"Perhaps irrelevant": the iconography of Tycho Brahe's small gilt brass quadrant

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Having first offered him the island of Hven in 1576, Frederick II of Denmark encouraged Tycho Brahe "to erect buildings on the island, and to construct instruments for astronomical investigations as well as for chemical studies."[1] The result of this generous patronage was the famous castle, Uraniborg, along with the underground observatory, Stjerneborg, which Tycho equipped with a vast array of astronomical instruments that he designed and constructed in his workshops on the island. Employing these instruments in a systematic programme of observation, the data compiled by Tycho during his twenty-one years on Hven provided the foundation from which Kepler was to derive his laws of planetary motion.

Although Tycho's instruments do not survive to the present day, Tycho ensured their survival in literary form, lavishly illustrating and describing them in his *Astronomiae instauratae mechanica* of 1598. Though Tycho had long conceived of a literary account of his instruments, the publication of the *Mechanica* was prompted by his loss of royal favour (and consequently financial support) in Denmark. Dedicated to the Holy Roman Emperor, Rudolph II, the *Mechanica* was sent to influential members of the European nobility with the aim of procuring patronage. This text therefore not only provides a good indication of the extent and sophistication of the hardware at Tycho's disposal, but the circumstances of its production also provide significant insight into how

[1] Tycho Brahe, *Instruments of the Renewed Astronomy*, translated by Jole. R. Shackelford, Alena Hadravová, Petr Hadrava (Prague: KLP, 1996), p. 121. Originally published as *Astronomiae instauratae mechanica* (Wandsbek. 1598). Hereafter *AIM* (1996).

Tycho wished to present himself to the most influential men of the period.

Despite this, Tycho's instruments have received relatively little scholarly attention beyond a consideration of their innovative design and capacity for precision measurement.[2] Whilst of historical interest, this bias towards the more technical aspects of Tycho's instrumentation presupposes that their principal function was as 'scientific instrument', and fails to consider any alternative role that Tycho may have intended his instruments to play. Yet the very fact that he chose to present himself to the European nobility through his *instruments*, rather than any other aspect of his astronomy, emphasises the value that Tycho ascribed to them, as well as suggesting their capacity for self-expression.

Indeed, the images and accompanying descriptions provided in the *Mechanica* suggest that Tycho often decorated his instruments with complex iconography in order to lend meaning to his tools. By examining the decorative features of the first instrument presented in the *Mechanica*, this study will highlight the extent to which Tycho drew on the wider visual culture of the Renaissance to transform his instruments into vehicles of self-expression. In this way, we can appreciate Tycho's instruments as more than simply observational tools, but also an important mechanism by which he presented his ideas and ideologies.

[2] See, for example, Allan Chapman, "Tycho Brahe – instrument designer, observer and mechanician," *Journal of the British Astronomical Association*, 1989, *99*:70-76; Allan Chapman, "The Accuracy of Angular Measuring Instruments used in Astronomy between 1550 and 1850," *Journal for the History of Astronomy*, 1983, *14*:133-137; Victor Thoren, "New Light on Tycho's Instruments," *Journal for the History of Astronomy*, 1973, *4*:25-45; Michael Rosa, "How Really Precise and Accurate are Tycho Brahe's Data?" in *Kepler's Heritage in the Space Age (400th Anniversary of* Astronomia nova*)*, edited by A. Hadravová, T. J. Mahoney, P. Hadrava (Prague: National Technical Museum, 2010), pp. 102-113; Gudrun Wolfschmidt, "The Observatories and Instruments of Tycho Brahe," in *Tycho Brahe and Prague: crossroads of European science* (Frankfurt am Main: Deutsch, 2002), pp. 203-216; G. L. Tupman, "A Comparison of Tycho Brahe's Meridian Observations," *The Observatory*, 1900, *23*:132-135; Walter G. Wesley, "The Accuracy of Tycho Brahe's Instruments," *Journal for the History of Astronomy*, 1978, *6*:42-53. A notable exception is Adam Mosley's *Bearing the Heavens: Tycho Brahe and the Astronomical Community of the Late Sixteenth Century* (Cambridge: Cambridge University Press, 2007), whose examination of Tycho's modes of communication highlights the extent to which Tycho utilised his instruments to convey his ideas alongside more conventional media such as books and letters. See also Volker Remmert, "Visual Legitimisation of Astronomy in the Sixteenth and Seventeenth Centuries: Atlas, Hercules and Tycho's Nose," *Studies in History and Philosophy of Science*, 2007, *38*:327-362, which calls attention to the iconography of Tycho's great equatorial armillary.

