also this science could not truly be called divine, as it has been judged, if we could have a perfect knowledge of its proportions."

the analogy between micro and macrocosm could still operate with its invisible connections, assuring man the possibility of approaching God through spiritual ascent.

In his treatise on sundials, La Pratique et demonstration des horloges solaires, published nine years after Institution Harmonique, Salomon de Caus opens with a section dealing exclusively with the problem of mathematical proportions. Here he also groups musical and astronomical proportions together, as being of the kind having "ratios which to us are irrational."35 After having demonstrated all proportions that have certain and demonstrable ratios (geometrical and mechanical). De Caus gives "what to [him] seems the ratios of the consonances of music and shows how the said consonances cannot aggree with our numbers."³⁶ The tone of his statements regarding the disagreement between human and divine numbers is somewhat sharper in this text, which might indicate that he had developed a more independent position regarding Zarlino's music theory. De Caus asks the reader to construct a monochord with consonances of the commonly agreed on simple numerical proportions and then to listen to the tones that it produces. It will then be "easy to judge by the hearing sense ... that they [the proportions] are false." This shows that "all the said numbers are irrational, except the Diapason, which necessity demands to be double, since if divided otherwise one part of the chord would sound higher than the other, and it would no longer be Diapason." So if one adjusts each consonance a little up or down, one can easily attain the just proportions, because "the ear must be preferred to numbers, since the aim with music is to please the hearing sense."37

In this discourse Salomon de Caus often uses "Nature" in a sense that directly implies "God" or the "Divine". For example it is *Nature* that ordered the consonances and it is *Nature* that never uses human numbers in what she organises. This makes sense in relation to the above discussion of natural and artificial. If Nature is the Divine then it would be a serious mistake to attempt to reach the true knowledge of it only using the human instrument of intellectual reason. For this reason, one has to defend the human artifice and use the

³⁵La Pratique et demonstration des horloges solaires, in Dedication.

³⁶Ibid, in *Discours sur les proportions*, section on musical proportions (my underlining).

³⁷Ibid, in *Discours sur les proportions*, section on musical proportions.

proportions that actually have been given for man to know, the proportions of geometry and mechanics. As De Caus warns the reader "man should not step out of these boundaries if he wishes to act correctly."³⁸ The musician and composer should thus take care to use his intellect wisely and allow his senses an important role of judgement letting his inspiration guide the music. Not until these important questions have been considered does De Caus define the just proportions of the monochord in his "Harmonic Institution".

The established monochord is referred to as our "institution"; something which, in its resemblance to the word "intuition", the immediate ground for its establishment, the judgement of the human senses, strikes the modern reader as a fascinating word-game, not at all likely to have been intended by the author. "Institution", was a common term often used in titles of the time. De Caus obviously took his title from Zarlino's *Istitutioni Harmoniche* but the significance of it is nevertheless greater than a mere reference to an earlier work. Institution signified at the time both an instructional, educational work, a place for education, and the establishment of laws and fixed rules.³⁹ In Latin *Institutio* moreover signifies "Method of arrangement, organisation, system."⁴⁰ In the 1690 *Dictionaire Universal* Antoine Furetiere defined the word in the following way:

"INSTITUTION Etablissement. L'institution des ceremonies, des Festes, des jeux, des Compagnies...INSTITUTION, se dit plus generalement de tout ce qui est inventé & estably par les hommes. Il est opposé à la nature. Tout ce qui vient de la nature est du même en tout lieux, & en tout temps ce qui est d'institution divine...INSTITUTION, se dit aussi de plusieurs maisons ou Colleges où on instruit les Novice & la Jeunesse...^{m1}

In relation to De Caus' text, the late date of this dictionary, is of course of significance, especially in terms of this discussion. Human institutions were in 17th century architectural theory a much debated issue in relation to what becomes true according to

³⁸Ibid, in Discours sur les proportions.

³⁹Larousse Dictionnaire du Moyen française - la Renaissance.

⁴⁰Oxford Latin Dictionary.

⁴¹Antoine Furetiere Dictionaire Universal, contenant generalement tous les mots François, tant vieux que moderne: "INSTITUTION Establishment. The institution of ceremonies, festivities, games, companies... INSTITUTION, is more generally used to speak of all that is invented and established by men. It is opposed to nature. All which comes from nature is the same in every place and for all times, which is the divine institution. INSTITUTION is also used to speak of many houses or Colleges where one instructs novices and youth."

custom and use. In his Ordonnance des cinq espèces de colonnes selon la méthode des Anciens of 1683 Claude Perrault attempted to establish the right proportions of the Architectural orders using only the real measures found in previous buildings or treatises, and finding the average measure from the two extreme dimensions.⁴² For him there was no truth to be drawn from macrocosmic analogies. Instead he believed human custom to be the only appropriate source for the rules of his "Architectural *Institution*".⁴³ Salomon de Caus, operating 70 years earlier, was still defending the existence of a divine institution, where, as Furetiere says, "all is the same in every place and for all times," that is; there existed a source for truth outside the transient world of human life. Nevertheless Salomon de Caus was more than aware that his "Harmonic Institution" was human, and not Divine. He trusted the hearing sense as the only vehicle to find the just and natural proportions, which reflected the Divine, but never disclosed its exact measure.

Salomon de Caus refuted the possibility that there might be different musical proportions in different parts of the world. This could not be true since nature is the same everywhere and God gave all humans a reasoning soul. In a comment on music in other parts of the world, which, since the people there are "ignorant of letters and have no knowledge of the sciences," is inferior to European music, he states: "It must be so that those proportions [of bells in Java] relate to ours, if they are in consonance with each other, since seeing that we have all which nature can give, it would be wrong to think that their proportions are other than ours."⁴⁴ The belief that all which nature produces reflects the mechanics of the divine institution, in combination with a confidence in man's capacity to make universally valid judgements based on his senses, made it possible for De Caus to maintain a reflection of universal truth in his experientially established institution. The method he proposed by which the reader might confirm that the consonances "proportioned according to our institution are good and according with nature", was to construct an instrument tuned according to the reader's own judgement and then compare with what is

⁴²Alberto Perez-Gomez, Introduction to Ordonnance for the Five Kinds of Columns after the Method of the Ancients, p 21.

⁴³Joanne Paul Of Substantiating Nature, p 3-4.

⁴⁴Institution Harmonique, Part I, last page: "...il faut que lesdites proportions se rapportent aux nostres, s'ils sont en consonnantes les unes avec les autres, car veu que nous avons tout ce que la nature peut donner, ce seroit erreur de penser que leurs proportions fussent autres que les nostres..."

given.⁴⁵ In order to find the natural proportions, human reason thus had to be assisted by the hearing sense. Reason had been established in us by God, in order that we should be able to understand, up to a certain limit, his creation, and make us admire our creator, but through the help of premediated intuition we would be carried further towards our star.⁴⁶ The hearing sense could rely on inspiration, and as the inspiration of the muses travelled across the divine boundary, music was carried through the air to man; not until after it had passed through the ears would it be ordered by reason.

The first, theoretical part of *Institution Harmonique* thus provided the practicing musician with a frame through which to operate. It also gave a rough outline of the cosmic order music was expected to reflect, while maintaining the distance between the human and Divine; art and Nature. In this sense the first part is static. It lays out the pattern and establishes the components of music, its matter and form, but music is not yet put in motion. In its essence, before its realization, music is of a divine geometry whose smallest unit is the sound and as "the point of Geometry has no size in itself, and the unit in Arithmetics has no parts, so has the sound in Music neither interval, proportion or consonance in itself."⁴⁴⁷ De Caus' analogy to Geometry and Arithmetics confirms his basic belief in the presence of a perfectly ordered cosmos which was reflected by Astronomy and Music and represented by human artifice. It was Leon Battista Alberti who, in his 1450 *De re aedificatoria*, first introduced the concept of *lineamenti*, that is; the immaterial Euclidean outline, into Architectural theory.⁴⁸ The immaterial foundation was necessary for a connection with the highest celestial spheres; via the lineaments the spirit could travel and bring divine influences down to corruptible man. John Dee translates this passage in Alberti as follows:

⁴⁵Institution Harmonique, Part I, Prop. XXXVII.

⁴⁶See the ascent of the soul from the rational to the intuitive in Pontus de Tyard's Solitaire premier, discussed in Frances Yates the French Academies off the Sixteenth century, p 79. See also Richard Patterson The 'Hortus Palatinus at Heidelberg and the Reformation of the World - Part II, p187 and Fernand Hallyn The Poetic Structure of the World, p 246 on man's reason, ratio, and mens, God's universal innate knowledge.

⁴⁷Institution Harmonique, Part I, Def. V.

⁴⁴Werner Oechslin Geometry and Line. The Vitruvian "Science" of Architectural Drawing, p 31.

"The whole Feate of Architecture in buildyng consisteth in Lineamentes, and in Framyng...., so y^e whole forme and figure of the buildyng, may rest in the very Lineamentes...And we may prescribe in mynde and imagination the whole formes, *all material stuffe beyng secluded...Seyng then, these thinges, are thus: Lineamente, shal be the certaine and constant prescribyng, conceived in mynde: made in lines and angles: and finished with learned minde and wit.

* The Immaterialitie of perfect Architecture."49

Through this discussion I hope to have clarified De Caus' response to the acknowledgement that the numbers and proportions deemed divine in a Pythagorean cosmology did not actually represent the harmonious proportion as they were experienced. I have argued that De Caus essentially kept the traditional metaphysical belief in the harmonious correspondence of all parts in the universe. This was possible since he maintained that human numbers were of a different kind than those God had used in his creation. The full materialization of divine truth in human numbers was hence impossible, and moreover in contradiction with man's righteous place on earth, as the image of God. If divine truth was transparently present to man, man would no longer be the image, but man himself would be God. Nevertheless De Caus respected the attempts to understand nature and the divine sciences through numbers, because through them one could come close to the true proportions, as long as they were not in themselves believed to be divine. As optical correction was necessary to make the classical temple appear as divine to the human senses, so the musical scale needed "aural" adjustments in order to become truly effective as a harmonious vehicle for the travels of the human soul.

Musica Humana -The Virtuous Effects of Music on the Human Soul The modes as the emotive orders of musical character

The traditional image of the universe as a set of analogies and corresponding planes was reinforced by neoplatonic philosophy as it developed in the Renaissance out of the hermetic texts, translated and interpreted by Ficino. The important alteration, in relation to the medieval cosmology, was essentially the focus on the individual man as the nodal point

⁴⁹Leon Battista Alberti, Book I, Ch. I, quoted by John Dee in *The Mathematicall Praeface*, section on *Architecture*.





Fig. 20: "The Divine Monochord", represented by Robert Fludd. The figure demonstrates the primary unity of cosmic and musical harmonies. In Robert Fludd Utriusque Cosmi Maioris Scilicet et Minoris Metaphysica, Physica atque Technica Historia. (From Joscelyn Godwin Robert Fludd, p 47).



ł



Fig. 22: The Senario. Zarlino's figure demonstrating how all consonances could be expressed in ratios of the first six numbers. (From Gioseffo Zarlino Le Istitutioni Harmoniche, Ch. 15, p 25).



Fig. 23: The Ottonario. De Caus' figure demonstrating that number eight was needed in order that all consonances should be expressed. Note the marked absence of number seven. (From Salomon de Caus Institution Harmonique, Part 1, Prop. 18).


Fig. 24: Salomon de Caus' monochord with all natural intervals. (From Salomon de Caus Institution Harmonique, Part I, Prop. 22).



Fig. 25: Orpheus bringing nature into harmony with his songs. (From Salomon de Caus Les Raisons des forces mouvantes, Book II, Prob. 17).

of exchange between matter and spirit. As was pointed out in the introduction, the transformation of the world was to take place through the reformation of individual souls and their aspiration to join the divine spirit. The analogies of the cosmos were the corner stone of such a philosophy, and it is important to keep in mind that it was never in principle a matter of exact matching between micro and macrocosm, but rather one of "sharing a common nature."⁵⁰ Consequently Boethius' concepts of *Musica Mundana, Humana* and *Instrumentalis*, were revived as a strong model with which to view the significance of music for man. Music was the harmony of the world, cosmos and the four elements; the harmony in man, that brought incorporeal reason and the body together, and kept the parts of the body in order; and the harmony resting in instruments. *Musica Instrumentalis* was the music which was perceived with the hearing sense. In Boethius own words:

"The first kind, the cosmic, is discernible especially in those things which are observed in heaven itself or in the combination of elements or the diversity of seasons....If a certain harmony did not join the diversities and opposing forces of the four elements, how would it be possible that they could unite in one mass and contrivance?...we discern in cosmic music that nothing can be so excessive that it destroys something else by its own intemperance. Everything is such that it either bears its own fruit or aids others in bearing theirs."⁵¹

This vision of worldly harmony is echoed in Alberti's notion of *Concinnitas*, which "compose[s] parts that are quite separate from each other by their nature, according to some precise rule, so that they correspond to one another in appearance. ...Everything that Nature produces is regulated by the law of *concinnitas*...the main object of the art of building."⁵² While the worldly music was the model and the aim was to make it perceivable, it was in ourselves, in the human music where the journey had to begin. "Whoever penetrates into his own self perceives human music. For what unites the incorporeal nature of reason with the body if not a certain harmony?...What is it that intermingles the elements of the body in an

· • .

⁵⁰Carl Dahlhaus On the Historicity of a Metaphysical Principle, p 18.

⁵¹Boethius Fundamentals of music, pp 9-10. Boethius' (480-524AD) treatise De institutione musica was very influential throughout the Middle ages as the foundation of western music theory. In the late Renaissance its general application to practice was dismissed but it remained important as a source for the understanding of Ancient music (Greek) which was an essential part of the humanist movement in music. Of special significance to De Caus was its significance for Baïf's academy in Paris. (See introduction to Boethius Fundamentals of music, pp xiii-xiv and Frances Yates The French Academies of the Sixteenth Century, p 87).

⁵²Leon Battista Alberti On the Art of building in Ten Books, Book 9, Ch. 5, p 302.

established order?"⁵³ The moral implications of this notion of human music as an inner harmony between body and soul was strongly emphasized in the neoplatonic philosophy of Baïf's Academy of Poetry and Music in Paris, as well as by the Italian Musical Humanists; both schools anxious to recover the powerful effects of Ancient music. If the human soul of the material body could be connected with celestial harmony through experienced instrumental music, there was hope for a transformation of the fallen world. Pontus de Tyard gives an account of Pythagoras' own practice of spiritually enhancing music:

"...après qu'il avoit usé de son corps plus corporellement, comme au dormir et au boire et manger, touchant une Lyre. Je rappelle (disoit-il) les Muses eslongnées de moy par ce corporel exercise, et les invoque à fin que par leur ayde soient rassemblées en un mes parties plus celestes, égarées quelquefois loin de leur immortelle sourse, pour le soustenement de ceste humanité. Et ce entendant non seulement de la Musique harmonieuse de voix et d'instrument, mais encore de celle harmonie des vertus qui guide l'Ame à son bien souverain d'extreme tranquillité, et comme par un ravissement, l'eslieve hors de toutes corporelles passions."⁵⁴

The spiritual effects of music on the human soul was an important driving force behind the 16th century quest for the revival of Ancient music, of which many stories accounted its miraculous influence. This was the other side of its divine justification, which Salomon de Caus also stresses in the *Proëme* to his treatise. He justifies the importance of music, saying that it stands on top of all the human sciences, "for both its divine proportions and the utility one can draw from it."⁵⁵ By utility he obviously means its effects on man, because the sentence is immediately followed by a long section with well-known accounts of these effects, drawn from the Bible or other classical sources. "[F]inally music serves to move our passions following our desire, to elevate our souls towards the Divinity and even to cure some

⁵³Boethius Fundamentals of Music, p 10.

⁵⁴Pontus de Tyard Solitaire Second, p242: "...after he had used his body for more corporeal purposes, as for sleeping or eating, he took up a Lyre. I recall (he said) the Muses becoming distanced from me through this corporeal exercise, and invoke them so that by their help I can, reassemble into one the most celestial parts of me, sometimes led far astray from their immortal source, for the sustainment of this humanity. And with that is not only understood the harmonious music of voices and instruments, but also this harmony of virtues which guides the soul to its good, souvereign tranquility, and as if through a ravishment, takes it out of all corporeal passions."

⁵⁵Institution Harmonique, Part I. Proëme: "je diray seulement qu'elle doibt estre colloquee au dessus toutes sciences humaines, pour raison de ses divine proportions quand à l'utilité en peut tirer,...".

sicknesses."⁵⁶ The latter effect he supports with evidence from Pontus de Tyard's *Solitaire Second* from 1552.

