

MODELS OF EXEMPLARITY: URANIBORG AND SOLOMON'S HOUSE

MODELE DE EXEMPLARITATE: URANIBORG ȘI CASA LUI SOLOMON

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Abstract

In Francis Bacon's New Atlantis the heart of Bensalem was Solomon's House. This was the home for a diverse range of instruments and apparatus and hub of intellectual life on the island. This paper addresses the question of where did Bacon derive the inspiration for such an organisation? In this article I shall argue that the case can be made that part of the inspiration for Solomon's House came from Tycho Brahe's astronomical castle Uraniborg. This was the home of Tycho Brahe's vast and incomparable collection of instruments, and during the early-seventeenth century had a reputation as a prestigious site of learning, as such it become a model of exemplarity with political and ideological associations that was drawn upon by many of Bacon's peers to legitimise their own projects. Evidence for this can be seen from the works of Edward Wright, John Dee, Libavius and Johannes Andreaes. That Bacon is likely to have also drawn upon Uraniborg as an influence can be seen through a comparison of the key features of Uraniborg and Solomon's House, which exposes a number of similarities between the two organisations.

Key Words: *instruments, Uraniborg, Solomon's House, ideology, Tycho Brahe.*

Cuvinte cheie: *instrumente, Uraniborg, Casa lui Solomon, ideologie, Tycho Brahe.*

The seventeenth-century has been called the 'Bacon-faced generation.' [1] This century was one in which the influence of Francis Bacon permeated the intellectual development of society. The prominence of Bacon's influence amongst members of the Royal Society, and the Hartlib group has lead historians to attempt to account for Bacon's ideas and trace the source of them in a genealogy of ideas. [2] The result has been the uncovering of a myriad and diverse range of influences that Bacon incorporated within his philosophy. The literary scholar Brian Vickers has made the point that it was from this vast reservoir of influences that Bacon drew upon in order to provide the rich metaphors and images that gave persuasive power to his ideas. [3] The fact that Bacon drew upon such an eclectic collection of ideas in his writings makes any delineation of them difficult to ascertain, yet in order to see how *New Atlantis* interacted with contemporary texts it is necessary to establish the commonalities between the texts and the mutual influences. One such link that I shall introduce in this article is the role that Tycho Brahe and his astronomical castle Uraniborg played as an influence upon *New Atlantis* and other contemporary texts.

Whilst this article discusses Uraniborg as an exemplary model, and its influence on *New Atlantis*, it is important to note that there were other organisations that existed concurrently with Uraniborg, which contributed to the intellectual climate of Bacon's time. [4] It is likely these organisations also contributed and influenced Bacon in writing *New Atlantis* to some extent and in looking at the role of Tycho Brahe's influence on Francis Bacon's *New Atlantis* it is not being suggested Uraniborg was the prime factor or only influence, but rather that it contributed significantly to the vast reservoir of influences Bacon drew upon in composing his works. [5]

Uraniborg shall be focused on due to the similarities it has with Solomon's House and its influential role to a cluster of idealised projects parallel to Bacon's. [6]

This essay will demonstrate how it is possible to detect the influence of Tycho Brahe within the internal dynamics and infrastructure of Solomon's House in *New Atlantis*. I shall first outline how Uraniborg gained a series of political links, through its patronage of King Frederick and its association to King James VI, which made it salient to be used as a model to legitimise subsequent projects. This usage can be seen in the works of Edward Wright, Andreae Libavius and Johannes Andreae. The second section discusses how Tycho Brahe's Uraniborg became representative of a certain ideology in the early seventeenth-century. This role as a symbol combined with its political networks would have increased its attractiveness as a model to Bacon. The final section shall compare the two institutions and discuss the relevance of the similarities between them.

Uraniborg

The Danish King Frederick II granted Tycho Brahe the island of Hven as an incentive to persuade Tycho to reside in Denmark. On this island Tycho built his castle Uraniborg with astronomical towers and an alchemical laboratory to provide him with a suitable structure from which to investigate the heavens and the earth. Tycho soon found he needed additional buildings to house his ever-expanding arsenal of astronomical instruments, so he built the observatory Stjernborg (Fig. 1), and later added a paper-mill and printing press. In the course of its operation and use Uraniborg gained a reputation as the prestigious home of the noble Lord Tycho Brahe and his magnificent instruments. The prestige of Uraniborg and its unprecedented resources meant that it attracted many visitors. As the historian John Robert Christianson has observed, the island was more than just the home of Tycho's equipment; it had been a hub of intellectual activity during its lifetime and attracted an impressive collection of foreign visitors, who worked as Tycho's assistants. [7] Due to the self-contained nature of the island and the team of assistants helping Tycho, Victor Thoren, Tycho's most recent biographer, has argued that Uraniborg was the world's first scientific institution on the basis that Tycho whilst there operated as a dean of proto-scientific institution. [8] This role can be observed in Tycho's final years of study, when he delegated many of his observations and experiments to assistants, and his role was that of an overseer and manager of Uraniborg. [9]

Through this constant flow of assistants Tycho established a network of people who corresponded with him and informed him of any developments throughout Europe. More crucially this extensive web of former assistants were able to spread the word about Uraniborg and Tycho's instruments throughout Europe increasing his reputation.