The instrument with which Tycho opens his *Mechanica* is a small gilt brass quadrant, constructed around 1573 (fig. 1).[3] With a radius of only one cubit (approximately 40 cm), the quadrant was one of Tycho's smaller instruments. Consistent with the majority of the images in the book, the illustration of this instrument is visually striking and would surely have created an immediate impression on the curious reader. Unlike several other of his instrument illustrations, this image was seemingly created specifically for inclusion in the *Mechanica*, while its engraved rather than woodcut form further differentiates it from several of the other images.[4] The use of letters to label various parts of the illustration was also an effective means by which Tycho was able to make reference to specific elements of the instrument in his accompanying textual description, contributing to a rich interplay between image and text evident throughout the *Mechanica*.[5]

<fig. 1 here>

Despite its privileged position as the first instrument introduced to the reader, the small quadrant is technically rather disappointing. Victor Thoren, twentieth-century biographer of Tycho, has even asserted that it was "so far obsolete by 1580 that [Tycho] never again used it."[6] Indeed, Tycho acknowledges the shortcomings of this instrument, stating that it was useful for finding celestial altitudes only "in such cases when complete accuracy is not necessary."[7] Although Thoren suggests

[3] While this is one of Tycho's earliest instruments, it is not indeed the earliest depicted in the *Mechanica*; both the wooden sextant and giant Augsburg quadrant were constructed prior to this quadrant (c. 1569 and 1572 respectively). It is worth noting that the instruments in the *Mechanica* are not presented in the chronological order in which they were built. For more on the chronology of Tycho's instrument construction, see Victor Thoren, "New Light on Tycho's Instruments," *Journal for the History of Astronomy*, 1973, *4*:25-45.

[4] While the majority of the images in the *Mechanica* are woodcuts, there are a few others besides that of the small quadrant that are engraved. It is therefore difficult to draw any specific conclusions about the use of this printing technique in this instance, although the significantly greater cost of engraving is indicative of the value that Tycho ascribed to his instruments and perhaps reflects the princely audience for which this book was intended.

[5] Though the use of such labelling is not unusual in the period, it enabled Tycho to conveniently direct the reader's attention and, in combination with his highly detailed descriptions of the instruments in use, may have played a role in encouraging the reader to visualise the instruments and imagine handling them in real time and space,

[6] Victor Thoren, *The Lord of Uraniborg: a biography of Tycho Brahe* (Cambridge: Cambridge University Press, 1990), p. 163.

[7] Tycho Brahe, *Tycho Brahe's Description of his Instruments and Scientific Work as given in* Astronomiae instauratae

that Tycho did not realise that the instrument would fall short of his rigorous standards, this is called into question by the fact that from the start it was divided into only five minutes of arc – well below the standard of precision demanded by Tycho in his observations.[8] One of his earlier instruments, it was constructed prior to Tycho's well-documented application of transversal divisions to his instruments and thus its small size would have necessitated a compromise on the precision of its measurement scale.[9] And though an attempt at increased precision is made through the inclusion of Nonnian divisions,[10] Tycho is rather nonchalant about their use, contemplating in the *Mechanica*, "if one desires to use in addition the Nonnian divisions ..." In fact, he goes on to dismiss this method of division entirely, claiming it to be "insufficient in practice, and experience will show that the promised accuracy is not in fact obtained by it."[11]

The instrument was also constructed prior to the maturation of Tycho's innovative sighting devices and thus relies instead on pinhole diopters, themselves responsible for the introduction of significant parallax errors in astronomical observation. However, it seems that the improved sights (or at least a primitive version of them) were later added, for Tycho states that "On the lower pinnule at A slits parallel to the sides of the upper one are sometimes used."[12] The use here of the word 'sometimes' [*nonnunquam*] suggests, like the dismissive reference to the Nonnian divisions, that preferential use of the improved sights was far from *assumed*, and therefore that precision measurement was not necessarily the primary function of this instrument. If this is indeed the case, it is perfectly feasible to suggest that Tycho was aware of the limitations of this instrument in terms

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mechanica, translated by Hans Raeder, Elis Strömgren, Bengt Strömgren (Copenhagen: Ejnar Munksgaard, 1946), p. 15. Originally published as *Astronomiae instauratae mechanica* (Wandsbek. 1598). Hereafter *AIM* (1946).

[8] Thoren, *Lord of Uraniborg* (cit. note 4), p. 77.

[9] Tycho was thoroughly aware of the correlation between size and resolving power, having constructed a giant quadrant with a radius of over five metres in the garden of the mayor of Augsburg only the year before the construction of the small quadrant, precisely to allow further subdivision of the measuring scale. This instrument too was depicted by Tycho in his *Mechanica*; see *AIM* (1946), pp. 88-91.