85

Pontus de Tyard was another important source for Salomon de Caus, who refers to his music theory many times and takes some illustrations directly from Tyard's *Solitaire Second*.⁵⁷ The significance of Tyard's position in this context is his emphasis on the moral dimension of music. For him music was the universal science, the whole structure of the cosmos; as well as the composition of the material body of man and the guide which would enable him to ascend the Mount Parnassus, on top of which was Apollo - the Divine light and reason.⁵⁸ For Tyard, the true *Musica Humana* was not so much the bodily, structural analogy to the macrocosm, but the human actions guided by a good purpose and virtuously tempered passions. He believed "that each [man] in him can sense it [music humana], if with some consideration he contemplates himself."⁵⁹ Thus it is the Apollonian oracle's "know thyself" which becomes the guiding principle of the muses. The moral effects of music turned the gaze inwards and simultaneously raised the soul up and away from the corporeal passions. Ficino, in his comments to *Timaeus* says of the power of musical motion:

"But musical sound by the movement of the air moves the body: by purified air it excites the aerial spirit which is the bond of body and soul: by emotion it affects the senses and at the same time the soul: by meaning⁶⁰ it works on the mind; finally, by the very movement of the subtle air it penetrates strongly: by its contemperation it flows smoothly; by the conformity of its quality it floods us with a wonderful pleasure: by its nature, both spiritual and material, it at once seizes and claims as its own, man in his entirety."⁶¹

⁵⁶Ibid, Proëme.

⁵⁷Richard Patterson points this out in *The Hortus Palatinus and the Reformation of the World*, Part II, p 189, where he applies Tyard's model of the soul's ascension to his interpretation of De Caus' garden in Heidelberg.

⁵⁸ See Frances Yates The Franch Academies of the Sixteenthe centuries, p 78-85. According to Ficino, Apollo is the author of music, all music comes from him. (The Book of Life, p 159). Likewise, music is the source of all learning, Apollo's true domain.

⁵⁹Pontus de Tyard Solitaire Second, p 236: "Mais si les actions guidées à bonne fin et les passions temperées par les vertus sont dites la vraye Musique de l'homme, je seray avec vous, et croiray que chacun en soy la peut sentir, si avec quelque consideration il se contemple soy-mesme."

⁶⁰With "meaning", Ficino is probably referring to the "sense" of words which was believed to affect directly the intellect, in contrast to the naked melody who had to operate through the hearing sense.

⁶¹Marcilio Ficino; quoted in Claude V. Palisca Humanism in Italian Renaissance Musical Thought, p 169.

The kind of music Tyard proposed, and which was propagated in Baïf's Academy of Poetry and Music in the late 16th century, strove for a harmonic bond between text and music, which was claimed to have ancient origins.⁶² As Tyard said; "one without the other does not seem to be very efficient." He therefore required that one, "on the model of the Ancients, uses for our songs manners prescribed from the length of the verse." If observing the rhythm and meaning of the rhymes the result will "testify that harmony and rhymes are of almost the same essence, and without the marriage of these two, the Poet and the Musician will remain less successful in the blessing they seek to acquire."63 Tyard was one in a group of 16th century musical theorists who led a reactionary movement against the modern practice of polyphony, in favor of the simple melody accompanying text.⁶⁴ In these songs music was entirely subordinated to the rhythm of the verse. While music is an imitation of the harmony of the universe, as Ficino wrote, poetry "is superior...since ... it speaks not only through the ear but also directly to the mind. Therefore its origin is not in the harmony of the spheres, but rather in the music of the divine mind itself, and through its effect it can lead the listener directly to God Himself." Music was only the mimetic vehicle with which the mind could be opened through the spirit, but it was indeed a very powerful one.65

The mythical union of poetry and music had its origin in the Orphic chants, which were taken up by Ficino as a means of healing both body and soul.⁶⁶ In Christian mythology the songs of David were considered to be of a similar nature. David, according to De Caus' account of the story, was a shepherd who was called upon when King Saul was possessed by an evil spirit, in order to cure him by singing amd playing on his harp. David then became king succeeding Saul and composed his divine Christian songs, the psalms. As mentioned above, these were used by Salomon de Caus to illustrate the twelve musical modes. The myth of Orpheus, Apollo's son, captures the essence of the strong belief in the fatal power of music on human action. It covers both the light, temperate, Apollonian side of music, which Orpheus himself represents, as well as its darker, frantic, Dionysian side, represented by his

⁶²D.P. Walker Musical Humanism in the 16th and Early 17th Centuries, Music Feview II, p 8. ⁶³Pontus de Tyard Solitaire Second, pp 242-44.

⁶⁴D.P. Walker Musical Humanism in the 16th and Early 17th Centuries, Music Review II, p 5. ⁶⁵Ibid, p 9. Ficino quoted in F. Yates The French Academies of the Sixteenth Century, p 40. ⁶⁶Ficino The Book of Life, Book 3, Ch. 21.

adventures in the underworld and his tragic death, as accounted here by Ovid:

"By such songs as these the Thracian poet was drawing the woods and rocks to follow him, charming the creatures of the wild, when suddenly the Ciconian women caught sight of him....All their weapons would have been rendered by the charm of Orpheus' songs, but clamorous shouting, Phrygian flutes with curving horns, tambourines, the beating of breasts, and Bacchic howlings, drowned the music of the lyre. Then at last the stones grew crimson with the blood of the poet, whose voice they did not hear."⁶⁷

In Francis Bacon's interpretation of the fable Orpheus represented Universal Philosophy understood as the combination of natural and civil or moral philosophy. With his music Orpheus controlled both; the natural world of minerals, plants and beasts as well as the "civilized" world of men and gods. "For Orpheus himself - a man admirable and truly divine, who being master of all harmony subdued and drew all things after him by sweet and gentle measures - may pass by an easy metaphor for philosophy personified. For as the works of wisdom surpass in dignity and powers the works of strength, so the labours of Orpheus surpass the labours of Hercules."⁶⁸ In a proposal for a grotto in *Les Raisons* Salomon de Caus used this scene of Orpheus controlling nature with his music, representing the moment when he had in his power all parts of the natural world, and all was in harmony (fig.25). The tragic end of the story was anticipated in this scene. The contemporary reader knew that the Bacchic music was soon to arrive and break the spell so that the natural world again would turn into chaos.

With this background, it may easily be understood how the retrieval of the Orphic songs was considered a crucial task in the 16th century. As part of the general quest for a moral reformation, it was a dream of great importance to find the keys to the understanding of Orpheus' divine, celestial music.⁶⁹ This was the principal reason for the intense attention that was directed to the musical modes. The modes could be described as different musical characters, which helped the composer to order his melody according to the intended effect. Defining the modes was, for the Renaissance humanist, a question of subjecting the effects

⁶⁷Ovid Metamorphoses, p 246.

⁶⁸Francis Bacon A Selection of his Works, p 287 (from The Wisdom of the Ancients). ⁶⁹Frances Yates The French Academies of the Sixteenth Century, p 36-42

of music to the intellect, taming it by reason and protecting man from Dionysian frenzy. They were the means by which it could be certified that it was Apollo's sensible lyre who guided the soul up the hillside to the top of Mount Parnassus.

The modes helped the composer to fit an appropriate melody to a selected verse: "in ancient times a mode was a certain fixed form of melody, composed with reason and artifice, and contained within a fixed and proportioned order of rhythm and harmony, adapted to the subject matter of the text."⁷⁰ It was a means by which one of the representational aspects of music was clarified. Choosing to work within a specific mode the composer could predict the emotional impact of his song. From Aristotle music was understood to be a *mimetic* art, and the object of its imitation was character or *ethos*.⁷¹ When being presented with a specific *ethos* through music, the disposition or character of the listening person was believed to change in sympathy with the imitation.⁷² Music was considered to be the only artform that could directly represent the immaterial object of character. Painting, sculpture, poetry and theatre could only represent character at work within a figure, while the direct presence of character in music immediately affected the listeners mind.⁷³ To capture the image of a particular character or *ethos* in prescriptive rules for melodic pitch and selected chords, is then to be understood as the purpose behind and the method for the classification of the modes. Ficino writes on the subject of imitation:

"Remember that song is the most powerful imitator of everything. For it imitates the intentions and affections of the soul, and words, and this matters for the gestures and movements of the body, the acts of man, and his customs. It imitates and does all these so strongly that, in order to imitate and do the same it provokes the one who is singing and then those who hear it. When the heavens are imitated with the same power, it provokes our spirit to the heavenly influx, and then, marvellously, it provokes the influx to our spirit."⁷⁴

⁷⁰Gioseffo Zarlino On the Modes - The Fourth Book of le Istitutioni Harmoniche, p 10.

⁷¹In Aristotle's Politics and Poetics. Göran Sörbom Aristotle on Music as Representation, p 37.

⁷²Ibid, p 41.

⁷³Ibid, p 43.

¹⁴Marsilio Ficino The Book of Life, Book III, Ch. 21, p 161.

The second part of Salomon de Caus Institution Harmonique, deals with the practice of music: the art of composing, or counterpoint. Here it is explained at length how the modes and their different natures may be used, before the art of counterpoint is taught. It was important to make sure that the student first gained control over the effects before learning to compose more complex pieces. As did Zarlino, De Caus did not seem to hold anything against the practice of counterpoint composition, on the contrary he saw the development of it as a great improvement. In polyphony richer harmonies could be expressed, more fully imitating the Divine harmony, but in order to fully affect the human soul, a thorough knowledge of the modes was required. "The modes," he writes, "being well ordered, subject our music to specific rules fitting to the lyrics, or to the subject of our song."⁷⁵ Salomon de Caus demonstrates each of the twelve modern modes in chapters 11-22 and concludes with a convenient table showing principal notes from each: "through which one can know the nature of each particular Mode, so that in following the subject given to compose, we choose a mode fitting to it, reiterating rather often the principal notes of the said "ode." De Caus refers to Zarlino as a modern writer on the subject, both of the ancient modes and of the modern. It was Zarlino who had defined and determined the number of modes as twelve, he dedicated the fourth book of his *Istitutioni Harmoniche* to the modes. Zarlino begins this book by defining what a mode is in discussing the proper meaning of the word:

"[T]he word 'mode'...properly means 'reason', namely, that measure or form which prevents us from going too far in anything we do, making us act in all things with a certain temperateness and moderation...

This temperateness or moderation is nothing other than a certain delimited and closed order of operation through which the essence of a thing is preserved by virtue of the proportion found in it....From this it arises that if order is separated from proportion, either by chance or by intention, the result is offensive and abhorrent to our feelings to a degree that goes beyond description.¹⁷⁶

"'Modes' are so named after the Latin word modus, which is derived from the verb *modulari*, 'to sing'. Or perhaps the term is used because of the moderated order perceived in the modes, for it is not permissible, without offense to the ear, to go beyond their boundaries and to disregard the nature and property of

⁷⁵Institution harmonique - Part II, Def V: "Lesdites modes, estantes bien ordonnees, assubiettisent nostre musique soubs certaines reigles convenables à la parolle, ou au subiect de nostre chant:"

⁷⁶Gioseffo Zarlino On the Modes, pp 1-2.

each."77

Zarlino clearly understands the term as a limiting aesthetic⁷⁸ concept, permitting the composer a way of acting to find an appropriate, reasonable and ethical expression. *Modus* in a modern Latin dictionary also indicates this meaning in a general sense; it is simply a specific measured amount but it moreover carries the moral implication of due or proper measure and the avoidance of extremes. *Modus* as well as *Mode* was also used to characterize specific ways of living as related to varying customs and fashion.⁷⁹ Technically a "mode" could be described "with Boethius" as "a certain constitution in all the orders of notes, differing by pitch, and... this consitution is like a full corpus of melody which arises from the conjunction of the consonances."⁸⁰ Zarlino qualifies Boethius' definition by stating that "the mode is a certain form or quality of harmony found in each of the seven species of the diapason."⁸¹ What the modes thus technically regulated was the range of tones and the specific consonances that the melody employed.

Zarlino wished that more musical practitioners would work according to the existing rules regulating how words and notes may be joined. "When I reflect that a science which has given laws and good order to the other sciences is at times so confused in some things as to be barely tolerable, I cannot pretend it does not sadden me."⁸² Zarlino viewed music as a science which ought to be ruled by reason; its practice was to be guided by rational principles.⁸³ Nevertheless, his efforts never implied the existence of a simple prescriptive formula, which would produce "perfect" songs. In the quotation above Zarlino expresses the nature of the modes as "a closed order of *operation*." Composing a piece of music was

⁷⁷Ibid, p 13.

⁷⁸With the term "Aesthetic", here and in the following, I am not implying the limited understanding of it as a principle of the "beautyful" which developed in the 18th century and later attained an oppositional meaning to "meaning" through the division between "form" and "content". The term has a more profound origin in the Greek notion of *Aesthesis*; what it is to look at and to listen to things. (See Göran Sörbom *Aristotle on Music as Representation*, pp 37-8)

⁷⁹Oxford Latin Dictionary and Antoine Furetiere Dictionaire Universal, contenant tous les mots François.

²⁰Gioseffi Zarlino On the Modes, pp 11-12.

[&]quot;Ibid, p 12.

¹²Ibid, p 97.

¹⁰Claude V. Palisca Humanism in Italian Renaissance Musical Thought, p 244.

understood as a matter of action, it was a process, in which the theoretician could only contribute with operational rules - not with a prescriptive method. In music, it was only in the interpretative moment of actual performance that the composition became a reality. This condition prevented a further instrumentalization of music theory. The long journey from the theoretician's proposed "order of operation" via the composer's piece abstracted on paper in notes, to the actual, "site-specific", musical performance, was recognized as a transformative creative process and its implications were not dismissible. Theory and practice in music could thus never collapse into one large equation, envisioned as automatically producing the "correct" and most ethical music.

With this particular aspect in mind it is interesting to draw a parallel to architectural theory and the "classical orders" as a similar means with which to regulate the character of the work. It could be argued that the architectural orders lent themselves more easily to a prescriptive, instrumental method, as the understanding of making as a temporal process gradually disappeared. In architecture the "journey" from the theoretician's designed measures and proportions, displayed with figures, via the architect's drawing, to the built house was shorter than in music: on the surface the process only operated within the spatial dimension, represented in the model and the drawing, and the temporal and site-specific dimension of building as a transformative activity was easily discarded.

In Leon Battista Alberti's *De re aedificatoria* we find the first attempt since Vitruvius to provide the architect with a complete instruction for his profession, including the "whole matter of building...lineaments and structure."⁸⁴ As Zarlino sought in his theory to regularize practice in order to perfect the science of music and avoid its abuse, Alberti wished to prescribe aesthetic as well as structural principles for the architect to follow. Nevertheless, Alberti's theory was not prescriptive in a reductive sense; in a similar way to De Caus, he realized the limits of human reason and proportions, while still strongly belleving in the existence of an immaterial order of intrinsic beauty.⁸⁵ In looking at his theory of beauty and ornament and its relation to the orders, from the view point of the

³⁴Leon Battista Alberti On the Art of Building in Ten Books, Book I, Ch.1, p 7.

¹⁵T.A. Anstey, Feigned Music: The Composition of Alberti's facades for the Tempio Malatestiano, p. 92.

theory of musical effects and the modes, some light might be shed on the operation of a noninstrumentalizing architectural theory which in its essence can be argued to have remained in use until the early 17th century.⁸⁶ Three aspects which relate to the Renaissance discussion of musical modes will be examined in Alberti's treatise: Firstly the question of the effect of the work; to what extent was architecture as music considered responsible for almost magical influences on people's behaviour and health? Secondly; what did the architectural orders represent in relation to the musical modes, what guided the choice of a particular order or mode? And thirdly; is there a correspondence between melody and consonance, and ornament and beauty; and is there moreover a relation between these concepts and the three notions of *musica mundana, humana* and *instrumentalis*?

Myths and stories of the remarkable effects of music were an important part of any musical treatise in the Renaissance. No other art could so directly and profoundly affect the listener as music. Earlier was explained how this was connected to the theory of spirits and natural magic, in Ficino for example. Nevertheless other imitative arts were also created with the purpose of invoking different states of minds in the perceiver. To affect the viewer was a primary object of painting, sculpture, poetry, drama and, as Alberti regarded it, also of the art of building. In the sixth book on ornament he states: "Who would not claim to dwell more comfortably between walls that are ornate, rather than neglected? What other human art might sufficiently protect a building to save it from human attack? Beauty may even influence an enemy, by restraining his anger and so preventing the work from being violated. Thus I might be so bold as to state: no other means is as effective in protecting a work from damage and human injury as is dignity and grace of form."⁸⁷ Thus architecture had in itself the means of bringing forward and restraining human emotions. The means at its disposal was the cooperative efforts of beauty and ornament, the first intrinsic and universal, the latter

⁸⁶The theoretical foundation which Salomon de Caus appears to act upon, appears to relate in important aspects to Alberti's theory. Even if more than 150 years had passed since the publication of the *De re aedificatoria* at the time of De Caus' practice, the assimilation of Alberti's theory into the Renaissance of northern Europe had only begun in the latter half of the 16th century. The essential notions of ornament and beauty, *istoria* and outline which are discussed in what follows are those which I would argue remains in operation up until De Caus' time. Even though John Dee in his *Mathematicall Praeface* only brings up the mathematical aspect of Alberti's theory, De Caus' with his work shows that the narrative and ornamental dimension may still, at that point, be considered an important source of poetic meaning.