The greatest piece of propaganda for Uraniborg comes from Tycho's self-published work *Astronomiae Instauratae Mechanica*. This lavishly published work was part of his project to gain patronage upon his move from Denmark. It contains a comprehensive list of his instruments. Each instrument is carefully described and is accompanied by a detailed illustration. Within the work, a section entitled *De Architectonicis Structuris astronomicis observationibus accomodis* describes what Tycho saw as the ideal place and correct architecture in which to pursue the study of the heavens and the world. [10]. Tycho believed with the building of his observatory and alchemical laboratories in Uraniborg he had created this ideal space. Tycho in doing this viewed himself as a pioneer and example of the way in which astronomy and alchemy should be done, and hoped that his work would be emulated by those "who will take great pains to imitate or even surpass" that which he has done and that "anybody may take what he wants and adapt it accordingly to his needs." [11] It can be seen then that Tycho Brahe had a tremendous self-belief that he was at the frontier of astronomical development, and his perception of himself as being one of the great astronomers.

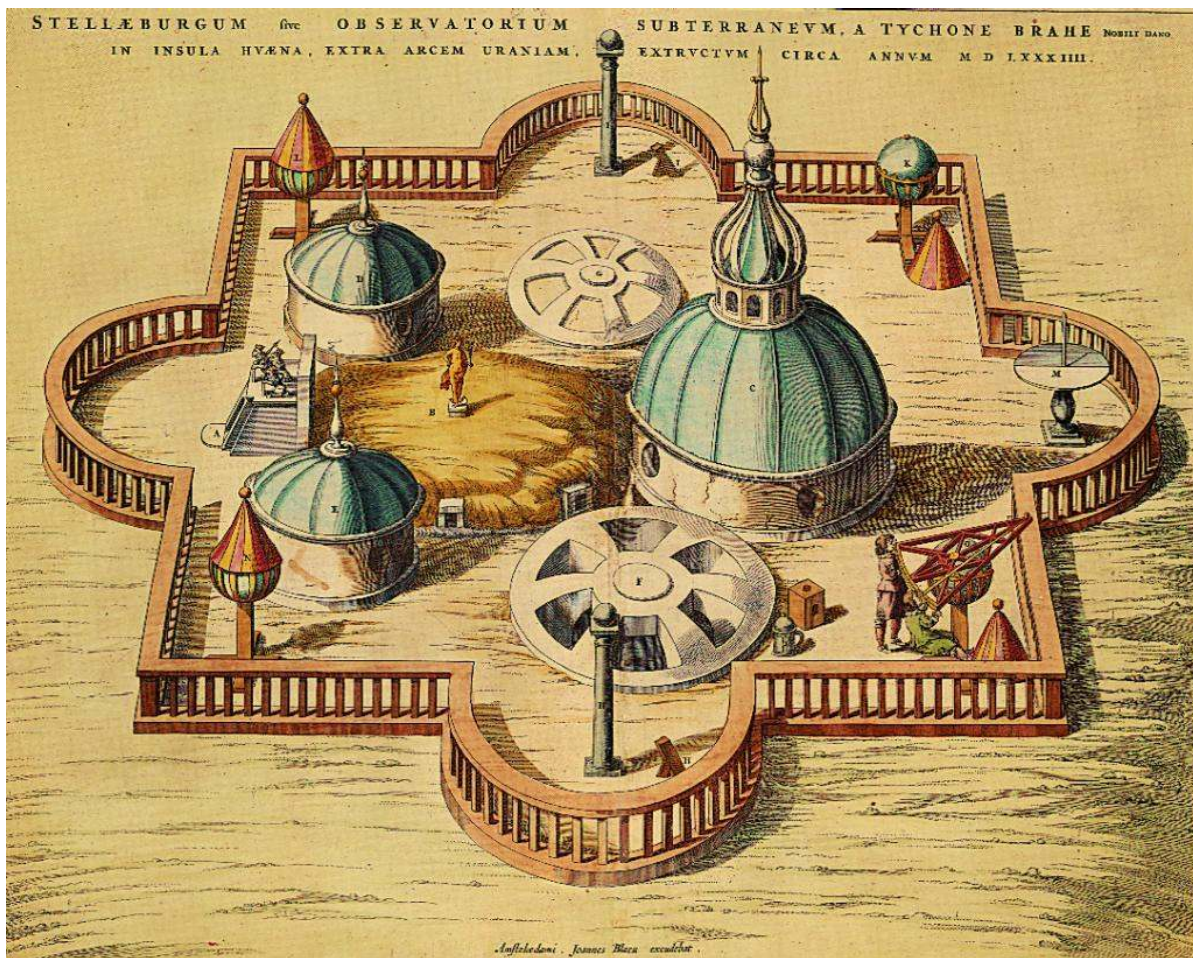


Figure 1

A printing of Stjernborg from *Astronomiae Instauratae Mechanica* (1598)

This is lucid throughout *Astronomiae Instauratae Mechanica* but is also reflected in the portraits of the great astronomers such as Hipparchus, Ptolemy, Alfonso and Copernicus he had displayed in a gallery in Stjerneborg. Tycho had, in reference to his perceived own achievements, also placed a portrait of himself alongside them. [12] Tycho in doing so placed himself in a genealogy of great astronomers and saw his contribution to astronomy as equal to theirs. This may have been an egotistic self-promotion of his inflated legacy, but it shows the way in which he viewed himself and cultivated the image of himself as an exemplary in the way of conducting natural philosophy and astronomy. Tycho thought of himself as a trailblazer forging the way for others to follow and this can be seen in the hall of portraits with the displaying of his heir ‘Tychonides,’ who would take up his mantle and “imitate or even surpass” his achievements. [13] Further echoes of this can be seen in his final words to Johannes Kepler when he said “Let me not seem to have lived in vain.” [14] Tycho expected Kepler to use Tycho’s work to continue and build upon his work, as he saw himself as a figure that should be imitated and followed.