⁴⁷Leon Battista Alberti On the Art of Building in Ten Books, Book VI, ch. 2, p 156.

an added layer bringing the universal forward in each particular situation. Later in the same book Alberti discusses magical effects that "are said to be" of human art; how it can make snakes harmless, prevent flies from entering a palace and other such useful things. He is not sure whether these effects indeed "are the result of artifice or of Nature," but his mentioning of them indicates his concern for the reality of magical powers housed in material things, or even in buildings.

The appropriate decoration of a house is achieved through employing variety according to a unifying principle:

"The method of decoration ought to be precise and, above all, unencumbered. The decoration should not be packed together too closely, piled up in a single heap; it should be arranged and positioned in so fitting, correct and apposite a manner, that any alteration would be felt to disturb the delight of its *concinnitas*.... All should be composed with such method and order that not only do they vie one with another to ennoble the work, but one could not exist on its own, nor maintain its dignity without the other...In each case make sure that the rules for the lineaments are not overturned, which would happen, as I mentioned, if Doric were mixed with Corinthian, Ionic with Doric, and so on. Each story has appropriate parts, not scattered indiscriminately here and there, but arranged in their own appropriate places."⁸⁸

What Alberti demands in the work is an inner coherence, the same kind of coherence which holds the melody together as a whole, and as fitting to a particular expression: the result of a correct employment of a specific mode. As "ancient" music had three principal modes, Dorian, Phrygian and Lydian, architecture had its three classical orders Doric, Corinthian and Ionic. Alberti indicates their guiding, prescriptive function in putting the orders in relation to *the rules of the lineaments*.

It is interesting to note the parallel that Alberti draws between the ornamental structure and a *story*. In *On Painting* the notion of *istoria* is one of the three principal parts of the art of painting, being that which communicates the wholeness of the scene and the interrelations between its parts.⁸⁹ The narrative structure has the function of giving a sense to the whole

⁸⁸Ibid, Book IX, Ch. 9, pp 313-14.

⁸⁹Leon Battista Alberti On Painting, p 75.

while at the same time holding within it a variety of details; a similar function as that of ornament. Alberti sees three principal components of Architectural theory: number, outline and position. Whereas "number" and "outline" are concerned with the more intrinsic and universal qualities of arithmetics and geometry, it is through "position" that the work *appears* in its materialized form. Position thus relates to ornamentation in its widest sense; the placement of the house on a good and healthy site is as much an issue of ornament as the sculpted decoration on the porch. In adding ornament to a house, and providing a painting with *istoria*, the work becomes situated for the visitor/viewer and thus makes a unified and lasting impression. This is also the principle which guides Alberti's own writing; *De re aedificatoria* is filled with a number of short stories giving life and reality to his abstract theories. The understanding of ornamentation, or decoration, as the art of appropriate positioning, is an idea present in Vitruvius. The following is a quotation from the 1547 French translation of the passage on "*decoration*" translated in the Morris Hicky Morgan as "propriety".

"Decoration est la belle apparence de l'oeuvre, côposée de chose bien approuvées & avec bonne authorité. Ceste decoratio se faict en eslisant la situation d'un lieu que les Grecz disent Thematismos, ou par coustume, ou par Nature, Et pour doner exemple de ceste situatio, c'est quad les Edifices pour Iupiter, pour só Fouldre, pour le ciel, pour le Soleil, ou pour la Lune, sont bastiz a descouvert & à l'air, a raison qu'en ce Mõde inferieur nous voyons les especes & effectz de ces Dieux, manifestement & a veue d'oeuil. Mais quād lon edifie a la facon Dorique pour Minerve, Mars, ou Hercules, il fault que ce soit sans mignotize: autrement cela repugneroit a la force & vertu de leurs divinitez. Si c'est pour Venus, Flora, Proserpine, ou quelques Nymphes de Fōtaines, qu'il faille edifier des Temples, ilz requierent la mode Corinthenne, d'autat qu'elle en ses proprietez est garnie des delices covenables a ces Deesses, veu mesmement que pour exprimer leurs natures delicates, on fait toutes ses parties plus simples & moins fortes que les precedentes, ... Si c'est a Juno, a Diane, a Bacchos, & autres semblables, lon leur fera des temples Ioniques, afin de tenir le moyen: car l'ordre Ionique temperera aucunement la severité du Dorique, & la mignardise de celuy de Corinthe: & par ainsi sera entretenue bone & vraye proprieté.⁴⁹⁰

⁹⁰Marc Vitruve Pollion Architecture ou Art de bien bastir, Book I Ch.4, fol.6: "Decoration is the pretty appearance of the work, composed of things well approved and with good authority. This decoration is made by selecting the situation of a place which the Greeks call Thematismos, or by custom or by nature. And in order to give an example of this situation, it is when the edifices for Jupiter, for this thunder, for the sky, for the Sun, or for the Moon, are built uncovered and in the open, because in this inferior world we can regard the species and effects of these gods, manifested and present to the sight. But when one builds in the Doric way for Minerva, Mars or Hercules, it must be without daintyness: otherwise that would work against the strength and virtue of these divinities. If it is for Venus, Flora, Proserpine or some water Nymphs that one must build a temple, they

This passage puts the three architectural orders into perspective and their function as principles of decoration, assisting the architect in making an appropriate design for the intended purpose. In using the Doric, Corinthian or Ionic order different characters was to be brought forward, each appropriate to a specific group of divinities. The three ancient musical modes were described with similar terms, but instead of being employed for the representation of characters appropriate for gods their purpose was the moral transformation of the human soul. The Doric mode was the heaviest and most appropriate for the education of youth according to Plato's republic; the Phrygian mode was suitable for arousing passions before marching to the battlefield; the Lydian mode in turn was very mild and sad, appropriate for mourning.⁹¹ Following this line of thought, it can be argued that both musical and architectural theory of the Renaissance saw as one principal object of representation the capturing of the appropriate *ethos*, or emotive character, with the purpose of making as efficient an impression on the soul as possible. Alberti repeats what Vitruvius says of the characters of the different orders but he substantially develops the theoretical discussion of ornament in distinguishing its relation to beauty:

"Beauty is that reasoned harmony of all the parts within a body, so that nothing may be added, taken away or altered, but for the worse. It is a great and holy matter; all our resources of skill and ingenuity will be taxed in achieving it; and rarely is it granted, even to Nature herself, to produce anything that is entirely complete and perfect in every respect....ornament may be defined as a form of auxiliary light and complement to beauty. From this follows, I believe, that beauty is some inherent property, to be found suffused all through the body of that which might be called beautyful; whereas ornament, rather than being inherent, has the character of something attached or additional."⁹²

If ornament is that added layer, the *istoria* which makes the work appear in an immediately comprehensible form, directly affecting the senses; beauty might be understood as the deeper universal object of representation, the very outline of cosmos, the principle of the first and divine creation. While beauty depends on the ornament if it is to appear as a

require the Corinthian mode, since that in its proprieties is garnished with delicacies fitting to these Godesses, also note that in order to express their delicate natures one make all the parts simpler and less strong than the precedent, ... If it is for Juno, Diana, Bacchus or other similar gods, one makes to them Ionic temples, in order to keep the middle [position]: since the Ionic order by no means will moderate neither the severity of the Doric or the delicacy of the Corinthian: and thus maintain a good and true propriety."

⁹¹Institution Harmonique, Part II, Ch. IX.

⁹²Leon Battista Alberti On the Art of Building in Ten Books, Book VI, Ch. 2, p. 156.

reflection in the material world; ornament on its own has no value; the representation of emotive characters or fictions always aimed at a purpose beyond the immediate impact. This question may be viewed in relation to what has been said earlier in connection to De Caus' employment of anamorphic perspectives and automata as vehicles that provided the viewer with a double projection: first of oneself and then, through oneself towards God; a God who could not be reached directly but only filtered through the human condition of materiality and corruption. One could also recall Ficino's statement of the power of imitation in song, both of the strength of emotional effects but more importantly the imitation and influence of the heavens. The functioning and meaning of the concepts of ornament and beauty in Alberti might then be compared to melody and consonance in song; both sets of concepts are regulated for practitioners through the classification of the orders or the modes, respectively. Whereas ornament and melody belong to the transient world of humanity, both beauty and consonance have their origin in the eternal and immutable world of God. One might thus further stretch the argument and regard these aesthetic concepts as representations of the metaphysical notions of *musica humana* and *mundana*.

"Beauty is a form of sympathy and consonance of the parts within a body, according to definite number, outline, and position, as dictated by *concinnitas*, the absolute and fundamental rule in Nature. This is the main object of the art of building, and the source of her dignity, charm, authority and worth. All that has been said our ancestors learned through observation of nature herself; so they had no doubt that if they neglected these things, they would be unable to attain all that contributes to the praise and honor of the work; not without reason they declared that Nature, as the perfect generator of forms, should be their model. And so, with the utmost industry, they searched out the rules that she employed in producing things, and translated them into methods of building."⁹³

Alberti saw in "Nature" the model in which to seek the fundamental rule; since Nature was the "generator of forms" it was presumed to employ the same rules established by God in Genesis. He also argued for a direct application of musical proportions to the outline of buildings and rooms. "The very same numbers that cause sounds to have that *concinnitas*, pleasing to the ears, can also fill the eyes and mind with wondrous delight. From musicians therefore who have already examined such numbers thoroughly, or from those objects in

which Nature has displayed some evident and noble quality, the whole method of outlining is derived."94 Since numbers and lines were thought of as immaterial universal properties it was a natural conclusion that what appeared as a perfect proportion in one art would maintain its intrinsic quality regardless of the "site" of its further application. What differed was that which the number or line characterized (tone or spatial measurement) and the nature of its embellishment, whether a gay or sad melody or ornamentation. It must be emphasized that Alberti's theory never was intended to be instrumental. He did not consider it possible for the mortal man to ever reach the knowledge of this "absolute and fundamental rule of Nature" which was the source of the experience of *concinnitas*. Moreover, according to the principles of his theory, even if the "fundamental" rule could indeed be found, the perfection of art would nevertheless not be automatically achieved. For Alberti, as later for De Caus, it was only in the skillful *application* of the rules, to the actual, *site-specific*, work of art, that the true key to the appearance of beauty to human experience was hidden, and this would never be possible to describe exactly with universally applicable rules. De Caus, probably in argument with his contemporaries who were gradually losing the image of the world as a fine set of correspondences, had to further emphasize this point in clarifying the divine nature of numbers and proportions, and distinguish them from the human numbers that had were gradually becoming considered a part of the physical, material world.

Musica Instrumentalis - The Spiritual Vehicle Playing an instrument as a process of understanding

In concluding this chapter on Renaissance music theory in relation to De Caus, the last of Boethius' three species of music, instrumental music, will be considered as a constitutive part of De Caus' theory of human production. It will be recalled that *Musica Instrumentalis* was the kind of music which rests in particular instruments and the proportional principles to be applied in tuning them. In Book III of *Les Raisons*, De Caus discloses the art of constructing organs including all aspects of the craft; from making the pipes to the fine tuning of the instrument (pl.14).⁹⁵ Music had a prominent position in *Les Raisons*, which was

⁹⁴Ibid, Book IX, Ch. 5, p.305.

⁹⁵Livre Troisiesme traitant de la fabrique des orgues; Third book of Les Raisons des forces mouvantes.



Fig. 26: Design of a hydraulic machine operating an organ with water instead of air. (From Salomon de Caus Les Raisons des forces mouvantes, Book I, Prob. 31).



Fig. 27: Detail of a musical wheel, a devise used in De Caus' designs for automata singing or playing on instruments. (From Salomon de Caus Les Raisons des forces mouvantes, Book I, Prob. 30).



PLATE 15

Fig. 29: Diagram relating the musical consonances to the nine muses and the seven planets. (From Gioseffo Zarlino *Le Istitutioni Harmoniche*, Ch. 29, p 102).



Fig. 28: The Mount Parnassus, the muses' heavenly abode, whose top was sought to be reached by the wise man. (From Salomon de Caus Les Raisons des forces mouvantes, Book II, Prob. 13).

TABLE, Hu	1120¢' [2.	122	4	ः 📢	6	7
(1 C \$ 0 - C-		• I T	N	Ċ	Ť	ារដ	Ŕ
OTHNS.			1.1	E C	DID	.	277 R/161V
In this Table 62	we			<u>ь</u> 2	TIV		
AN is be all					O	0,	e e
th been in Pa- Af It	10 2019	P	d d		1994 - P	4	્ષ્ટ
Ale at allohow	HI St.	17.54			Fri. 1	Barf.	Mon-
in (without as		1 A 1					2.4
tint) equally	Second Par	10. 19. 200	- 7	3-2 j		al office	<u></u> .
and in the - Ada	m is Defe	re Morian	Scufibility	Seeing	Lewing	kejoscing _i	Peavenly
nd what he is			G (0. 0-			10 a a	• • •
atan's Deckits	ing for Shar	nef: Sayn	Para	Bitter was	Haing	Defpait.	"affier
hat that Man-	in Cat		1		Glaria	Perer	Divine
ent (whereby		ere State		1. 19 A. 19			Effence
e is become Ad	m in Sim	b- Our gen	Hearing	High	Hamoble I	raifing	Haity
al) is in bies. Per	adije søde	Spirit		1000			a a a
And then now	1990 A 1997		3 6.4 -10		Pride	mathing	Felly

Fig. 30: Interpreting the world through the Divine Word. Jacob Boehme designed four tables of Divine Revelation, seeing in the "out-spoken visible WORD" the beginning of the "external visible world." (From *Four Tables of Divine Revelation*, 1654, in *Essential Readings*, p 220-24).

	443
A Summury of Directions, both for the CHARACTER.	and LANGUAGE, Relating to
(Raderit ; etter ; Chales Chales Chales	Cha-Lan
	Constant Con
Contraction of the Contraction o	Martine - Co
	tente a series a s
The Part of the Pa	and Qual - Tri and Judicial
CL CL CL CL CL CL CL CL	
	Sound & Second & Berindical Sy
Construction of the second	
	the strengt der Letter B.
Constant of the second states	Contracting the st- Continent
Courses ; whether	
	Grand Difference Species
Childrenter Varmer and San Tall Lands (Childrenter) 10	the set has the sales the sales
	and white Was shared the Bandho
Adjudiene Adding, and Will Very Times Wergering Adding Ad	the she yest the yalds the yalds
	nen wird Bas Arekatidh ym Baidho
(Adverse Anting Concession Land Barned Landerse	Here BAR Bairm The Barnah Ling Sclimber
aufenten ; Vie Phend Hember by såding if en die Officienter Ling Bild	
L full Vowel, or by pronouncing # note, in the Course [Long] Dida	

Fig. 31: Mapping the entire world through the word. Wilkins' tables aimed not only at assemblying all existing things and notions, but classified and interconnected them into one true presentation of the world. (From John Wilkins *An Essay Towards a real Character and a Philosophical Language*).

published the same year as *Institution Harmonique*. Many of the machines De Caus demonstrated produced melodies, and music was also an important theme of the stories presented in the grottoes.

In the opening statement the general sense of the word Organo is discussed. Organo was originally a Greek word signifying instrument: being "a general name for all that there is through which another thing is made, as a hammer, saw, knife...are organs through which a work is put in perfection, so are all kinds of musical instruments called organs and the work which shall be made through them is music."% Since the word "organ" was used in this very general sense, it was difficult to trace the history of the particular instrument. In introducing it in this way, Salomon de Caus implies an elevated position for the organ. It is not only regarded a particular instrument, but is also assigned a role as the "ur-organ", the tool of tools. In its present state of perfection, the organ is the instrument which manages the closest representation of the human voice. De Caus also compares the parts (organs) of the organ with the organs of the human body; the bellows with the lungs, the pipes with the throat, the keyboard with the teeth and the hands playing with the tongue. The analogy between organ and body is thus partly based on functional considerations and partly on visual similarities. It is interesting that the human input, the hands, are considered part of the machine in this context. After establishing this prominent position for the organ as the musical instrument closest to man himself, De Caus explains what it takes to become a good organ-maker:

"La science de bien faire & ordonner un jeu d'Orgues, est laborieuse, plaine de grande industrie, & requiert un homme qui aye la cognoissance, au moins de trois arts, premierement est besoing qu'il soit bon musicien, tant en la theorique, pour bein ordonner la mesure convenable aux tuyaux, comme aussi en la pratique, pour joüer& bien accorder lesdits tuyaux, les uns avec les autres, secondement il faut qu'il sçache l'art de plomberie, pour ... fabriquer les tuyaux, chacun en sa proportion, tiercement est aussi necessaire, qu'il aye bonne cognoissance de l'art de menuisserie,... & ayant bonne cognoissance de ces trois

⁹⁸Les Raisons des forces mouvantes. Book III, Introduction: "...car ce mot organo, est grec qui signifie instrument, qui est un nom general, pour toutes choses que ce soit par laquelle, aucune autre chose est faite, comme un marteau, une sie, un couteau..., sont organes avec lesquels un ouvrage est mis en perfection, aussi sont toutes sortes d'instruments musicaus dits organes, & l'oeuvre qui doibt estre faict par iceux est la musique."

arts, il sera capable d'estre bon maistre."97

De Caus emphasizes that the art of making organs depends on more than the hands of a skillful artisan. He refers to it as a science and establishes its basis in musical theory. Seeing that no other author has written of this art, he finds it "necessary for the completion of this book [Les Raisons des forces mouvantes] to demonstrate what this science depends on as much to serve some of the hydraulic machines treated in this book, as for the purpose of constructing other organs."⁹⁸ The claim that he has seen no work on the subject is worth observing. The writing of treatises on the making of machines and other inventions was a relatively recent phenomenon, in the beginning of the 17th century, as Paolo Rossi points out in his Philosophy, Technology and the Arts in the Early Modern Era.⁹⁹ It developed from a growing respect for the knowledge of the artisan. The acknowledgement that actual practical experience could be a source of true knowledge inspired a stream of handbooks, containing both manuals for the making of a specific invention as well as demonstrations of the more universal principles that lay behind the particular method.¹⁰⁰ Theory thus took on a new role as the *fruit* of practice, rather than its opposite. A parallel development took place, as was discussed above, in music, between the traditional musica speculativa and the art of composition. That music was a science particularly suited for maintaining both these aspects had also been noted by Boethius:

"From this it follows that, since there happen to be four mathematical disciplines, the other three share with music the task of searching for truth; but music is associated not only with speculation but with morality as well."¹⁰¹

⁹⁷Institution Harmonique, Book III, Introduction: "The science of making and designing an Organ, is laborious, industrious and demands a man who has knowledge of at least three arts. Firstly he must be a good musician, as much in theory, in order to well prescribe the just measures to the pipes, as in practice, in order to play and tune the pipes in accordance with each other. Secondly he must know the art of plumbing...to make the pipes, each in its own proportion. Thirdly it is also necessary that he has a thorough knowledge of the art of carpentry...With a thorough knowledge in these three art he would be able to become a master."

⁹⁶Ibid, Book III, Introduction.

[&]quot;Paolo Rossi Philosophy, Technology and the Arts in the Early Modern Era, p 41.

¹⁰⁰Tbid, p 42.

¹⁰¹Anicius Manlius Severinus Boethius The Fundamentals of Music, p 2.

The concept of instrument, or tool, appears to have been central to the understanding of knowledge in the early modern era. The "instrument" was the method by which to proceed in the search for truth; it was the tool applied in order to perfect something else, acting in the process as a catalyst or lifegiving spirit. De Caus employs Vitruvius' definition of machines in the preface to Les Raisons: "This word machine, as Vitruvius says, signifies an assemblage and firm conjunction of wood or some other material, which has force and movement in itself or by some means that there is."102 Salomon de Caus was faithful to Vitruvius' definition but he did not mention the further important distinctions which Vitruvius made:¹⁰³ First Vitruvius establishes two species of movement; "mechanical" and "organic". The first moves from "the ingeniosity of art" and the second from "contractions of air." Then there was a difference between "machines" and "organs", distinguishing between that which requires the labour of many workmen and that which demands skill rather than physical force for its operation. The most obvious interpretation of this latter statement, considering it in the light of the modern view of technology, would be that the organ is judged as better by Vitruvius on account of the efficiency due to the ingenious invention. Indra Kagis McEwen has questioned this view in interpreting Vitruvius' use of organs from the original Greek sense of *organon*, arriving at a wider implication of the term; a tool by which matter is made to appear to the senses.¹⁰⁴

In 17th century French the words *machine*, *engin*, *instrument* and *organe* were used with sometimes overlapping significations. In Furetiere's dictionary of 1690¹⁰⁵ machine was defined as: "Engin; an assemblage of many pieces by the art of mechanics which serves to augment the strength of the forces of movement." As a verb *machiner* also implied to think; specifically to invent something clever in one's mind.¹⁰⁶ While *Engin* in Furetiere was said to specifically signify a machine for lifting heavy things in construction, it had been used for

¹⁰²Les Raisons des forces mouvantes, To the reader.

¹⁰³The 1547 Jean Martin French translation of Vitruvius has been used in this discussion, with the purpose of reflecting the 16th century significance of the terms in relation to De Caus. The passage on machines is found in Book X, Ch. I.

¹⁰⁴Indra Kagis McEwen Instrumentality and the Organic Assistance of Looms, Chora 1, pp 123-142.

¹⁰⁶Antoine Furetiere Dictionaire Universal, contenant tous les mots François.

¹⁰⁶Thresor de la langue françoise tant ancienne que moderne de Jean Nicot.

all sorts of mechanical instruments and engins earlier in the century, and moreover it was understood as spirit in connection to the faculty of understanding, deriving from the latin *Ingenium*.¹⁰⁷ The word "engineer" has its origin in the latter, since "genius" was needed for the invention of engins. *Instrument* corresponded in Latin to *Instrumentum* or *Organum* and the organs in the body could be referred to as *"instruments de corps"*¹⁰⁸. It had the more general meaning in Furetiere of "that which serves a cause in producing its effect." Furetiere notes its origin in the Latin verb *instruere*, which is particularly interesting in connection to the contemporary view of the "method" of searching truth as an instrument in itself, and the modern implication in architectural theory of "instrumental" principles. *Organe* was generally used in a similar sense as *instrument*. Furetiere defines *organe* primarily in its biological sense as a part of a living body. The organ "is so disposed ...as to make possible for it to perform an action which is appropriate and particular to it." The verb *Organiser* signified the act of making a musical instrument or singing accompanied by an instrument.

It is in the relation to "thinking" and to "spirit" that the implications of these man-made vehicles are most interesting. The organic movement was induced by air, *pneuma*, which also was the medium of the spirit and that which carried the aural harmonies of music to man. *Esprit* was the *souffle vital*, the life-giving breath, and the principle of life, reason and understanding.¹⁰⁹ In the operation of hydraulic machines the spirit of man and of nature was at work. In inventing a machine man breathed his spirit, or soul, into it. Human reason, in penetrating into the rules or principles of nature, was able to control the spirit of nature and put it to work in a useful machine. The role of the instrument as a paradigmatic concept for this time can thus be understood in the light of its connection to human understanding and reason. Everything that existed in God's creation and all that man had made could in itself be regarded as an instrument which, if played upon by human reason, could be used to reach knowledge of God. In the work of Jacob Boehme, a 17th century German mystic and shoemaker, this analogy is particularly present. In the following quotation he emphasizes the role of the spirit as the skillful musician playing on the signatures of God:

....

¹⁰⁷ Ibid.

¹⁰⁸Larousse dictionnaire du Moyen française - la Renaissance.
¹⁰⁹Ibid.

"And then secondly we understand, that the signature or form is no spirit, but the receptacle, container, or cabinet of the spirit, wherein it lies; for the signature stands in the essence, and is a lute that liest still, and is indeed a dumb thing that is neither heard nor understood, but if it be played upon, then its form is understood, in what form and tune it stands, and according to what note it is set. Thus likewise the signature of nature in its form is a dumb essence; it is as a prepared instrument of music, upon which the will's spirit plays; what strings he touches, they sound according to their property."¹¹⁰

In this light, the significance of De Caus' third book in Les Raisons becomes clearer. The organ is not only a technologically advanced hydraulic machine, but "the" instrument which most closely imitates the human voice. In inventing and perfecting this machine, man is re-producing God's signature left in man. The sole purpose of this "reproduction" is to assist man in understanding God. Not until the organ is played upon and made to produce harmonic songs, will man be able to see more clearly "the hidden spirit" and the "essence of all essences" in God.¹¹¹ Salomon de Caus saved the secret of this powerful invention until the end. In the last line of the book he promises to show a rare machine at a later date, "which will represent a music more perfect than any human creature could ever produce, neither with the voice nor with manual instruments."¹¹² The implications of this last promise is of course very serious. The making of a machine that surpassed the natural human voice, the "ur-organ", implied that a decisive step had been taken in approaching the knowledge of God. It meant that the operation of the principles of nature could be considered a more perfect source of knowledge if working through the artifice rather than through man himself. While man was God's instrument, the artifice now became man's. Nevertheless, as discussed above, De Caus was careful to always remind the reader of the superiority of God, and man's eternal dependency on His resources for the operation of all man's artifices.

The *musica instrumentalis* as the aural product of human artifice is what actually establishes the medium for the understanding of God in man. De Caus' book on the making of organs complements the *musica mundana* and *humana* of the *Institution Harmonique*, with the instrumental, sensual music that had to stand in between. Without the "organ", supplying

¹¹⁰Jacob Boehme Essential Writings, p 58.

¹¹¹Ibid, p 60.

¹¹²Les raisons des forces mouvantes, book III, p 8: "une qui representera une musique plus parfaicte qu'aucune humaine creature ne peut faire, soit avec les voix ou instruments manuels."

the means of perfecting without taking part itself, both the composer and the philosopher would stand helpless and unable to establish the link between man and God, microcosm and macrocosm, which was the true purpose of their efforts. The book seems to have been placed as a link between the two treatises on music and machines, signifying their mutual interdependence, and being the "nodal point of exchange" between theory and practice. In Boethius' observation, quoted above, that music was fitted not only for the contemplation of truth but also for the moral transformation of man, lay the key to the interdependency between the three kinds of music. The instrumental music had to exist in between the immutable and the corruptible, to make sure that they were kept distinctly separate and to act as the spiritual medium between the two.

The above related discussion on the significance of the modes and the implication of seeing their function as a prescriptive tool was more present in Zarlino than in De Caus' Institution Harmonique. The modes are mostly understood as a very practical tool in De Caus' treatise and he never went to much trouble to explain its essential significance on a theoretical level in the way that Zarlino had done. Salomon de Caus' was evidently more interested in the application of theory to practice than in the metaphysical implications of theory in itself. Indeed, what he had learnt from Pontus de Tyard, Zarlino, Fogliano, Gafurio and many other writers on the subject, had probably been appropriated with the explicit intention of putting the theory into practice. Nevertheless De Caus' treatise shows a deep concern with the more essential and foundational aspects of the science of music. In brief passages deep metaphysical questions concerning the limits of human knowledge and God's intention with his creation, are fitted into the text at pivotal points. In illustrating the modes with psalms, their ethical significance stands out clearly; music has its primary justification in elevating souls up to God, and in making Him appear more clearly in His own creation. In his works Salomon de Caus demonstrates rather than describes the essential nature of music and the appropriate way of using it. He uses a firm structure for his treatise in which he separately lays out how to operate beween the two poles in music, the worldly and the human. In a parallel treatise, Les Raisons, De Caus provided the key to the actual "production" of music by the instrument. It might be significant that, even though the two works were written at the same time, Salomon de Caus first assured the publication of Institution Harmoniaue before giving Les Raisons to the printer. One could imagine, that by

this he wanted to make sure that he would not be responsible for any fatal misunderstandings as to the true purpose of the making of machines. Without the worldly and the human music, without God as the beginning and as the end of human endeavour, De Caus feared that the instrumental music and the actions of man would prove aimless and be easily lead astray.

Salomon de Caus was not concerned with writing philosophical discourses, even in writing he was primarily a maker; the books in his hands were treated as artifacts just as his gardens and grottoes were composed to be read as books. In the following concluding chapter this interdependency between word and world in De Caus' works will be discussed. It is significant to grasp at this point that this method of writing and making has an important ground in the changing attitudes towards practice that have been observed in the 16th century.¹¹³ To "show" rather than to "say", to provide an instrument rather than to call for theoretical discourse, was considered the most appropriate way of conveying knowledge. Salomon de Caus clearly placed himself among those who refused to respect the "Ancients" on any other grounds than the actual truth, as proven to experience in contemporary practice. He saw the history of music as a history of the perfection of a science.¹¹⁴ Even if the aim was to approach what man once had before the fall, De Caus does not seem to be of the opinion that the Ancients for this reason could have known better than the Moderns. This is why De Caus has trouble in understanding the reason for Zarlino's detailed description of the "useless" Greek scales. He also complains in Les Raisons about the modern writers Augustin Ramelli and Jacob Besson for describing machines that are mere products of the mind and have not been tested to experience.¹¹⁵

To the modern mind De Caus might seem to favour practice to theory. Nevertheless the novelty in this historical situation, which De Caus' works reflects, was rather the inclusion of theory in practice. It was the mutual presence of both which guaranteed the correct operation of these "vehicles" or "instruments" for knowledge. It was still important to maintain a certain distance between theory and practice, which De Caus emphasized

¹¹³See above. Paolo Rossi Philosophy, Technology and the Arts in the Early Modern Era, p 41-62.

¹¹⁴Institution Harmonique, On the Origin of Music; Book I, Prop. XXXXIIII.

¹¹⁵Les Raisons des forces mouvantes, To the Reader.

through the disposition of his musical treatise. "In the second part", he writes in his dedication, "I give the means to put the said proportions to work."¹¹⁶ Composing, "is performed through an assemblage of consonances, mixed together, in a way that the parts can all correspond one against the others with good proportions, which was treated in the first book, and also that the meaning of the lyrics are put to a fitting song...That is the two principal points of this science: and moreover one is required to conduct the said counterpoint with good invention. Now this invention is a gift from nature, which cannot be aquired through study...And as poetry and painting require men of inventive nature, so does the composition of music require a similar natural disposition."¹¹⁷

In opening the practical part of his *Institution* with this statement, Salomon de Caus establishes that the purpose of his text is only to provide the ground from which the composer can operate. By no means does he see his treatise as holding the truth or being an end in itself, which is consistent with the way he saw the human search for knowledge: "There is no science that man can know in which there will not always be something to augment, in order to make it more perfect....The science of music which was invented a little after the creation of the world, and always have been pursued by excellent personalities up to our present time, seems to be in a state of perfection. Nevertheless we cannot be sure that those who come after us will not find things which we have ignored."¹¹⁸ The reason for this limit to human knowledge was, according to De Caus, that God thought it better to keep reminding man of his ignorance. Whatever man does can therefore never be truly complete in itself, all human works will always be silent if they are not touched by Divine inspiration;

¹¹⁶Institution Harmonique, Dedication: "en la seconde partie, je donne le moyen de mettre lesdites proportions en oeuvre"

¹¹⁷Ibid; Part II, Proëme: "...Composition, laquelle se fait par une assemblage de consonnances, meslées ensemble, en sorte que les parties se puissent toutes correspondre les une contre les autres avec des bonnes proportions, telles comme a traité au premier livre, & aussy que le sens de la parolle, soit fait sur un chant convenable à ycelle...Voila les deux principaus points de ceste science: et en outre il est requis de conduire ledit Contrepoint avec une belle invention. Or ceste invention est un don de nature, lequel ne se peut acquerir bonnement pas estude....Et tout aynsy comme la poesies et la peinture requirent gens de nature inventifs, aussy la Composition de la musique requiert une semblable naturelle disposition."

¹¹⁸Institution Harmonique On the Origin of Music: "car il n'i a science aucune que puisse savoir l'homme, ou il n y a quelque chose a augmenter, pour la rendre plus parfaite....ceste science de Musique laquelle comme est dit a esté inventee un peu apres la creation du monde, & tousiours a esté poursuivie par d'excellens personnages jusques à present, & semble qu'elle soit en sa perfection, toutefois nous ne pouvons asseurer que ceux qui viendront apres nous, ne trouvont encores plus choses par nous ignorees."

as happens when a skilled musician makes the worldly music appear through an instrument and affects the harmony of human music.

This "invention" or inspiration that the skilled musician, composer, artist or poet had was a gift from Nature according to De Caus. The study of nature was also the first stage on the ascent of the Mount Parnassus as pictured by Pontus de Tyard (fig.28). Through "poetic enthusiasm, proceeding from the gift of the muses", the soul was awakened and well-ordered, ready to contemplate nature with new eyes.¹¹⁹ What has been seen in this chapter is that the *musica instrumentalis* could act as a metaphor for all that was in between the Divine boundary and the body of man. *Musica mundana* was hidden in God, the eternal unchangeable harmony, and *Musica humana* in man, what held the corruptible and mortal together. "Instrument", as tool, medium, spirit was the essential metaphor for the acquiring of human knowledge; the automata of De Caus were important sources for the experience of truth in their operation. Man making music - this was the act of constructing the bridge to wander back to the native star. In "theory" the shimmering goal was pointed out far away in the distance, in "practice" the foundations of man's end of the bridge were laid and the tools provided for the beginning of a solitary journey, guided by reason and the muses' inspiration, alone.

¹¹⁹Frances Yates The French Academies of the Sixteenth Century, p 80.