Tycho may have had an inflated image of himself as an exemplar astronomer and of the significance of his astronomical castle, but it is important to establish the accuracy of his self-image and the extent this portrayal permeated beyond the walls of Uraniborg. [15] The fame of Tycho can be detected in the way his astronomical observations were utilized in astronomical globes and almanacs. As Adam Moseley has recently argued in his book *Bearing the Heavens*, Tycho and his data was employed in the service of producing many astronomical globes that were based on his

comprehensive mapping of the heavens on his *globus magnus orichalcicus*, or great brass globe. [16] Tycho's star mapping was used because of its unprecedented accuracy and comprehensiveness. This generated respect for his work that fostered the perception of Tycho and Uraniborg as an exemplary model. Further evidence that demonstrates that Tycho was influential during this period is the Jesuit astronomers' adoption of his astronomical system, and Uraniborg's influence upon the Peking and Greenwich observatory. As J. R. Christianson observed, the legacy of Uraniborg, "passed to the Universities of Copenhagen, Leiden, and Franeker, to Prague, Greenwich, Beijing, and many other places across the face of earth, where it was carried on by astronomers and other researchers and technicians who were inspired by the example of Uraniborg." [17] This is significant as it shows that Uraniborg was later used for inspiration across Europe and even reached into China.

Another indication of Tycho's popularity is found in the almanacs published in the early seventeenth-century. Almanacs were mass-produced astrological tables that contained astronomical data used by astrologers to inform their predictions on their patron's future. The ability of astrologists to make accurate predictions was directly related to the accuracy of the astronomical tables, therefore it was imperative they had the most reliable information within the almanacs. Thus, the choice of data used in the tables gives an indication of the perceived reliability of the astronomical data by the compilers.

It has been observed by Francis Johnson that many of the almanacs produced in the early seventeenth-century utilized data Tycho Brahe had compiled on Hven. [18] The use of Tycho's data is indicative then of the acceptance it had within the astrological community at the time. An example of the use of Tycho's observations can also be seen from Arthur Hopton in his Almanacs from 1606 to 1614 in which he frequently referred to Tycho's and Copernicus' figures and states that he had a preference for the Tychonic astronomical system. [19] Likewise, Philip Ranger in his almanacs also supplemented the old Ptolemaic data with Tycho's new figures. The most striking example of the substantiation of Tycho's work being revered by the astrological community in the seventeenth-century is present in the works of Walter Frost, who included in all his almanacs a short treatise 'Of Astronomie in generall.' Frost in this section praises Tycho for the "infallible observations and instruments" that he possessed; which he notes, has been instrumental in proving that the celestial orbs were non-existent. [20] This shows that whilst historically Tycho Brahe has been eclipsed by the image of Galileo and the Copernican revolution during the early seventeenth century he was still a dominant figure on the intellectual map in the time of Francis Bacon. The fact that his data was used for astrological tables, inspiration for observatories and the production of astrolabes is evidence that Tycho was an influential figure in the early seventeenth-century. This is significant when considering the role Uraniborg played as a model of exemplarity and the potency of its ideological and political power.

Political Power

Uraniborg developed a political power as a symbol due to its association with various rulers of Europe. The key figure in its power was the patronage of King Frederick. He funded the building and support of Uraniborg, which was crucial to the perpetuation of Tycho's island and establishing its prestige. [21] Denmark, during this time, had a reputation for being a powerful and wealthy nation, which continued into the reign of Christian IV. The subsequent support of Tycho Brahe by the holy roman emperor, Rudolph II, in Prague, further assisted in providing Tycho with powerful political associations. [22] Tycho came from a noble background, the Brahe family, who were part of the *Rigsraad*, or the elite political council of Denmark; this meant that Tycho had powerful connections within Denmark to the royal family. The fact that King James I married Princess Anna of Denmark meant that the Brahe family were linked to King James.

King James and his wife after their wedding in December 1590 spent one month celebrating at Kronenborg castle then continued onto Copenhagen for another month. [23] This period is

relevant as King James as part of this celebration made a trip across the Sound to visit Tycho Brahe's island of Hven. [24] James whilst on his visit to the Island of Hven had a grand tour of the island and spent the day discussing the Copernican system of astronomy with Tycho. The time together ended with a lavish feast in which the Royal Chancellor of Scotland, John Maitland, described Uraniborg as "Muses royal castle, jewel of the world, rivalling Olympus." [25] This visit clearly impressed King James and his entourage, for whilst it never resulted in financial support, King James I granted Tycho 30 years copyright in Scotland. What makes this more significant is that when James sent the document granting the copyright, he also included four poems he had written in tribute to Tycho. [26]

King James I in these poems describes his stay in Uraniborg, where he was able to see "shining stars in glistening graithe." The significance of these poems is the way in which they show how King James I was impressed by Tycho and what he perceived as being his achievements. This can be seen in this quote: "Then greate is Ticho who by his booke, commandment doth over these commands brooke." [27] James also notes the fine astronomical instruments Tycho had developed and his belief that Tycho had solved the planetary problem, which had plagued astronomers for centuries, when he said: "Looke Tichoes tooles, there finalie shall be founde Eache planet dancing in his proper spheare." [28]

King James was convinced that Tycho with his impressive arsenal of astronomical tools had been able to finally locate the planets accurately. For this reason James calls Tycho "greater art thou then Apollo" the son of Zeus as "Uranias eldest foster deare." [29] James then saw Tycho as the dearest to Uranias, the muse of astronomy, as a significant individual in the realm of astronomy. These poems were later published in *Astronomiae instauratae progymnasmata* the text through which it is most probable that Bacon became familiar with the ideas of Tycho Brahe. What is notable about James' visit is not only the effect that it had on James but the legacy surrounding the visit. This event was significant enough that Joshua Childrey, in 1662, 70 years after the visit, wrote in his *Britannia Baconica*, that "it is reported that *Tycho Brahe* in his Isle of *Huena*, shewed K. *James* the stars in the day-time." [30] This validates that James' visit to Uraniborg was that well known that it still remained in the cultural memory 70 years later. The fact that King James was so impressed by Uraniborg would have made Uraniborg a very salient model or reference to be utilized in any attempt to gain patronage from King James due to Tycho Brahe and Uraniborg's favorable association with him.

This demonstrates that Tycho was able to gain a series of potent political associations. However, political associations in and of themselves are not enough to establish his reputation as an exemplar. What made Tycho stand out was the way in which he was able to mobilise these political associations to aid in furthering his projects by gaining funding and support for his work through these associations. Tycho was immensely successful at this and was able to gain funding from King Frederick for Uraniborg, an expensive project that used 5% of the national budget, and later the support and patronage of the Holy Roman Emperor Rudolf II. As a result, Tycho and Uraniborg became a model of patronage and an example of what could be achieved through the patronage system, which other natural philosophers and writers of the time noticed and utilized for their own ends. It was, however, not simply its example of patronage that made it popular, it was also associated with a certain methodology of investigation. It was this association that endowed it with ideological power as a symbol.

Ideological Power

The rise of Uraniborg and Tycho as a symbol of an ideology can be seen in the way in which his plans were mobilised by various people in order to give their projects legitimacy. Some examples of these are Andreae Libavius, Edward Wright, and Johannes Andreae. Each of these engaged with Tycho's design as part of a proposal for a major large-scale project or as a means to gain patronage and were all doing that which Bacon would later do in *New Atlantis*; they used a

prominent source as validation of their stance, in order to improve the possibility of their proposal, gaining support by powerful patrons such as King James I/VI.

Edward Wright in his work *The Certaine Errors of Navigation* demonstrates the way in which Tycho and Uraniborg were used as examples for emulation and to legitimate their own projects. In this work Wright calls for extra funding from the State in order to solve the problem of latitude. [31] The problem of latitude had tormented sailors for centuries and the quest to solve it was of foremost importance to many natural philosophers and political leaders at the time. This was because whoever was able to solve the problem of latitude would have a significant advantage militarily and economically over other nations. In the 'Preface to the reader' Wright says that Tycho Brahe gave him hope that if sufficient funds were invested in a similar scheme in this country like they were for Uraniborg, where Brahe "made many and most diligent observations, with large and exact instruments," then mariners would soon be able to solve the problem of latitude which had plagued sailors for centuries. [32] This would aid imperialistic aims and the discovery of new lands. Wright uses Tycho as figure who is to be emulated and Uraniborg as an example of the way in which they should follow. Wright invoked Tycho to give credibility to his scheme, for Wright was doing no more then building upon the work that the "noble Lord of Knudstrup, Tycho Brahe" had already done. Wright was drawing attention to the similarities between what he was doing and what Tycho was doing to improve the credentials of his project. This reveals the use of Uraniborg as a symbol of achievement to be emulated and its use as a guide for action towards progress.

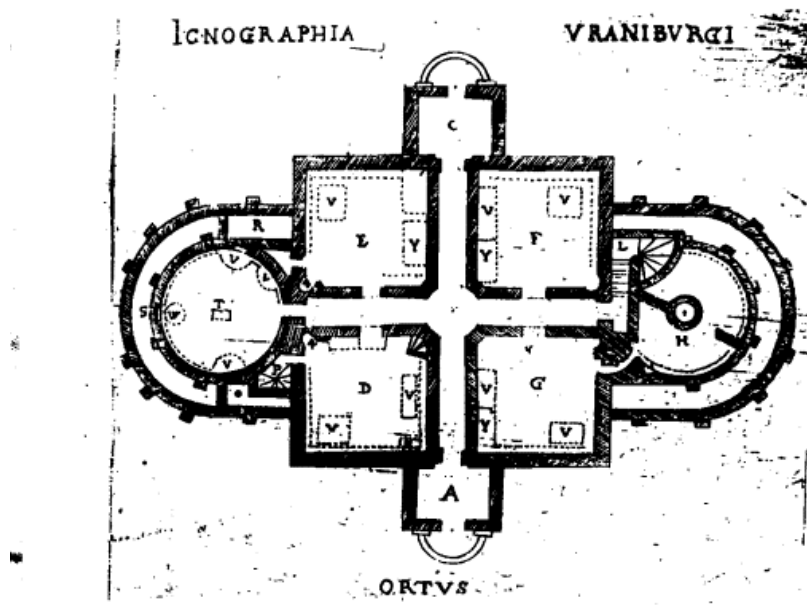


Figure 2

Plate 76 from *Andreae's Collectaneorum Mathematicorum Decades XI. Centum et decem tabulis Aeneis exhibitae* showing the floor plan of Uraniborg.