4. READING THE PALATINATE GARDEN Myths, metaphors and metamorphoses - Conclusive chapter

Having now considered at length the collected theoretical writings of Salomon de Caus, we have arrived at the site where he put these words into matter, the Hortus Palatinus in Heidelberg. As the site where De Caus could perform his duty as a true Archemaster most successfully, using all available means to bring powerful and synaesthetic experiences to the visitors; the garden will be used in this chapter to conclude this thesis. The discussion is focused on the interaction between the composition of the garden as a spatial structure, and the individual "events" which take place in the different parts of the garden. It will be argued that De Caus worked on the design of his garden according to principles similar to those used in the composition of his theoretical treatises. As has been noted, the conscious interplay between structure and event, can be claimed to turn De Caus' books into gardens; similarly here, his garden might be read as a book. This interchangeability between spatial and textual organization was not particular to Salomon de Caus but the natural outcome of working in an age which still regarded text and letters as a material part of physical reality. As was the natural world, the human language was one of the instruments God had given man. Hidden in its present state of corruption the original truth could be expected to be found. The quest for the Ursprache, the original language, was pursued on many corresponding levels in the beginning of the 17th century; it was believed to be hidden in ancient texts as well as in the book of nature. Before entering the garden, a brief overview of the quest for the Ursprache will be offered, in order to clarify the crucial interrelation between language and materiality in De Caus' world. Francis Bacon saw in the mythological figure of Pan an allegory of Nature and his interpretation of Pan's origin elegantly weaves together words, matter and corruption as the original principle of Nature:

"Pan as the very word declares, represents the universal frame of things, or nature. About his origin there are and can be but two opinions: for Nature is either the offspring of Mercury - that is of the Divine Word (...) - or else of the seeds of things mixed and confused together ... The third account of the generation of Pan ... applies to the state of the world, not at its very birth, but as it was after the fall of Adam, subject to death and corruption. For that state was the offspring of God and Sin, and so remains. So that all three stories of the birth of Pan (...) may be accepted as indeed true. For true it is that Pan, whom we behold and worship only too much, is sprung from the Divine Word, through the medium of confused matter (which is itself God's creature), and with the help of sin and corruption entering in"

The belief in the existence of an *Ursprache* had its foundation in the Mosaic Genesis. In the Garden of Eden Adam had been assigned the task of naming all the beasts and fowls God had created for him: God "brought them unto Adam to see what he would call them: and whatsoever Adam called every living creature, that was the name thereof."² At this moment Adam created the first language and his names were believed to have reflected the immediate truth of God's presence in His creation since this occurred prior to the fall. As Jacob Boehme, the German mystic hom we encountered at the end of last chapter, makes clear in his description of this episode of Adam's life; the names of the Adamitic language reflected the true essence and spirit of each beast:

"When God had created Adam thus, he was then in paradise in the joyfulness; ... man was wholly beautiful, and full of all manner of knowledge; and there God brought all the beasts to him (...), that he should look upon them, and give to every one its name, according to its essence and virtue, as the spirit of every one was figured in it. And Adam knew what every creature was, and he gave every one its name according to the quality of its spirit. As God can see into the heart of all things, so could Adam also do, in which his perfection may very well be observed."³

Even after the fall the original language was preserved: "And the whole earth was of one language, and of one speech,"⁴ until man challenged God a second time in building a tower "whose top may reach unto heaven."⁵ God's punishment was, as we know, to "go down, and confound their language that they may not understand one another's speech."⁶ After this man was both separated from the reflection of truth in language and condemned to eternal disputes that scattered men over the earth. The eariy 17th century projects for the recovery of the original language aimed at solving both these problems; to reunite man with truth and to bring peace to mankind. Language was a human instrument for the mediation

¹Francis Bacon The Wisdom of the Ancients in A Selection of His Works, p 280-81.

²The Holy Bible, Genesis 2:19.

³Jacob Boehme Essential Readings, p 119-20.

⁴The Holy Bible, Genesis 11:1.

⁵Ibid, Genesis 11:4.

⁶Ibid, Genesis 11:7.

of knowledge as well as the means for intersubjective communication. For language, as for an instrument, the material components of which it was assembled, letters and words, were as important for its functioning as the structure of the whole. Letters and words were in themselves considered important fragments of an original truth. George Steiner writes: "In Merkabah mysticism, each written character may be regarded as embodying a fragment of the universal design of creation; ... Those numinous letters whose combinations make up the seventy-two names of God may, if they are probed to the hidden core of meaning, reveal the cipher, the configurations of the cosmos."⁷ It is this belief in the "embodiment" of truth in letters and words which makes the linguistic structure of the early 17th century so particular. It is here that the key to understanding the close interaction between matter and text at this time might be found. The word was not only a sign for something else, it held the essence of Divine truth; in itself it did not only re-present, but presented in its own being a fragment of the Divine.

For Jacob Boehme every thing had the signature of its essential quality written on its surface. He wrote: "[A]s it stands in the power and predominance of the quality, so it is signed and marked externally in its outward form, signature, or figure; ... everything as it is inwardly so it is outwardly signed...^{"8} For Boehme, the signature was the necessary vehicle for the process of human understanding. In the signature the inward spirit was materialized and lay open to be assimilated in the human mind. The signature was the medium for the spirit: "[I]f his [God's] sound and spirit out of his signature and similitude enter into my own similitude, and imprint his similitude into mine, then I may understand him really and fundamentally...^{"9} At the root of Boehme's theology lay the hermetic idea that the Divine *mens* was present in the human mind. He used the metaphor of a book to explain the Divine imprint on the mind. It was God who "opened" this book to him; "I have written", he says, "out of my own book which was opened in me, being the noble similitude of God, the book of the noble and precious image (...) was bestowed upon me to read."¹⁰

⁷George Steiner After Babel, p 63.

⁸Jacob Boehme Essential Readings, p 60.

^oTbid, p 57.

¹⁰Tbid, p 65.

Materiality, in Bochme, as has also been noted in his contemporaries, was understood as a prerequisite for the mediation of knowledge to man. It was in their materiality that words, as signatures, manifested meaning. God left his signature not only in man, but everywhere in the natural world:

"Therefore the greatest understanding lies in the signature, wherein man (...) may not only know the essence of all essences; for by the external form of all creatures, ..., the hidden spirit is known; for nature has given to everything its language according to its essence and form, for out of the essence the language or sound arises, ...

Everything has its mouth to manifestation; and thus is the language of nature, whence everything speaks out of its property, and continually manifests, declares, and sets forth itself for what is good or profitable; for each thing manifests its mother, which thus gives the essence and will to the form."¹¹

It is important to insert a qualification here which characterizes the shift from seeing a similitude between essence and word, to the later belief in the possibility of finding a oneto-one correspondence between words and things. In John Wilkins' attempt to create a philosophical language and in Gottfried Leibniz' search for a universal character in mathematics, the distance between the signifier and the signified, the "word" and the "thing", can be said to be very close to collapsing. It is a fine line which De Caus, Bacon or Boehme never stepped over, since they all saw that in materiality was provided a friction which made any representation different from its original. Wilkins' project represents the most extreme instant of the quest for a universal language. His An Essay Towards a Real Character, And a Philosophical Language of 1668 presents a language based on a firmly structured classification of all things and notions. Every single existing thing is supposed to have its place in Wilkins' tables. By inventing signs signifying the place in the tables, and a grammar prescribing the composition of the signs into sentences, Wilkins constructed a true philosophical language which would end the confusion inflicted on mankind by Babel (pl.16). His interest lies mainly in the unification of mankind and the founding of a system which will facilitate learning. He wrote: "I shall assert with the greater confidence, That the reducing of all things and notions, to such kind of Tables, as are here proposed (were it as compleatly done as it might be) would prove the shortest and plainest way for the attainment of real

¹¹Ibid, pp 60-61.

Knowledge, that hath been yet offered to the world."12

Wilkins appears to be no longer searching for the Ursprache, even if he believes in the Biblical account of its existence. Taking the world as it "is" he rather gathers all that he finds, in a true Baconian manner, and classifies it according to a system which he believes to be the same as the world order. It is a subtle difference, but I would argue that Wilkins. in contrast to Boehme, no longer looks back to find the hidden truth. Instead Wilkins constructs his language based in the present and aiming for future progress. Wilkins' system is reductive in the sense that it attempts to erase all ambiguities in language; to make it so exact that in fact no poetic language would be possible. Metaphorical language relies on ambiguities, and plays on the possibility of saying the same thing with different words and different things with the same. Wilkins complains of words signifying more than one thing: "In regard of *Equivocals*, which are of several significations, and therefore must render speech doubtful and obscure; and that argues a *deficiency*, or want of a sufficient number of words." As an example Wilkins takes the Latin word Malus, which "signifies both an Appletree, and Evil."13 This example, illustrates very well the potential threat which Wilkins' system poses to poetic meaning. The junction of apple-tree and evil in one and the same word, is of course highly significant, but on a level which Wilkins' language cannot account for.

Leibniz' search for a universal character is of a much more abstract nature than Wilkins'. Through mathematics he attempted to unify the order of things and their names. "[T]here is nothing which is not subsumable under number. Number is therefore, so to speak, a fundamental metaphysical form, and arithmetic a sort of statics of the universe, in which the powers of things are revealed."¹⁴ His intention, as Wilkins', was to reduce disputes, which "arise from the lack of clarity in things, that is, from the failure to reduce them to numbers."¹⁵ Leibniz' universal characteristic had very much in common with modern

¹²John Wilkins An Essay Towards a Real Character And a Philosophical Language, Epistle.

¹³Ibid, p 17.

¹⁴Leibniz Towards a Universal Characteristic [1677] in Selections, p 17. ¹⁵Ibid, p 24.

symbolic logic, which Wilkins' philosophical language also had to an extent, and in a certain way, they can both be said to prefigure the loss of poetic meaning in the modern era.^{1b} Nevertheless neither of them ever arrived at a completely transparent world. For both there was still the existence of the Prime Mover, the First Cause, who was present in the world and admired as its mathematical equation. They were part of an age which brought truth within reach of man. Therefore they could argue, in a way that neither De Caus nor Boehme would ever have believed possible, for the attainment of truth through an enquiry into the present state of things. Truth was to be found here and now for the benefit of the future; it was no longer to be searched for in the past before the fall or far away in a distant unreachable God. The difference from Boehme's world is stated clearly by Galileo:

"Philosophy is written in this grandest of all books forever open before our eyes (I mean the universe), but which cannot be understood if we do not learn to first understand the language and interpret the characters in which it is written. It is written in mathematical language, the characters are triangles, circles and other geometrical figures, without which it is quite impossible to understand a single word: without these there is only aimless wandering in a dark labyrinth."¹⁷

Still using the metaphor of the book, no longer of nature but of the universe, Galileo does not at all consider outward signs as they manifest themselves in matter. He goes behind the things to find the underlying mathematical formula directly. Thus the immanent layer of materiality that mediated knowledge in the Renaissance had definitely been declared useless for the pursuit of Divine truth. Having now placed De Caus' garden in the context of the quest for the *Ursprache*, we might be better prepared to read it both as a reflection of the book of nature and of the original *Urgarten* itself.

¹⁶George Steiner After Babel, p 78.

¹⁷Galilei Galileo quoted in Paolo Rossi Francis Bacon - From Magic to Science, p 220.

"Post Tenebras Spero Lucem"¹⁸ A garden for the new dawn

In the years between 1613 and 1620 Salomon de Caus was employed by the Palatinate elector Frederick V, who had married the English princess Elizabeth; a marriage with deep symbolic significance for the Protestant states of Europe. As Frances Yates points out in The Rosicrucian Enlightenment, Bohemia was at this time an important centre for Protestant utopian thought and magico-mystical activities, and the place where the first Rosicrucian documents appeared.¹⁹ The Palatinate Court, and the garden De Caus structured around it, were for many reformers the very image of the philosophy they encompassed; the reformation of the world that would bring humanity back together in harmony with nature and the universe. One important idea behind the fraternity of the "Rosy Cross" was the active pursuit of the preparation of the world for the "new dawn"²⁰, a preparation that should be pursued in silence. The method was to spread out as an "invisible college" in the world and mix in with humanity without revealing the true mission, to "cure the sick."²¹ Teaching in this "college" was a matter of showing the "way" rather than preaching the "truth". It was structured as an underground guerilla movement, focusing in the margins on individual change rather than asking the individual to join a system of belief. As Richard Patterson argues in his two articles on the subject, it seems likely that the "Hortus Palatinus", in itself had a similar function; to demonstrate a way to go through life within a framework of change and transformation, while at the same time making manifest the existence of a larger timeless structure.²² The invisibility of the Rosicrucian brothers was in itself such a metaphorical structure; according to their scheme they could continue to exist as a unity forever, but in life they would only be noticed in the effects of their actions.

¹⁹This sentence appears on an emblem in Salomon de Caus' *La Perspective avec la raison des ombres et miroirs*, Chap. 15.

¹⁹Frances Yates The Rosicrucian Enlightenment, Chs. 1, 2 and 6.

²⁰Ibid, p 232.

²¹Ibid, p 243. From *Fama Fraternitatis* reprinted in appendix: "The agreement was this: First, That none of them should profess any other thing than to cure the sick, and that *gratis*..."

²²Richard Patterson *The 'Hortus Palatinus' and the Reformation of the World*. Two major axes are identified in the garden, one which reads as "atemporal and universal" and another which reads as a "narrative" of an event; "the reascent of the soul."

•


PLATE 17





Fig. 33: Perspective of the Palatinate Garden (From Salomon de Caus Le Jardin Palatin, fol. 2).





Fig. 34: The 'Royal' parterre; a garden within the garden this is the starting point for De Caus' itinerary through *Le Jardin Palatin*. (From Salomon de Caus *Le Jardin Palatin*, fol. 3).





Fig. 35: The parterre for orange trees and melons, hiding the musical consonances in its geometrical lines. (From Salomon de Caus *Le Jardin Palatin*, fol. 6).

PLATE 18







Fig. 36: The column of the first parterre with the Reichsapfel at the top. (From Salomon de Caus Le Jardin Palatin, fol. 4).

y





Fig. 37: The cubefountain; the "ideal" form of the natural world overgrown with the wilderness of untamed nature. (From Salomon de Caus *Le Jardin Palatin*, fol. 16).



Fig. 37: The cube as the figure of the perfect man. Engraving from George Wither *A Collection of Emblemes*, 1635. (From W.A. Mc Clung *The Architecture of Paradise*, p 56).



Fig. 39: The grotto of the animal kingdom where the wonder of the forces of the natural elements, fire and water, are displayed in the background. (From Salomon de Caus *Le Jardin Palatin*, fol. 22).



Fig. 40: The philosophers' grotto. On the rocks in the background grow two coral branches, probably signifying the philosophers' stone; the attainment of which was the aim with the journey through the garden, as well as through life itself. (From Salomon de Caus *Le Jardin Palatin*, fol. 26).

What remains of the garden today is very far from its original state. In its short lifetime the site became very famous for its marvellous water-works and was regarded as the eighth wonder of the world.²³ It was, nevertheless, partially destroyed during the Thirty Years War that immediately followed its construction. It is somewhat ironic then, that even in discussing the garden, once materialized and fully present to all senses, we have to rely on De Caus' written work, imagining what it might once have communicated. Before he left Heidelberg in 1620, Salomon de Caus collected his designs for the garden in a book in which he also explained in short passages how these designs worked. This book, published in 1620 in both French and German, naturally follows a very different pattern from his other writings; here it is an existing reality that is to be preserved and communicated, not its underlying order. When he wrote, the war had already begun, and he was more than conscious of the possibility that his garden would never be finished, or perhaps even be entirely destroyed. In the following discussion we will follow his own itinerary through the garden, supposing that the order in which he placed the folios was a conscious and significant choice.

Hortus Palatinus - Walking the Text

The garden and its works grew out from the only flat piece of land which could be found in direct connection to the Palace. As De Caus points out, the earlier Princes had arranged their garden further down towards the town and river, but to avoid that inconvenience he assisted the Prince in "flattening" out the hillside and constructing the garden in terraces along the hillside. This resulted in an L-shaped garden with at least six different levels, many different parterres and fountains; and two locations for grottoes (pl. 17). Salomon de Caus' point of departure for the itinerary is positioned in the angle of the 'L', the parterre which was first constructed and is a walled garden in itself (pl. 18). Obviously this parterre is of essential importance, being the garden within the garden, and located in the meeting point of the two axes, a point of transition and of stillness, both end and beginning. The fountain in the center is octagonal with a rustic Ionic column, holding on top of it the *Reichsapfel* - the apple of the kingdom - a symbol of the divine justification

²³Lili Fehrle-Burger Der Hortus Palatinus als "achtes Weltwunder", p 106.

of the royal power. This parterre obviously represented the very conjunction of heaven and earth, symbolised by the King as the mediator between the two. Its place within the garden assures the radiation of this royal "spirit" into every part of it. As God created Eden so did Frederick create this earthly paradise.