Johannes Andreae also used Uraniborg as a model in his utopian novel *Christianopolis*. This is significant as *Christianopolis* has an affinity with Bacon's *New Atlantis*, inasmuch that Bacon's work has been interpreted as nothing but a reconfiguration of the works of Andreae and Campanella. [33] The structure of *Christianopolis* is similar to Bacon's as both of them have an idealised scientific community that is found as part of a pseudo-travel narrative. *Christianopolis* draws upon Tycho Brahe's Uraniborg for its influences and structure and demonstrates how

Uraniborg was being used as a blueprint for the ideal scientific community, which Bacon was also trying to articulate. [34]

Andreae in his *Collectaneorum Mathematician Decades* has a series of plates that Andreae engraved himself; these plates show the role of Uraniborg in his thinking and development of *Christianopolis*. The juxtaposition of images in the collection is indicative of what Andreae was influenced by and how he saw them and their relationship to each other. [35] Plate 76 (Fig. 2) gives a depiction of the floor plan of Uraniborg. This plan was included in Brahe's *Mechanica*. The duplication of this image shows that Andreae was familiar with this work and viewed as significant to duplicate within his work. The next plate (Fig. 3 and Fig 4) contains a visualisation of his *Christianopolis*, which is almost identical to the image that Brahe included of his gardens on Uraniborg (Fig. 5). Uraniborg was being utilised as the infrastructure by Andreae, which he embellished and expanded, to form *Christianopolis*. [36]

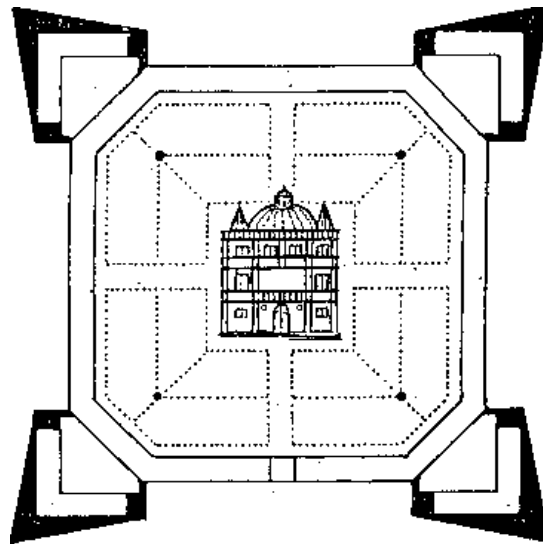


Figure 3

Plate 77 from Collectaneorum Mathematicorum Decades XI. Centum et decem tabulis Aeneis exhibitae, which shows a basic plan of Christianopolis. To see a more comprehensive image of it see Figure 4 below

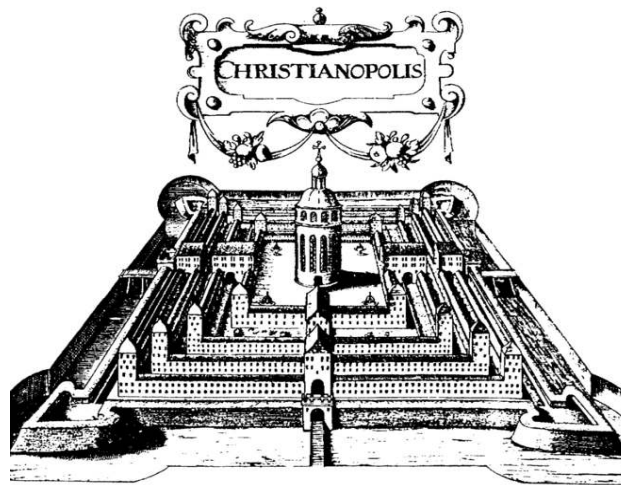


Figure 4

Frontispiece to Johannes Andreae's Christianopolis compare to Plate 77 of Collectaneorum Mathematicorum Decades (Fig. 3) and to the map of Uraniborg and its gardens (Fig. 5)

The second factor shows the influence even more overtly. In the city of *Christianopolis* there is an astronomical observatory with various astronomical instruments described by Andreae as “all to be found in the design of the admirable Tycho Brahe.” [37] For Andreae, it was evident that Uraniborg was an exemplary model for a scientific organisation, one that he could duplicate in his idealised utopian city, that he outlined and expanded in *Christianopolis*, his vision of the future organisation of science within society.

Tycho Brahe’s Uraniborg was not only used as an ideal example of the organisation of knowledge and discovery but it was also used as a location for criticism and attack. An instance of it being used as a site for criticism, as Jole Shackelford and Owen Hannaway have shown, is within the work of Andreas Libavius. [38] Initially Libavius was impressed by Uraniborg and saw Tycho as a “refuge of great hope” in the way in which chemistry and astronomy would develop. [39] After Tycho left Denmark and became associated with the centre of alchemical occultism, RudolFINE Prague, Libavius lost the respect that he had for Tycho and criticised Tycho and Uraniborg in *Alchemia* (1606). Libavius’ change in opinion regarding Tycho may have been due to Tycho’s new occult association with Rudolf II, he may also have been influenced by the disparaging attack against Tycho by Nicholaus Raimarus Bär, known as Ursus in *De hypothesis astronomicis tractatus* a work which Nicolas Jardine described as “savage and scurrilous even by the standards of sixteenth-century polemic.”[40] Whatever the cause Libavius had in the intermittent period of time had a dramatic change of opinion regarding Tycho that had lead him to criticise Uraniborg and Tycho’s portrayal of it as an ideal way of investigating nature.

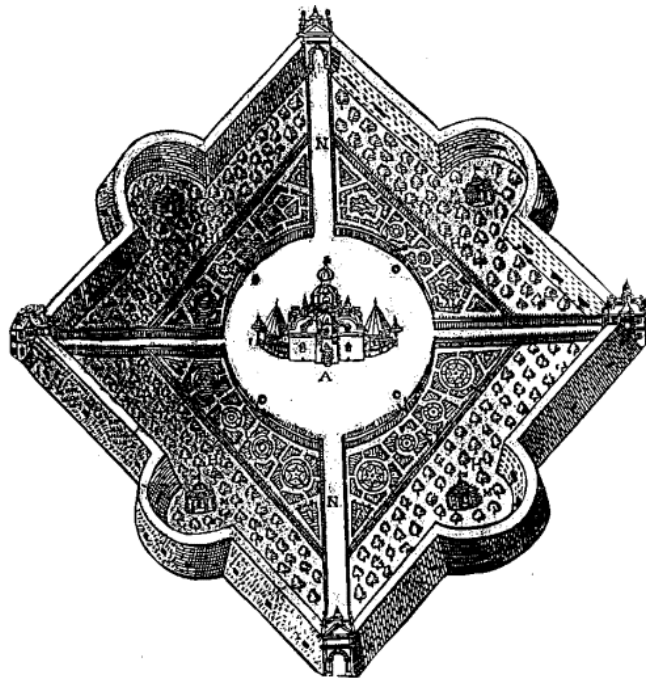


Figure 5

A map showing the gardens of Uraniborg from Tycho Brahe’s Astronomiae Instauratae Mechanica. Through comparison with Figures 3 and 4 the similarity can be seen between Uraniborg and the layout of Christianopolis

Tycho had believed that there was a connection between architecture and method. This connection meant that the right building would be conducive to the right system of investigation. Libavius also saw this bond between the building’s design and its function. Libavius used this relationship of architecture and method to make use of Uraniborg to undermine a certain way of investigating nature and to highlight the superiority of his hypothetical plans for a Chemical House,

which he saw as the embodiment of the way in which alchemy should be conducted (Fig. 6). Libavius did this by criticising the architecture of Uraniborg, but doing so it meant that he could by extension also make a statement about Tycho's methodology.

Libavius used the plans of Uraniborg in order to characterise the nature of Tycho's alchemical laboratories in a negative light. Libavius portrayed Uraniborg as a dark and secretive place hidden away to worship Vulcan, the patron god of alchemy. This portrayed Tycho as an alchemical Paracelsian who conducted alchemical investigations in the dingy, dark basement, which was a stark contrast to Libavius' proposal for a Chymical House in which his laboratory was open and filled with light. [41]

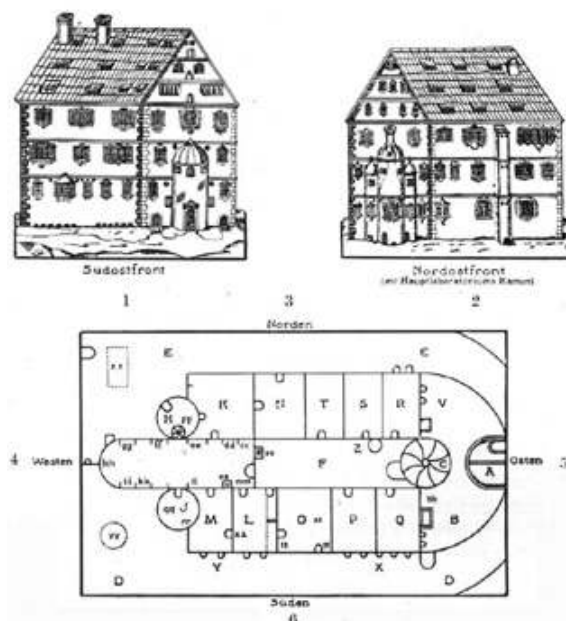


Figure 6

A copy of Libavius' Chymical House from Andreae Libavius, Rerum Chymicorum Epistolica Forma Liber Primus (1595)

In characterising Uraniborg as a dark secretive place he created a dichotomy between Uraniborg and his Chemical House, this created a space in which he could aggrandise himself at the expense of Uraniborg. Libavius attacked Uraniborg in order to establish his superiority over Tycho Brahe and his methodology, as by undermining Tycho, one of the dominant intellectual figures at the time, it would elevate both Libavius and his proposals for a Chymical House. The fact that Libavius would invoke the usage of Tycho and Uraniborg as part of his rhetoric shows that it was possible that the symbol of Uraniborg could be used for both for positive and negative uses.

I have shown how during the early seventeenth-century Tycho Brahe and Uraniborg were mobilised by various authors for a variety of purposes. Uraniborg came to embody a certain ideology, which was used to validate schemes and also to show what was seen as a flawed methodology, as in the case of Libavius. Its close association to King James would have been particularly pertinent to Francis Bacon who had spent considerable effort planning to build a philosophical college and encouraging King James to support and provide patronage for the development of natural philosophy.

Solomon's House

To show the connection between Uraniborg and Solomon's house involves comparing the core elements of each institution. Before a comparison is made it should be considered the extent to which Bacon was aware of Tycho Brahe's observatory and was familiar with Tycho's works.

The most compelling evidence of Bacon's knowledge of Tycho is shown within *Descriptio Globi Intellectus*, where Bacon discusses various astronomical theories of planetary motion and the evidence for them. [42] Bacon analyses competing planetary theories observing that "the sun manifestly has Venus and Mercury as his satellites, and in the opinion of Tycho the other planets also." [43] This denotes a familiarity with the Tychonic system which has the sun rotating round the earth and the remaining planets orbiting the sun; this was the geo-heliocentric model Brahe had proposed as a compromise between the Copernican and the Ptolemaic model. [44] The fact that Bacon was aware of Tycho and his planetary theory means that he also knew of Uraniborg and was likely to also be influenced by Uraniborg.