After this follow a series of parternes and constructions which demonstrate a wise management of the elemental forces, most notably the sun; emphasing its role providing the means of both "prediction" and "production". The sun provided both a fixed point of reference and made possible the everlasting transformation in cyclical growth and decay on earth. The first parterre works as a solar clock; Urania, the muse of astronomy, casts her shadow on the embroidered ground, which displays the shape of a royal crown in each quarter. The four entrances to this parterre are flanked by the eight remaining muses. The nine muses thus assembled to bring down the wisdom of the sun. In the second parterre orange trees and melons are placed in the summer between labyrinthine paths forming an intricate geometrical figure; a star with eight corners inscribed in a square and in its center a circle of eight trees surrounding a cubical base holding the middle tree (fig. 35). Patterson suggests that this figure is derived from the diagram of the Ottonario in Institution Harmonique, the figure described above in chapter three which shows all consonances to be contained within the number eight (pl.12), implying that the parterre represents the harmony of music as hidden in nature.²⁴ The likeness between the two figures is not at all striking on the surface, and demands the operation with a compass to be found. Thus the order in nature was only to be found if subjected to human reason. What is evident to the immediate experience of the observer is the significance of the number eight as well as the implicit connection between the centered cube in this parterre and Urania in the former; cubic earth and elemental production was preceded by the eternal truth of the heavenly fire.

The next parterre introduces the element of water as the purifying substance, represented by statues of women washing their hair and shirts and a male figure protected from the water by a "royal" umbrella, crowned with a smaller version of the *Reichsapfel*.

²⁴Richard Patterson The 'Hortus Palatinus' and the Reformation of the world, Part I, pp 85-87. See Institution Harmonique, prop XVIII.

The orangery, which takes up the following three folios, is the great pride of De Caus' garden. It was both a means by which oranges could be grown throughout the year, a symbol for the possibility that man might make the eternal spring return. The orange was after all the mythical golden apple of the Hesperides with connections back to Eden.²⁵ This part of the walk culminates in the flower parterre, continuing the theme of eternal spring and contrasting it with seasonal change. In planting flowers specific for each month in sections sequentially ordered in a circle, the parterre becomes a calendar, demonstrating change as well as the recurring pattern of the heavenly gifts to man. In the "Grand Pavillion," the intended use of which remains unknown, the reader is offered a rest before descending to the lower gardens. Patterson suggests that this building might have been intended as a laboratory or for housing a collection, a *Kunst und Wunderkammer* perhaps.²⁶ However, the building was never completed.

Salomon de Caus lets the reader pass through the lower gardens with only a brief glance at its fountain with river gods representing the Main and the Neckar and two embroidered parterres, before he "returns to speak of the higher level." Here in the opposite end of the 'L', close to the entrance of the garden, is a rustic fountain in the shape of a cube, whose side, according to Patterson, is the module with which the whole garden has been composed.²⁷ The cube, platonic symbol of earth and man, is covered with rocks and shells, contrasting nature with its own foundational principle (pl.19). It is placed in an octagonal basin, a polygon on its way to becoming a circle. In connection to this implied transition of geometrical forms, from the earthly cube to the heavenly circle, it is interesting to note that it was impossible to truly represent round forms in perspective with the help of reason. According to De Caus' instructions in *La Perspective* all curved lines had to be constructed in perspective through imagining points on the line, making the circle into a polygon, and then, when these points had been put into perspective, drawing the line between them by hand (pl.9). When doing this the artist could no longer rely on reason but had to trust his

²⁵Ibid, p 88.

²⁶Ibid, p 97.

²⁷Ibid, p78.

own *judgement*.²⁸ The basis of nature, the cube, was comprehensible to the human mind and thus also representable according to the principles of geometry, as was its container, the octagon. Number eight, significant for De Caus as that number which held all consonances, still held the earthly human perspective. Nevertheless, as the true divine harmonies could not be comprehended in human numbers, the perfect circle could never truly appear to the human senses. The Divine circle would not let itself be represented in perspective based as it was on human geometry.

Having pointed to the cube with all its significance. De Caus moves the reader's perspective upwards, to allow an overview of the garden; from the smallest part, the module, to the whole. Here there are four green cabinets with fountains taking the water through a stair to a lower level with Venus and a Cupid in a pond. The stair seems inspired by Serljo's classical theatre-type; its concave upper part shifting into a convex lower part. Passing a statue of his Highness, Frederick V, standing high up on top of a niche with Neptune below, we are led to the first set of grottoes, which are entered through a portico "composed of twelve animals". These grottoes have no human statues, but display so many inventions that it "takes well one hour to see all of them". In the drawing De Caus appears to suggest a play with hidden sources of light in a Baroque manner. Daylight filters through from deep inside the cave and lights up the spurting water from behind (fig.39). Passing a reclining giant or river god, seemingly a direct quotation from Pratolino, the Italian garden De Caus had visited in his youth, through a series of smaller parternes, the reader is led to the last adventures, the grottoes representing human life and society. The first grotto is framed by a gallery portraying the Herculean labours. The grotto serves as a small dining hall with walls covered in rocks, shells and corals, and refreshing water running down the walls from three rivergods (fig.40). The space has a very ceremonial character, and it seems likely that it signified a process of cleansing, of purification. This interpretation is strengthened by the presence in the fountain of coral branches, often associated with the philosophers' stone,²⁹ and the

²⁸La Perspective avec la raison des ombres et miroirs, Part I, Ch. 7.

²⁹Michel Conan *Postface du Jardin Palatin*. Conan draws a parallel between an emblem in Michel Maïer's *Atalanta Fugiens* where a man finds the philosophers' stone in a river in the shape of a coral branch and De Caus' grotto. Conan suggests that the allegorical significance of this correspondence was that the Philosophers' stone, signifying the arts and wisdom of the muses, should considered as a present guiding force at the Heidelberg Court.

118

theme of the gallery, as the labours in themselves were a form of redemption, a cleansing process washing off the original sin.

After this the reader is brought into a warm bath where he can listen to the three antique genres of music, the Diatonic, Enharmonic and Chromatic played by a Satyre; and see Narcissus (fig.7) admiring his own reflection beside a petrified nymph who is squirting water from every orifice. The end of the "walk" brings the reader back to himself and asks him to contemplate what he has seen in this recreated original garden. As we remember, the journey started out in the parterre of the column fountain, with a statement from the ruler, that here it is his order that is implemented, but his order is that which he received from God. The act of constructing the garden had been a literal re-enactment of the Divine creation. Out on the terrace an overview is offered again. In offering this composition as an earthly reflection, emphasized by the presence of Narcissus as indeed not being the *same* as the divine, and in reminding the reader of the walk as a redemptive, purifying process; De Caus makes sure that the distance is safely kept between copy and original, human life and Divine omnipresence. With strengthened faith and admiration, the reader goes out and returns to his place within the world.

Hortus Palatinus - Looking Back

Looking back on the garden just visited and comparing the view given through De Caus' text with what one can actually see depicted in the plan and perspective certain surprises may be discovered. Especially noticable is the oval maze, very prominent in the perspective but completely left out of the text by De Caus. The reasons for omitting elements could be many. Michel Conan suggests that there might have been a second reading to this garden which should remain a secret only admissible to the initiated. If this second level did exist, it seems a likely conclusion that Salomon de Caus, in the light of the recently initiated religious war and knowing that he was soon to return to Catholic France, would try to give as little as possible away of its magical or mystical intentions. Another possible interpretation is that, as in the case of the oval maze, De Caus himself was not the author of the design.

Patterson connects the maze, specifically the obelisk in the center, to other prominent scholars in and around Heidelberg at the time. Trigonometry was being developed as a new branch of mathematics which provided a new method of describing space, more universal than the geometrical coordinates of artificial perspective. One of its pioneers was Georg Joachim Rheticus, who, in 1596, had published the earliest trigonometric tables, having on its title page two obelisks. The obelisk was a strong symbol uniting the new scientific discoveries with ancient Egyptian origins, glorifying the sun as the true source by which time and space might be measured. As Patterson observes, the oval was not at all a common garden shape at this time.³⁰ From our viewpoint it is easy to make the literal association to Kepler's heliocentric universe with its elliptical orbits. However, this interpretation remains strongly hypothetical, relying on a close connection between the parterre's designer and advanced contemporary scientific debate. Kepler had put forward his hypothesis in 1609, less than ten years before the Heidelberg project³¹. If the parterre had been constructed as a representation of a heliocentric universe, where the planets, including the earth, moved around the sun in elliptical orbits, Salomon de Caus is not likely to have been its designer. De Caus clearly declared, as late as 1624 in his treatise on sundials, that he was not in agreement with the theory of a heliocentric universe.³² The reason why De Caus did not speak of the oval maze might thus have been that he did not find it fitting to his overall composition of the garden, and maybe it even contradicted it. When "publishing" the garden it became truly his, and there was no reason not to describe the garden as close to his own underlying scheme as possible. After all, not everything which was in it was built, and yet he walks the reader through it as if it were.

The Heidelberg gardens displayed a variety of influences from European garden styles; Italian, Dutch and French. According to Roy Strong the garden should in its totality be considered as part of the garden history of England.³³ Possibly regarded as a stylistic

³⁰Richard Patterson The 'Hortus Palatinus' and the Reformation of the World, part I, pp 93-95.

³¹Fernand Hallyn The Poetic Structure of the World, p 204.

³²In the discourse on proportions in *La Pratique et demonstration des horloges solaires* Salomon de Caus argues for a geocentric world-view, based on first "that it is dangerous to challenge well rooted beliefs' and second "that it says in the Bible that the sun turns around the earth." He concludes the argument by saying "We must thus stop curiosity within the limits of our religion."

³³Roy Strong The Mannerist Garden p 110. (Ch. 4 of The Renaissance garden in England).

weakness, this method of combining "quotations" was not something which Le Caus employed only in his garden designs, but an overall strategy for collecting knowledge. As a collection of rarities in the Renaissance was as much an encyclopaedia in the individual significance of each object as in the overall organisation of the work; so were De Caus' gardens and books advanced structures uniting many layers of significations where the smallest detail always echoed the whole in some sense. This organizational principle, rather than its stylistic appearance to the eye, the world about which it was made to speak, is what makes the garden an appropriate testimony to the ideas of its time.³⁴

To interpret this compositional pattern I will recapitulate the different stations De Caus describes for his reader. The five major parterres he mentions are in order; the royal garden, the muses' solar clock, the parterre of the artifical consonances as hidden among orange trees, the calendar of flowers, and the module of the garden, the cube. This series describes a circular, or rather a spiral movement. It starts from the Divine power given to the worldly ruler who reigns with wisdom and skill. Inspired by the muses, the ruler makes the world function by employing nature according to human reason. In following the seasonal changes, listening to the voice of nature, the simple "cubic" order of the material world can be universally detected, and if used with care, humanity brought closer to God. To make the elemental material world visible was the primary aim of the garden. The sudden movement from the cubic fountain up to the overview from the green cabinets, was obviously a significant step for De Caus. Reaching the cube was only a momentary point of reflection. From looking deep into matter, the eyes and the soul could be elevated in order to see more clearly the divine mystery. The pattern was structured as much with the purpose of demonstrating a "way" of conducting a life according to nature and its Divine order; as to provide a frame, or filter, through which to admire and worship God.

After the journey through the order of the natural world the reader was prepared to enter the grottoes. Here the contemporary visitor was expected to be able to see the hidden "lines" of natural reason in the wilderness of the animal kingdom and the justification of the eternal strife in human life. In the myth of the Herculean labours the visitor was supposed



to see himself reflected, and gather strength and faith to conduct a virtuous life following the wisdom gathered from the encyclopaedic journey through the garden. Seeing Narcissus starving from the love of his reflection, the last words of wisdom the visitor received from De Caus might have been: - Embrace the world, with love and reason. Do not raise yourself above your assigned position, in the belief that the recreation of marvellous works would make yourself a lesser god. Instead look aside from the reflection and see the light which allows it to appear. There find the strength to work through life.

In chapter two the compositional pattern of De Caus' treatises was described in terms of a firm structure within which points of deeper meaning, narrated through myths, were positioned. I also compared it to a polyphonic symphony, separating the composition into the overall structure and its melodic variations. In this chapter it has been argued that De Caus utilized a similar principle in the composition of the Heidelberg garden. In his writings De Caus frequently pointed out the importance of viewing a garden from above, and in Le Jardin *Palatin* he emphasized the points where the visitor can be provided with a view of the whole. De Caus consciously employed the play between the visitor's momentary experience of particular events and his seeking to understand their role within the larger structure. In the treatises, the discursive pattern of Euclidean geometry was used as the framework, implying a framing of Nature, the subject of the treatises, with human reason. Similarly in his garden, the overall structure appears to emphasize the subordination of nature to art,³⁵ an inevitable effect of any larger human construction. Nevertheless, I would argue that De Caus did not at all imply the superiority of man over nature, with the construction of his gardens he never wished to establish that the wilderness of nature could be tamed. Even though nature, or the fruits of nature, were given by God to be utilized by man, Nature was also endowed with the Divine spirit. The garden was instead the ultimate work of the archemaster; by framing nature De Caus brought the great mystery of Nature to human experience. Through the frame of art the paradisical state of man could be glimpsed and comprehended.

³⁵This is emphasized in Patterson's interpretation in which he takes the engraving of the Perspective as the point of departure for this discussion. (See Richard Patterson *The 'Hortus Palatinus' and the Reformation of the World*, part I, p 68.)

Conclusive Remarks

Having now considered a large part of Salomon de Caus works, textual and in mediated form, material traces of his world and personal intentions; some very important ideas and ambitions shine through which appear as the foundations of a moral philosophy of "right conduct". It has become clear that De Caus saw all the products of his hands as instruments for man to use, as vehicles to take him through life. Whether gardens, buildings, automata, music, drawings or books; they were all tools for man to use in order to attain meaning, they were never believed to be ideal compositions endowed with intrinsic meaning. Even though there existed in Salomon de Caus' world view an absolute truth which all his designs aimed at revealing, this truth was never believed to rest in the material object itself. Only *through* matter, through human sensual experience, could truth be regarded. In De Caus' world, meaning was thus both eternal and transitory, intrinsic in the cosmos and situational on earth. Maybe that world was as unstable and fluctuating as ours? On the earthly level of material life this might be true, but the difference was nevertheless great. In De Caus' world, even though far away and unreachable on this side of life, there was always the promise of an ultimate foundation in God.

Salomon de Caus has been shown to consciously work with two principal layers of meaning in his works. While one, which has here been referred to as the framework, is seen to address the intrinsic meaning of the order of cosmos; the other, which has been called the narrative, melodic or ornamental layer, addresses the mediation of situational meaning through matter. In human experience De Caus also counted on a third dimension to act together with the two layers of meaning. In use, or in human action the eternal structure and the specific event were united, and with its help, man would be carried through a passage of life. The third dimension, which De Caus took for granted, was thus the transformative effect of the observer on the meaning of the work; it was the act of playing the instruments which would otherwise stand dumb and silent. The *musica instrumentalis* was the intense experience of the moment of performance; whether architectural, theatrical or musical. In engaging with the world, playing with the given instruments, man was believed to carry himself continuously closer to his home; be it in God or his native star.

In his role as an architect, or more appropriate, as an archemaster, Salomon de Caus remains of interest to us today. In need of finding new ways to express poetic meaning in our buildings, his example demonstrates for us the possibility of letting even transitory truths shine through in an human artefact. While De Caus saw the framework as a reflection of the Divine order, but realized that in itself this order would never be attained, this principle might nevertheless be possible to reuse today, albeit in a different form. Even if the reflection can never again be of the "ultimate" order, and will always have to be an interpretation of a "possible order", a fiction, the frame is nevertheless useful as a tool to understand both the self, the other and the world. De Caus' works moreover demonstrate how the artefact, at that point, was a vehicle for both thought and action, an *instrument to perfect* both theory and practice. They testify to how, at this particular time, the structure of the world was essentially a many-layered complex one-ness. In this cosmos of correspondence the architect's mission was to reveal in the particular instant this totality of the world for human experience. With this thesis, focusing on the intertwining between order, action and materiality; language, man and the world in Salomon de Caus works, I hope to have provided an opening for a discussion on contemporary possibilities of reclaiming the connection between thought and action in architectural production.

• • • •

E PILOGUE "He must throw away the ladder, after he has climbed up on it."¹

Reconnecting to Wittgenstein, as he was abandoned in the Prologue, this is the place to leave Salomon de Caus behind. One hopes the reader will have considered satisfactory the offered tour of his garden as the gates are closed. The question that remains is; what is left for us after the ladder has been thrown away? Living in a world in which we can no longer refer to a common ground, the question was posed at the beginning whether any communication at all is indeed possible. Can an architecture that does not grow out of one true reality be meaningful to any person other than the one who constructed it? Can a building constitute a platform for human discourse, if the ground it stands on is unstable? The answer that was given initially was, based on empirical observation, yes: it can happen even today that a human construction communicates poetic meaning and provides a momentary foundation for human action. Maybe, after visiting the garden of De Caus, some light has been thrown on the question following that answer: How can it then be possible that, in a scattered world of infinite realities, meaning can still be carried from one self to another and from the world to the self?