Indications that early on in his career Bacon was drawing upon Uraniborg can be seen in *Gesta Grayorum*. A work which James Spedding described as "a first hint of his great project for the restoration of the dominion of knowledge, - a first draft of *Solomon's House*," [45] In this text we can detect the start of the core features of Solomon's House and also the influence of Uraniborg. *Gesta Grayorum* was written as part of a Christmas celebration at Grey's Inn and was a play in which a series of counselors, advise the prince regarding the governing of his kingdom. The six counselors advise him respectively on the exercise of war, the study of philosophy, fame of buildings, state and treasury, virtue and gracious government, and pastimes and sports. The most interesting one is the counselor who advises the prince about the study of philosophy, as within his speech we can detect the early ideas that would feature in *New Atlantis*.

The counselor advises the prince that he should do four things. The first is to construct a vast library of the greatest books in the world. Secondly, to build a garden that would contain samples of all the plants, animals, and fish in the world that would become a microcosm of the world. Thirdly, to have a cabinet filled with artifacts of nature and man, and finally to build "a still-house, so furnished with mills, instruments, furnaces, and vessels, as may be a palace fit for a philosopher's stone." [46] Traces of all of these ideas can be found in Uraniborg, which had a large and great library, a garden, and most importantly, a mill, furnaces and instruments. The island of Hven was unique in that it was a self-contained unit for research. This self-sufficiency was possible due to Tycho's construction of a mill and printing press in conjunction with a noble palace devoted to the study of the heavens and the earth. Uraniborg then seems to fit perfectly Bacon's description of "palace fit for a philosopher's stone." If we can find a direct parallel in the early stages of *New Atlantis*' development as an idea it is important to see if this can still be detected within the more fully developed concept as presented in *New Atlantis*.

In order to do so we must compare what the core features of Solomon's House were, and if they match up with the core features of Uraniborg. In *New Atlantis* we are given an concise outline into the characteristics of Solomon's house by the Father of Solomon's house who explains to the visitors that: "to make you know the true state of Salomon's House, I will keep this order. First, I will set forth unto you the end of our foundation. Secondly, the preparations and instruments we have for our works. Thirdly, the several employments and functions whereto our fellows are assigned. And fourthly, the ordinances and rites, which we observe." [47] From this passage the Father gives us four components of Solomon's House these being the purpose, instruments, workers and rituals of the organisation. I shall now look at the first three of these elements and compare the way in they reflect similar features found in Tycho Brahe's Uraniborg.

Purpose

The first element mentioned by the Father was the purpose of its existence. This was to discover "the knowledge of causes, and secret motions of things." [48] Solomon's House was not simply attempting to explain the way things superficially appeared but they wanted to understand the secret motions that worked underneath the appearance. This reflects the same objective of Uraniborg, which aimed at finding not only the true motion of the heavens, but also a discovery of the secrets of Alchemy and motions of earthly bodies. Tycho differed from many astronomers at

the time in that he was not simply searching for an instrumental or fictionalist account of the heavens; he was searching to find out the way the heavenly bodies really moved. [49] Having made observations as accurate and precise as his, he couldn't accept any explanation other than a realist account of the heavenly motions. [50] In 1588/9 Tycho said in a letter to Christoph Rothmann, the eminent astronomer at Kassel, that he was working "expressly for the restitution of the celestial motions that the truth may be known." [51] What is interesting is that Tycho viewed it as restitution of ancient knowledge not a new discovery. This is reflected also in the title of his works such as *Astronomiae Instauratae Mechanica*, the instruments for the restoration of astronomy. It is interesting that the word *Insturatae* an uncommon word at the time features in both Bacon's and Brahe's projects. Tycho's project was searching for the true motions of the heavens he wanted a realist account rather than an instrumental explanation.

As Kenneth Howell and Nicolas Jardine have pointed out Tycho's inaugural address *De disciplinis mathematicis oratio* at the university of Copenhagen shows both his views of restoring heavenly knowledge and his quest for realism. In the lecture Tycho draws upon Josephus to argue that the patriarchal fathers Seth, Abraham and Moses had a greater knowledge of the stars and astronomy, Tycho was attempting to restore the heavenly knowledge that the ancients once possessed but had now been lost and at the same time he wanted to reconcile Ptolemy and Copernicus, he wanted to fuse the physical truth of Ptolemy whilst keeping the mathematical superiority of Copernicanism. [52] Tycho was trying to combine the two concepts and bring the best out from both astronomers.

The theme of restoring to mankind lost knowledge in conjunction with new discovery was also a theme shared with Bacon and is reflected in Solomon's house. In *New Atlantis* the inhabitants of Bensalem possess an apocryphal work of Solomon known as Solomon's 'Natural History.' In *New Atlantis* this natural history is the inspiration and foundation for Solomon's House it is the canonical text that forms the basis of the experiments. [53] This is not the first time that Bacon refers to this text, Bacon first refers to this natural history in his *Filum Labrinthi* when he says that "Solomon, in his grant of wisdom from God, had contained as a branch thereof, that knowledge whereby he wrote a natural history of verdor". [54] This work is also referred to in the epistle dedicatory of *Instauratio Magna* when Bacon encourages James to emulate Solomon in "taking order for the collecting and perfecting of a Natural and Experimental history." [55] Thus a link is seen between the *Instauratio Magna* and *New Atlantis* with the former encouraging James to create a natural history and the latter showing the result that such a natural history would produce. This link is evidence that it is likely *New Atlantis* was an attempt to gain patronage of King James for creating Solomon's House.

Instruments

The main common factor between Uraniborg and Solomon's House is the role instruments and workers have in both Solomon's House and Uraniborg. The role of instruments in Solomon's House demonstrates the way in which Bacon drew upon an image and modified it for his own purpose. From reading the text of *New Atlantis* it is not obvious that Solomon's House is duplicating Uraniborg, as it has no reference to astronomy and none of the instruments appear to be related to astronomical investigation, thus, making it problematic in designating it as an influence on Bacon. However, it should be remembered that what distinguished Tycho's castle was the fact that it housed his arsenal of instruments, this was one of the fundamental parts of Tycho's achievements and what established his legacy. A reoccurring feature of his role as a model figure was the role of "his infallible observations and instruments", James referred to them as "Tichoes tools", Wright called them "his large and exact instruments" and Andreae had them as a central feature in his community in *Christianopolis*. We can see from these quotes that Tycho Brahe's collection of instruments was one of the chief factors that established his reputation amongst his peers. In the description of Solomon's House the majority of the passage is taken up with

elaborating on “The Preparations and Instruments.” Bacon expanded upon the instruments by incorporating numerous other types of instruments gathered together in one place.

As other scholars have noticed, Bacon was not using novel or imaginary instruments but was basing them upon contemporary instruments, many of which he had seen from Cornelius Drebbel and Salomon de Caus. Both Drebbel and de Caus had been attached to Prince Henry and his laboratory based in Eltham Palace and would have been familiar to Bacon. Rosalie Colie has shown that many of the experiments conducted there were very similar to those that were conducted by Bacon such as the elaborate fountains, his magical lanterns, and sound houses. For instance, the machine in Solomon’s House used for “going under water” was based upon the first successful submarine made by Drebbel for King James. [56] The similarity of the experiments conducted by de Caus and Drebbel and those in Solomon’s House has lead Colie to conclude that they provided two partial models for *New Atlantis*. If they provide a partial model then we must then look for the remaining model, or models, that Bacon utilised in Solomon’s House. Bacon in his works drew upon a diverse range of sources, and often his work is a hybrid and synthesis of these ideas. I would suggest that Uraniborg is also a likely candidate for a partial model for Solomon’s House.

In *New Atlantis* it is possible to see the same fusion of sources. For instance the core features of the Solomon’s House appear to be based upon, or at least similar to, those of Uraniborg, whilst the details of the instruments and experiments have been incorporated and synthesised from Drebbel and de Caus. Bacon had simply made Solomon’s House in Bensalem the home of Cornelius Drebbel and Salomon de Caus instruments rather than the astronomical instruments of Tycho Brahe. Solomon’s house mirrors Uraniborg in being based around a large collection of instruments. Bacon’s institution instead of focusing on the heavens has instruments dedicated to the study of nature and the earth. Tycho saw his instruments as being one of his greatest achievements and instruments were “the riches of Solomon’s house.”[57] Uraniborg had been presented as the ideal space to pursue astronomy and in a similar fashion Bacon had presented Solomon’s House as an ideal space to pursue natural philosophy.

Workers

The third factor that was an intrinsic part of Solomon’s House was the division of labour. The Fellows were divided into a hierarchical structure with various roles such as the Depredators who gathered information from books, the Pioners or Miners who performed new experiments. The data generated by the Miners was fed to the Compilers who put it into tables of observations, which the Interpreters of Nature then used to derive greater axioms and aphorisms. This is interesting as one of the things that Kepler pointed out about Tycho was the fact that “he also has workers and everything else which one might desire.”[58] The workers were then also part of the prestige which Tycho had. The role of Tycho’s workforce is interesting as it shows a collaborative venture that operated along similar lines to Bacon. New students at Uraniborg primarily were the ones that made the experiments and observations; these were delegated to separate individuals who worked on separate projects. [59] Tycho’s assistants generated a vast amount of data and observations, which Tycho collated and used to derive theories from them. Interestingly one of the problems that Kepler had with Tycho was the division of labour as it meant he was unable to see all of Tycho’s data but only that portion that he was assigned to work at. These observations were then passed onto the senior members of Tycho’s team such as Christian Longomontanus who compiled and calculated them. [60] Finally, this was given to Tycho who used them to derive conclusions and axioms from them. It can be seen then that the structure and way in which workers in Uraniborg and Solomon’s House operated were comparable. Both relied upon a vast amount of empirical data, and a hierarchal structure with a clear division of labour.

Having compared the three principles of Solomon’s House it has exposed that it has many similarities with Uraniborg. This would suggest that it is likely that Bacon like Andreae was using Uraniborg as a framework on which to base his own idealised vision of the future. Bacon was

transforming a popular image of his time to help his own ends, by combining images in novel ways. It would be too much to argue that Uraniborg was the influence that inspired Solomon's House, but it is possible to suggest that Bacon utilised it due to the fact that it had much in common with his own ideas and thus was a salient image to be incorporated within *New Atlantis*.

Conclusion

I have argued in this article that Uraniborg came to be seen to embody certain values and principles and that these ideological and political associations were used in the rhetoric of various contemporaries to Bacon. These principles came from the way in which Tycho Brahe had presented Uraniborg as the ideal place in which to study the heavens and conduct an astronomical instauration and the accurate and extensive observations he had made with his powerful instruments. As a result it had become a model of emulation for many astronomers and natural philosophers. I would suggest that Bacon incorporated the principles embodied by Uraniborg and modified them to fit into his own project of the great instauration in order to present Solomon's House as the ideal space in which to pursue natural philosophy. I have attempted to show in this article the extent to which Bacon in the construction of his ideal vision drew upon prominent influences around him such as Uraniborg and Drebbel. *New Atlantis* was a fusion of multiple sources from the world in which he lived. James Spedding, editor of Bacon's works said of *New Atlantis* that "the description of Solomon's House is the description of the vision in which he lived" and the similarities between Uraniborg and Solomon's House shows the extent to which *New Atlantis* was not only a vision of Bacon's time but also a product derived from the mixture of sources found within the culture of Bacon's time. [61]

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