In De Caus' work meaning depended on the interaction between three components which can be called; order, situation and action. The "order" was the reflection of the fixed and immutable divine, the "situation" was the interpretation of the specific condition at the moment of construction and "action" was the individual man's playing on the instrument. Today, any order, or structure that we impose on a work is by necessity of a fictional nature. It no longer has any reference to the real, it only refers to the possible or to what *might* be real; it does not *know*, but it *suggests*. For us the basis for designing a meaningful work is to be found in the process of imaginative interpretation. The architect creates a fiction from the specifics of the project, and with the building opens this fiction for others to take part in and interpret. Wittgenstein wrote: "[T]o imagine a language means to imagine a form of life."² In his later philosophy, the language as created from language-games can be

vi

Ludwig Wittgenstein Tractatus Logico-Philosophicus, § 6.54.

²Ludwig Wittgenstein Philosophical Investigations, §19.

interpreted as such a fictional structure, not invented by one man, but formed by life itself. Wittgenstein here positioned the meaning of language in *use* rather than in reality. Use is always situational and unpredictable, but it is regulated by the invisible rules of the language-game that are agreed upon. As different contexts make different forms of life possible, and different actions demands different ways of expression; different situations would be expected to require different buildings. The building can be viewed as an answer to a question formulated in the language-game in which it choses to take part. If architecture is regarded as the result of the playing of a language-game, there might be room for momentary truths to appear within the fictional frame of the game.

This parallel is drawn between Wittgenstein's understanding of language and the process of building because it shows us how the view that expects one true meaning to be hidden in the work and that demands a firm foundation outside of the structure to consider any ethical action possible, is mistaken. When Wittgenstein links linguistic meaning to play, he puts meaning into the temporal reality of life. Meaning is in his theory linked to a specific moment in time and space and does not remain in the word or the object itself. What is left after the time and place of the initial meaning are gone, is a trace which lies open for interpretation. Only through the interpretative act is it possible to catch a glimpse of the temporary meaning as it was left in the work, only through imagining the building's "language" the form of life that created it can be understood. Even if the ground for meaning in this view appears truly weak, it still allows the human artefact to be a mediator of poetic meaning.

Another important question to pose after the tour of De Caus' garden is whether the space of the garden still remains a refuge for the modern man. Can a modern garden provide shelter and allow man to dream of a utopian future? It is not a simple question to answer, only some reflections might be offered here. Some would suggest that the modern city is our garden. I would say that the modern city is a language-game. The problem with seeing the modern city as a garden lies in its lack of boundaries, of enclosures. Both the garden and the fiction need their boundaries to be what they are. The city of today reflects, but it does not interpret, the form of life which it houses. The modern city appears as a collage of fragments, and in a way that is what it is. Nevertheless it must be different since the city is

a collage without a single creator. Its poetic meaning is rather accidental than intentional. being the product of many different forms of life and realities. From the city might be made a dream, but it does not present the dream itself. It has turned into a "second Nature" and as such it requires the framework of fiction to be understood and lived within. As the wilderness of nature was once viewed through the filter of the garden, the garden today has its place within the city in order to make the city appear to its inhabitants. If the modern garden thus has its site in the city, the next step would be to ask for an appropriate gardener if there is one to be found. Today the poetic fictions of built reality might have their natural limits. A fiction might still be offered in a house, as a fragment of a larger whole, but maybe not as a spacious retreat providing a vision of the whole. Through the fragment of a building a limited view of the city and its life form may be offered, but the garden which comprehends it as a whole, might only rest with man himself. The fragment, the detail and the house are all modern "gardens" but they seem to have somehow been turned inside out. We can only see the enclosure from outside, and together guess its contents; but only if alone might each of us be allowed to enter. The cultural landscape of man might at last have become a wilderness to himself.

What our time has in common with De Caus' is the constant process of interpretation. Out of each reply that is offered to the questions that "things" and "beings" put to us, comes always another riddle. Still, every answer provides us with a frame through which to momentarily view the eternal questioning from above. While in our time nothing truly exists because the ground for a unified understanding has disappeared, it might have been so for De Caus because truth was elsewhere, with God. When we are turning the stones, on our solitary quest for the momentary truths of the worldly garden, it might happen that we find ourselves in a stone turned by another. Maybe we would also find another being in a stone turned by ourselves. Even if a solitary pursuit, the constant reading of traces in the world and the writing and making of new, still constitutes the ground for human interaction.

[&]quot;That is excellently observed', said Candide. 'But let us cultivate our garden."³

³Voltaire Candide ou l'optimisme, p 229: "- Cela est bien dit, répondit Candide, mais il faut cultiver notre jardin."

"Adele showed me places in the city I had never noticed, walled gardens in the midst of office blocks, odd-shaped little courtyards, an overgrown cemetery between a bakery and a bank...We went into the big department stores and wandered along the brightly lit aisles, gazing in silence at the racks of gaudy clothes and toiletries and packaged foods as if they were artefacts in a museum, the works of an immemorial golden age. People stared at us, children tugged at their mothers' skirts and pointed, avid and agape. Adele took no notice. She lived in the city as if she were alone in it, as if it were somehow hers, a vast, windswept pleasure garden, deserted and decayed"



"At this the professor made a violent whooshing noise, like a breathless swimmer breaking the surface, and turned to her in a fury.

-There is no certainty! he cried. That is the result! Why don't you understand that, you you you...! Ach, I am surrounded by fools and chil-dren. Where do you think you are living, eh? This is the world, look around you, look at it! You want certainty, order, all that? Then invent it!"

•••

"Have I tied up all the ends? Even an invented world has its rules, tedious, absurd perhaps, but not to be gainsaid."

John Banville Mefisto (pp153-4, 193 & 234)

BIBLIOGRAPHY

All translations from the original French, unless otherwise noted, by Katja Grillner 1994/95.

GENERAL REFERENCE

Encyclopaedia Britannica Macropaedia 15, Chapter on the Reformation, pp. 547-563; William Benton, Chicago 1976.

Encyclopaedia of Philosophy, Ed. Paul Edwards; Macmillan Publishing Inc., New York 1967.

Hall's Dictionary of Subjects and Symbols in Art, James Hall; John Murray Publishing Inc., London 1974.

The Holy Bible; Oxford University Press, Oxford. (Authorized King James Version).

Who's Who in the Ancient World, Betty Radice; Penguin Reference, London 1973.

DICTIONARIES

Compact Etymological Dictionary, Richard John Cunliffe and R.F. Patterson; Blackie & Son Ltd, London and Glasgow.

Dictionaire Universal, contenant generalement tous les mots François, tant vieux que moderne, & les termes de toutes les sciences et des arts: divisé en trois tomes, Antoine Furetiere; Paris 1690.

Dictionnaire des proverbes sentences et maximes, Maurice Maloux; Librairie Larousse, Paris 1960.

Dictionnaire Étymologique de la langue française; Presses universitaires de France, Paris 1975.

Dictionnaire Etymologique et historique du Français, Eds: Jean Dubois, Henri Mitterand and Albert Dauzat; Larousse, Paris 1993.

Larousse dictionnaire du Moyen française - la Renaissance, Eds. Algirdas Julien Greimas and Teresa Mary Keane; Lanousse, Paris 1992.

The Macmillan Book of Proverbs, Maxims, and Famous Phrases, Burton Stevenson; MacMillan Company, New York 1948.

Oxford Latin Dictionary, Ed: P.G.W. Glare; Clarendon Press, Oxford 1992.

Thresor de la langue françoise tant ancienne que moderne de Jean Nicot Edition A. et J. Picard; Fondation Singer-Polignac; Paris 1960 (started during 16th century first published 1606, reprint of 1621 edition).

PRIMARY SOURCES

Leon Battista Alberti On the Art of Building in Ten Books; MIT-Press, Cambridge and London 1992. (Translated by Joseph Rykwert, Neil Leach and Robert Tavernor).

Leon Battista Alberti On Painting; Yale University Press, New Haven and London 1966. (Translated by Joseph R. Spencer).

Hannah Arendt The Human Condition - A Study of the Central Dilemmas Facing Modern Man; Anchor Books, New York 1959.

Aristotle Poetics; Hill and Wang, New York 1991. (Translated by S.H. Butcher)

Francis Bacon The Advancement of Learning and New Atlantis; Oxford Unversity Press, Oxford 1960

Francis Bacon Francis Bacon - A Selection of his Works; MacMillan, Toronto 1965. (Edited by Sidney Warhaft).

Francis Bacon The Masculine Birth of Time. In: B. Farrington, (Ed.) The Philosophy of Francis Bacon; Liverpool University Press, Liverpool 1964.

Francis Bacon Sylva Sylvarum - or a Naturall History In ten Centuries; W. Rawley, London 1627.

John Banville Mefisto; Minerva, London 1993.

Walter Benjamin Illuminations; Schocken Books, New York 1968.

Jacob Boehme Essential Readings; Crucible, Wellingborough 1989.

Jacob Boehme Mysterium Magnum or An Exposition of the First Book of Moses Called Genesis; John M. Watkins, London 1965.

Anicius Manlius Severinus Boethius Fundamentals of Music; Yale University Press, New Haven 1989.

Johann A. Comenius The Labyrinth of the World and the Paradise of the Heart; Edinburgh 1905.

Johann A. Comenius Selections; Unesco, 1957.

Salomon de Caus Hortus Palatinus a Friderico Rege Boemiae Electore Palatino Heidelbergae Exstructu; T. de Bry, Francofurti 1620.

Salomon de Caus Le Jardin Palatin; Editions du Moniteur, Paris 1981.

Salomon de Caus Institution Harmonique; Jan Norton, Francfort 1615.

Salomon de Caus Institution Harmonique; Broude Brothers, New York 1969.

Salomon de Caus La perspective avec la raison des ombres et miroirs; Jan Norton, London 1612.

Salomon de Caus La pratique et demonstration des horloges solaires. Avec un discours sur les proportions, tiré de la raison de la 35 proposition du premier livre d'Euclide, &c; H. Drouan, Paris 1624.

Salomon de Caus Les Raisons des Forces Mouvantes; Jan Norton, Francfort 1615.

Salomon de Caus Les Raisons des Forces Mouvantes; Uitgeverei Fritz Kunf B.V., Amsterdam 1973.

Salomon de Caus Les Raisons des Forces Mouvantes....Augmentées de plusieurs figures, avec le discours sur chacune; H. Drouart, Paris 1624.

Salomon de Caus Les Raisons des Forces Mouvantes; Charles Sevestre, Paris 1624.

Salomon de Caus Von Gewaltsamen bewegungen. Beschreibung etlicher so wol nützlichen also lustigen Maschiner, beneben Underschiedlichen abriessen etliher Höllen od' Grotten und Lust Brunne....Erstlich in Französischer Jetzundt aber in unsser Deutsche Sprach an tag geben; A. Pacquart, Francfurt 1615.

John Dee On Astronomy (Propadeumata Aphoristica (1558 and 1586); University of California Press, Berkeley 1978.

John Dee The Mathematicall Praeface to the Elements of Geometrie of Euclid of Megara (1570); Science History Publications, New York 1975.

Euclid The Elements of the most auncient Philosopher EUCLIDE of Megara; London 1570.

Euclide Les Elements d'Euclide Expliquez Par le R.P.G. Fournier de la Compagnie de Jesus; Jean Henault, Paris 1654.

Euclid The Thirteen Books of Euclid's Elements; Dover Publications, New York 1956.

Marcilio Ficino The Book of Life; Spring Publications, Irving 1980.

Robert Fludd Robert Fludd and his Philosophicall Key; Science History Publications, New York 1979.

Robert Fludd Utriusque Cosmi Maioris Scilicet et Minoris Metaphysica, Physica atque Technica Historia; T. De Bry, Oppenheim 1617.

Martin Heidegger Basic Writings; Harper Collins, New York 1977.

Martin Heidegger Poetry Language Thought; Harper & Row, New York 1975.

Hero of Alexandria The Pneumatics; MacDonald & American Elsevier Inc., London and New York 1971.

Horace The Art of Poetry in C. Kraemer, (Ed.) The Complete Works of Horace, pp. 397-412; Random House, New York 1936.

Gottfried W. von Leibniz Leibniz - Selections; Charles Scribner's Sons, New York 1951. (edited by Philip P. Wiener).

Maurice Merleau-Ponty The Visible and the Invisible; Northwestern University Press, Illinois 1992.

Marin Mersenne Harmonie universelle contenant la théorie et la pratique de la musique; Editions Centre National de la Recherche Scientific, Paris 1965.

Friedrich Nietzsche The Birth of Tragedy and the Genealogy of Morals; Doubleday Anchor Books, New York 1956.

Friedrich Nietzsche The Gay Science; Vintage Books, New York 1974.

Friedrich Nietzsche Twilight of the Idols and The Anti-Christ; Penguin Classics, London 1968.

Ovid Ovid's Metamorphoses, Englished, Mythologized, and Represented in Figures by George Sandys; University of Nebraska Press, Lincoln 1970 (Reprint of 1632 edition).

Ovid Metamorphoses, Penguin Classics, London 1973.

Bernard Palissy Recepte veritable, par laquelle tous les hommes de la France pourront apprendre a multiplier et augmenter leur thresors; Librairie Droz S.A., Genève 1988.

Bernard Palissy and Henry Morley Palissy the Potter the Life of Bernard Palissy of Saintes, (his labours and Discoveries in Art and Science); Ticknor Reed and Fields, Boston 1853. (Contains partial translations of Recepte veritable and Discours Admirables by Henry Morley).

Plato The Symposium; Penguin Books, London 1951.

Plato Timaeus and Critias; Penguin Books, London 1971.

Paul Ricoeur The Function of Fiction in Shaping Reality; Man and World 12, pp.123-141, 1979.

Paul Ricoeur Hermeneutics and the Human Sciences; Cambridge University Press, Cambridge, 1982.

Edmund Spenser A Letter of The Authors in Spenser's Faerie Queen - Book I; Clarendon Press, Oxford 1895.

Pontus de Tyard Solitaire Premier; Librairie Droz, Genève 1950.

Pontus de Tyard Solitaire Second; Librairie Droz, Genève 1980.

Virgil The Aeneid of Virgil; Anchor books, New York 1953.

Vitruve Architecture ou Art de bien bastir; Gregg Press Inc., Ridgewood, 1964. (Reprint of Jean Martin's translation published in Paris 1547).

Vitruvius The Ten Books on Architecture; Dover Publications, New York 1960. (Translation by Morris Hicky Morgan).

Voltaire Candide ou l'optimisme; Editions A.-G. Nizet, Paris 1979.

John Wilkins An Essay Towards a real Character and a Philosophical Language; Scolar Press Ltd., Menston 1968. (Reprint of the 1668 edition for the Royal Society in London).

John Wilkins Mathematicall Magick or the Wonders that may be performed by Mechanicall Geometry; Sa. Gellibrand, London 1648.

John Wilkins Mercury or the Secret and Swift Messenger; John Benjamins Publishing Company. Philadelphia 1984. (Reprint of 1707 edition).

Ludwig Wittgenstein Philosophical Investigations; Macmillan, New York 1968. (Translated by G.E.M. Anscombe).

Ludwig Wittgenstein Tractatus logico-philosophicus; Routledge & Kegan Paul, London 1957. (Translated by D.F. Pears and B.F. McGuiness).

Ludwig Wittgenstein Lectures and Conversations on Aesthetics, Psychology and Religious Belief; University of California Press, Berkeley and Los Angeles 1994.

Henry Wotton The Elements of Architecture; John Bill, London 1624.

Gioseffo Zarlino Le Istitutioni harmoniche; Broude Brothers, New York 1965. (Reprint of 1558 Venice edition).

Gioseffo Zarlino On the Modes - Part Four of Le Istitutioni Harmoniche, 1558; Yale University Press, New Haven 1983.

SECONDARY SOURCES

Hans Aarsleff From Locke to Saussure - essays on the Study of Language and Intellectual History; University of Minnesota Press, Minneapolis 1982.

Thomas Clifford Allbut Palissy, Bacon, and the Revival of Natural Science in H. Milford, (Ed.) Proceedings of the British Academy 1913-14., pp. 233-247; Oxford University Press, Oxford 1914.

T.A. Anstey Feigned music: The Composition of Alberti's facades for the Tempio Malatestiano. Dissertation for the degree of Master of Philosophy, University of Bath 1994. (Unpublished).

Christopher Bamford (Ed.) Hommage to Pythagoras - Rediscovering Sacred Science; Lindisfarne Press, Hudson 1994.

Jurgis Baltrušaitis Anamorphic Art; Harry N. Abrams Publishers, New York 1977.

Roland Barthes Writing Degree Zero; Noonday Press, New York 1993.

Eugenio Battisti Natura Artificiosa to Natura Artificialis in D. Coffin, (Ed.) The Italian Garden, pp. 1-36; Dumbarton Oaks Trustees for Harvard University, Washington D.C. 1972.

Albert Becker Salomon de Caus und Zweibrücken; Ruperto Carola Mitteilungen der Vereinung der Freunde der Studentenschaft der Universität Heidelberg 6, p182, 1954.

Elizabeth Blair MacDougall (see MacDougall)

Jennifer Bloomer Architecture and the Text: The (S)crypts of Joyce and Piranesi; Yale University Press, New Haven 1993.

David Coffin The Wonders of Pratolino; Journal of Garden History 3, pp. 279-282, 1983.

Carl Dahlhaus On the Historicity of a Metaphysical Principle; Daidalos 17, pp. 18-25, 1985.

Allen G. Debus The Chemical Philosophy - Paracelsian Science and Medicine in the Sixteenth and Seventeenth Centuries; Science History Publications, New York 1977.

Allen G. Debus Man and Nature in the Renaissance; Cambridge University Press, Cambridge 1978.

Wilfried Dörstel Perspectiva Rhetorica; Daidalos 11, pp. 65-69, 1984.

Anne van Erp-Houtepen The etymological origin of the garden; Journal of Garden History 6, pp.227-231, 1986.

Lili Fehrle-Burger Der Hortus Palatinus als "achtes Weltwunder"; Ruperto Carola Mitteilungen der Vereinung der Freunde der Studentenschaft der Universität Heidelberg 14, pp. 106-119, 1962.

Michel Foucault The Order of Things - An Archaeology of the Human Sciences; Vintage Books, New York 1994.

Bertrand Gille Engineers of the Renaissance; MIT Press, Cambridge, Mass. 1966.

Ernest B. Gilman The Curious Perspective - Literary and Pictorial Wit in the Seventeenth Century; Yale University Press, New Haven 1978.

Joscelyn Godwin Robert Fludd - Hermetic philosopher and surveyor of two worlds; Thames and Hudson, London 1979.

Claudio Guillén On the Concept and Metaphor of Perspective in S. Nichols and R. Vowles, (Eds.) Comparatists at Work; Blaisdell Publishing Co., Waltham 1968.

Fernand Hallyn The Poetic Structure of the World - Copernicus and Kepler; Zone Books, New York 1993.

Vaughan Hart Art and magic in the court of the Stuarts, Routledge, London 1994.

G.L. Hersey Pythagorean Palaces - Magic and Architecture in the Italian Renaissance; Cornell University Press, Ithaca 1976.

Hans Holländer On Perspectives; Daidalos 11, pp.71-89, 1984.

John Dixon Hunt Garden and Grove. The Italian Renaissance Garden in the English Imagination 1600-1750; Princeton University Press, Princeton 1986.

John Dixon Hunt and Peter Willis The Genius of a Place - The English Landscape Garden 1620-1820; Elek Books Ltd, London 1975.

Oliver Impei and Arthur MacGregor (Eds.) The Origins of Museums; Clarendon Press, Oxford 1987.

Thomas DaCosta Kaufmann The Mastery of Nature - Aspects of Art, Science, and Humanism in the Renaissance; Princeton University Press, Princeton 1993.

Indra Kagis McEwen Instrumentality and the Organic Assistance of Looms; Chora 1, pp 123-142, 1994.

Indra Kagis McEwen Socrates Ancestor; MIT Press, London 1993.

Alexander Koyré From the Closed World to the Infinite Universe; Johns Hopkins Press, Baltimore and London 1957.

C.S. Lewis The Discarded Image - An introduction to Medieval and Renaissance Literature; Cambridge University Press, Cambridge 1994.

Elisabeth MacDougall Ars Hortulorum: Sixteenth Century Garden Iconography and Literary Theory in Italy in D. Coffin, (Ed.) The Italian Garden, pp. 37-59; Dunbarton Oaks Trustees for Harvard University, Washington D.C. 1972.

Elizabeth Blair MacDougall Imitation and Invention: Language and Decoration in Roman Renaissance Gardens; Journal of Garden History 5, pp.119-134, 1985.

C. S. Maks Salomon de Caus; Jouve & Cie, Paris 1934.

Gert Mattenklott The Garden as Symbolic Form: Pure Presence between Changes in Space and Time; Daidalos 46, pp.27-31, 1992.

William Alexander McClung The Architecture of Paradise; Univ. of California Press, Berkeley 1983.

Peter McCormick Real Fictions; Journal of Aesthetics and Art Criticism, Vol 46, pp. 259-270, 1987.

Joseph S. Mebane Renaissance Magic and the Return of the Golden Age; University of Nebraska Press, Lincoln 1989.

Norbert Miller The Secret Garden of Vicino Orsini; Daidalos 3, pp. 38-49, 1992.

Werner Oechslin 'Architectura Hydraulica' or 'Showplace of the Aquatic Arts', Daidalos 55, pp. 24-37, 1995.

Werner Oechslin Architecture, Perspective, and the Helpful Gesture of Geometry; Daidalos 11, pp.39-54, 1984.

Werner Oechslin Between Painting and Architecture. The Artificiality and Autonomy of Scenography; Daidalos 13, pp.21-35, 1984.

Werner Oechslin From Piranesi to Liebeskind - Explaining by Drawing; Daidalos 1, pp. 15-19, 1981.

Werner Oechslin Geometry and Line. The Vitruvian "Science" of Architectural Drawing, Daidalos 1, pp. 15-19, 1981.

Werner Oechslin The Labyrinth as the Apotheosis of Garden Architecture; Daidalos 3, pp. 52-58, 1982.

Werner Oechslin Music and Architecture: Universals of Architecture Paths of Approach; Daidalos 17, pp.59-73, 1993.

Werner Oechslin Nature and its Reduction to Architecture; Daidalos 12, pp. 44-53, 1984.

Werner Oechslin The Theatre of Invention - Stage Design and Architecture; Lotus International 17, pp. 66-77, 1977.

Giacomo Oreglia Tommaso Campanella; Ordfronts Förlag, Stockholm 1984.

Claude V. Palisca Boethius in the Renaissance in Music Theory and its Sources - Antiquity and the Middle Ages, pp. 259-280; University of Notre Dame Press, Notre Dame 1990.

Claude V. Palisca Humanism in Renaissance Musical Thought; Yale University Press, New Haven 1985.

Claude V. Palisca Scientific Empiricism in Musical Thought in H. Rhys, (Ed.) Seventeenth Century Science and the Arts, pp. 91-137; Princeton University Press, Princeton 1961.

Richard Patterson The 'Hortus Palatinus' at Heidelberg and the Reformation of the World - Part I: The Iconography of the Garden; Journal of Garden History 1, pp. 67-104, 1981.

Richard Patterson The 'Hortus Palatinus' at Heidelberg and the Reformation of the World - Part II: Culture as Science; Journal of Garden History 1, pp. 179-202, 1981.

Joanne Paul Of Substantiating Nature: The elements of architecture explained in eighteenth century interpretations, Retold by Fra Carlo Lodoli; M.Arch. thesis, McGill University, Montreal 1995. (Unpublished).

Alberto Pérez-Gómez Architecture and the Crisis of Modern Science; MIT Press, Cambridge, Mass. 1992.

Alberto Pérez-Gómez Introduction to Ordonnance for the Five Kinds of Columns after the Method of the Ancients by Claude Perrault, pp. 1-44; The Getty Center for the History of Arts and Humanities, distributed by Chicago University Press, Santa Monica 1993.

Alberto Pérez-Gómez Introduction to Polyphilo or The Dark Forest Revisited - An Erotic Epiphany of Architecture, pp. xi-xxvii; MIT Press, Cambridge, Mass. 1992.

Alberto Pérez-Gómez and Louise Pelletier Architectural Representation Beyond Perspectivism; Perspecta 27, pp. 20-39, 1993.

Denise Péricard-Méa and Mathilde Pigeaud Gardens of Love; Daidalos 46, pp. 66-75, 1992.

Paolo Rossi Francis Bacon - From Magic to Science; University of Chicago Press - Midway Reprint, Chicago 1978.

Paolo Rossi Philosophy, Technology and the Arts in the Early Modern Era; Harper Torchbooks, New York and London 1970.

Joseph Rykwert The First Moderns - The Architects of the Eighteenth Century, MIT-Press, Cambridge and London 1991.

George Steiner After Babel, Oxford University Press, Oxford 1992.

Roy Strong The Mannerist Garden 1 - Salomon de Caus in The Renaissance garden in England, pp. 72-112; Thames and Hudson, London, 1979.

Malgorzata Szafranska The Philosophy of nature and the Grotto in the Renaissance garden; Journal of Garden History 9, pp.76-85, 1989.

Göran Sörbom Aristotle on Music as Representation; Journal of Aesthetics and Art Criticism, vol. 52, pp. 37-46, 1994.

Christopher Thacker The History of Gardens; Croom Helm Ltd., London 1979.

Eustace M.W. Tillyard The Elizabethan World Picture - A Study of the Idea of Order in the age of Shakespeare, Donne and Milton; Vintage Books, New York.

Lucia Tongiorgi Tomasi Projects for Botanical and Other gardens: a 16th-Century Manual; Journal of Garden History 3, pp. 1-34, 1983.

Gianni Vattimo The End of Modernity; Johns Hopkins University Press, Baltimore 1991.

Gianni Vattimo The Transparent Society; Johns Hopkins University Press, Baltimore 1991.

Hélène Vérin Technology in the Park: Engineers and Gardeners in Seventeenth-Century France in M. Mosser and G. Teyssot, (Eds.) The Architecture of Western Gardens, pp. 135-142; MIT Press, Cambridge, Mass. 1991.

Brent M. Wagler Stars, Stones and Architecture- An Episode in John Dee's Natural Philosophy, M.Arch thesis, McGill University, Montreal 1995. (Unpublished).

D.P. Walker *Musical Humanism in the 16th and early 17th Centuries*; Music Review Vol II, pp. 1-13, 111-121, 220-227, 289-308; 1941 and Vol III, pp. 55-71; 1942.

D.P. Walker Music, Spirit and Language in the Renaissance, Variorum Reprints, London 1985.

D. P. Walker Spiritual and Demonic Magic - From Ficino to Campanella; University of Notre Dame Press, London 1975.

D.P. Walker Studies in Musical Science in the Late Renaissance; Studies of the Warburg Institute, London 1978.

Rudolf Wittkower Architectural Principles in the Age of Humanism; Academy Editions/St Martin's Press, New York 1988.

Kenneth Woodbridge Princely Gardens; Rizzoli, New York 1986.

Frances Yates Astraea - The Imperial Theme in the Sixteenth Century, Fenguin Books Ltd., Harmondsworth 1977.

Frances Yates The Art of Memory; The University of Chicago Press, Chicago 1966.

Frances Yates The French Academies of the Sixteenth Century; The Warburg Institute, London 1947.

Frances Yates Giordano Bruno and the Hermetic Tradition; University of Chicago Press, Chicago 1964.

Frances Yates The Occult Philosophy in the Elizabethan Age; Routledge and Kegan Paul, London 1979.

Frances Yates Theatre of the World; University of Chicago Press, Chicago 1969.

Frances Yates The Rosicrucian Enlightenment, Routledge and Kegan Paul, London 1972.

Richard Zimmerman The Hortus Palatinus of Salomon de Caus in M. Mosser and G. Teyssot, (Eds.) The Architecture of Western Gardens, pp. 157-159; MIT Press, Cambridge, Mass. 1991.

LIST OF ILLUSTRATIONS

- Fig. 1: Detail from Hollar's "long view" of London, 1647. (From Vaughan Hart Art and Magic in the court of the Stuarts, p 28).
- Fig. 2: Frontispiece to Henry Hawkin's Partheneia Sacra, 1633. (From W.A. McClung The Architecture of Paradise, p 22).
- Fig. 3: Geometrical figures. (From Salomon de Caus *La Perspective avec la raison des ombres et miroirs*, Book I, fol. 7. Courtesy of the Canadian Center for Architecture).
- Fig. 4: Fold-out figure. (From Salomon de Caus *La Perspective avec la raison des ombres et miroirs*, Book II, Ch. 10. Courtesy of the Canadian Center for Architecture).
- Fig. 5: Singing Automaton. (From Salomon de Caus Les Raisons des forces mouvantes, Book I, Prob. 35),
- Fig. 6: Pyramidal mountain. (From Salomon de Caus Les Raisons des forces mouvantes, Book II, Prob.10).
- Fig. 7: Narcissus. (From Salomon de Caus Le Jardin Palatin, fol. 29).
- Fig. 8: Optical correction of inscription. (From Salomon de Caus La Perspective avec la raison des ombres et miroirs, Book I, Ch. 31. Courtesy of the Canadian Center for Architecture).
- Fig. 9: Anamorphic portrait. (From Jurgis Baltrušaitis Anamorphic Art, p 43).
- Fig. 10: Anamorphic figure. (From Jurgis Baltrušaitis Anamorphic Art, p 44).
- Fig. 11: Apollo and Phaeton. (From Salomon de Caus La Perspective avec la raison des ombres et miroirs, Book II, Ch. 10. Courtesy of the Canadian Center for Architecture).
- Fig. 12: Frontispiece to Salomon de Caus Les Raisons des forces mouvantes.
- Fig. 13: Frontispiece to Salomon de Caus La Perspective avec la raison des ombres et miroirs. (Courtesy of the Canadian Center for Architecture).
- Fig. 14: Frontispiece to Salomon de Caus Institution Harmonique.
- Fig. 15: "Perpetual" machine. (From Salomon de Caus Les Raisons des forces mouvantes, Book I, Prob. 12).
- Fig. 16: Dodecahedron. (From Salomon de Caus La Perspective avec la raison des ombres et miroirs, Last page. Courtesy of the Canadian Center for Architecture).
- Fig. 17: Sphere. (From Salomon de Caus La Perspective avec la raison des ombres et miroirs, Book I, Ch. 18. Courtesy of the Canadian Center for Architecture).
- Fig. 18: Shadow projection. (From Salomon de Caus La Perspective avec la raison des ombres et miroirs, Book II, Ch. 8. Courtesy of the Canadian Center for Architecture).
- Fig. 19: Mirror in perspective. (From Salomon de Caus La Perspective avec la raison des ombres et miroirs, Book III, Theoreme I. Courtesy of the Canadian Center for Architecture).
- Fig. 20: "The Divine Monochord" by Robert Fludd. (From Joscelyn Godwin Robert Fludd, p 47).
- Fig. 21: "The Diapason closing full in Man" by Robert Fludd. (From Joscelyn Godwin Robert Fludd, p 47).
- Fig. 22: The Senario. (From Gioseffo Zarlino Le Istitutioni Harmoniche, Ch. 15, p 25).

- Fig. 23: The Ottonario. (From Salomon de Caus Institution Harmonique, Part I, Prop. 18).
- Fig. 24: Salomon de Caus' monochord. (From Salomon de Caus Institution Harmonique, Part I, Prop. 22).
- Fig. 25: Orpheus. (From Salomon de Caus Les Raisons des forces mouvantes, Book II, Prob. 17).
- Fig. 26: Hydraulic organ. (From Salomon de Caus Les Raisons des forces mouvantes, Book I, Prob. 31).
- Fig. 27: Musical wheel. (From Salomon de Caus Les Raisons des forces mouvantes, Book I, Prob. 30).
- Fig. 28: Mount Parnassus. (From Salomon de Caus Les Raisons des forces mouvantes, Book II, Prob. 13).
- Fig. 29: Diagram relating the musical consonances with the nine muses and the heavenly spheres. (From Gioseffo Zarlino Le Istitutioni Harmoniche, ch. 29, p 102).
- Fig. 30: Jacob Boehme's Four Tables of Divine Revelation, 1654. (From Essential Readings, p 220-24).
- Fig. 31: John Wilkins' universal "grammar." (From John Wilkins An Essay Towards a real Character and a Philosophical Language).
- Fig. 32: Plan of the Palatinate Garden (From Salomon de Caus Le Jardin Palatin, fol. 1).
- Fig. 33: Perspective of the Palatinate Garden (From Salomon de Caus Le Jardin Palatin, fol. 2).
- Fig. 34: The "Royal" parterre. (From Salomon de Caus Le Jardin Palatin, fol. 3).
- Fig. 35: Parterre for orange trees and melons. (From Salomon de Caus Le Jardin Palatin, fol. 6).
- Fig. 36: The column of the Reichsapfel. (From Salomon de Caus Le Jardin Palatin, fol. 4).
- Fig. 37: The cube-fountain. (From Salomon de Caus Le Jardin Palatin, fol. 16).
- Fig. 38: Engraving from George Wither A Collection of Emblemes, 1635. (From W.A. Mc Clung The Architecture of Paradise, p 56).
- Fig. 39: Grotto of the animal kingdom. (From Salomon de Caus Le Jardin Palatin, fol. 22).
- Fig. 40: The Philosophers' grotto. (From Salomon de Caus Le Jardin Palatin, fol. 26).

.

The images in the beginning and in the end of the main text were made by the author.