[10] This division technique, developed by Spanish mathematician Petrus Nonius, utilises a series of concentric arcs divided into a progressively smaller number of subdivisions; during observation, the point intersected by the alidade, along with its respective row, is noted and the data compared to a table (in this case inscribed on the back of the quadrant), which then provides a measurement value. For Tycho's description of the use of these divisions, see *AIM* (1946), p. 15.

[11] *AIM* (1946), p. 15.

[12] *AIM* (1946), p. 13.

of its precision from the very beginning. Furthermore, as Thoren himself admits, "If Tycho expected any great performance from it, he did not work very hard to get it, for his logs show very few observations using this instrument."[13] This is in contrast to Tycho's normal attitude towards his instruments and constant striving to improve and perfect his observations and instrumentation.[14] Indeed, had Tycho really expected a precision instrument yet was let down in practice, he would surely have begun work to replace this quadrant with an improved version; instead he began work on a new sextant and thus this instrument remained (at least temporarily) his primary quadrant.[15] All these factors suggest that from the outset precision measurement was not the primary function of this instrument.

This of course begs the question of precisely what *was* the principal role of the small brass quadrant, if not astronomical observation. It also leads to speculation as to why Tycho chose to open his *Mechanica* with this particular instrument, given his aim of procuring patronage to finance his ambitious reform of astronomy. Closer examination of the image and accompanying textual description reveals several striking features of this first instrument described in the volume. Unlike many of his other instruments, which are often depicted in a realistic architectural setting, emphasising the supports and footings designed for stability, Tycho's small brass quadrant is represented, somewhat surprisingly, outdoors. The ground at the foot of the stand upon which the gilt quadrant is set is uneven and there are small plants growing out of the earth. This setting depicting the earth and vegetation is reminiscent of some Renaissance illustrations of anatomised bodies, including those in Andreas Vesalius's *De humani corporis fabrica* (1543), in which

[13]Thoren, *Lord of Uraniborg* (cit. note 4), p. 77.
[14] Tycho offers some insight into the methodology and philosophy behind his instrument production, specifying that each device must be as "nearly perfect" as possible; as a result, "if they [the craftsmen] cannot perhaps do it all perfectly the first time, the constructor must not let himself be discouraged, but have the work repeated and improve the defects in every way, until none is left. … Consequently we have remade most of the instruments described in this book more than once, not without great expense." *AIM* (1946), p. 19.
[15] Thoren, *Lord of Uraniborg* (cit. note 4), p. 78.

dissected human figures are shown standing in a naturalistic landscape (fig. 2).[16] However, an exposed setting and uneven terrain would hardly have been suitable for situating astronomical instruments for use in observation.[17] By placing the gilt quadrant here, on uneven ground, Tycho may have intended to convey an idealised status for this instrument, removing it from a purely observational context and thus calling attention to its role beyond mere astronomical measurement.[18]

<fig. 2 here>

Not only is the instrument idealised in the image, so too is the role of the astronomer, through the inscription of a small decorative 'emblem' contained within the arc of the quadrant (fig. 3).[19] In

[16] See, for example, the images in Charles Estienne, *De dissectione partium corporis humani libri tres* (Paris: Simon de Colines, 1545); Juan Valverde, *Historia de la composicion del cuerpo humano* (Rome: Antonio Salamanca and Antonio Lafrery, 1556). There has been some scholarly attention to the function of the landscape setting in Vesalian iconography; see, for example, G. S. T. Cavanagh, "A New View of the Vesalian Landscape," *Medical History*, 1983, *27*:77-79; cf. Martin Kemp, "A Drawing for the *Fabrica*: and some thoughts upon the Vesalius muscle-men," *Medical History*, 1970, *14*:277-88. For the use of landscapes more generally, see Otto Pächt, "Early Italian Nature Studies and the Early Calendar Landscape," *Journal of the Warburg and Courthauld Institutes*, 1950, *13*:13-47.

[17] While it could be supposed that the outdoor setting of this instrument may have been intended to convey a sense of transportability, a consideration of this instrument in the context of Tycho's wider instrument collection suggests that this is not the case. While many of Tycho's instruments were not easily manoeuvrable (the mural quadrant, for example), there are a large number that were; Tycho takes great care to emphasise the transportability of his instruments where applicable. Indeed, having described the constructional advantages of another instrument, which could be easily taken apart and transported in a purpose-built case, Tycho confirms that "Therefore I generally refer to this as the portable azimuth quadrant", *AIM* (1946), p. 22. If Tycho did intend to use an outdoor setting to convey the transportability of his instruments, there were other more obvious choices for such treatment than the small brass quadrant in question. Furthermore, the only other instrument depicted in an idealised outdoor setting (apart from the Augsburg quadrant, which was in fact installed outside in the garden of the Mayor of Augsburg), is the great brass globe which, as Tycho himself acknowledges, was far from easily transportable: "On account of its great size which made transport difficult it remained in Augsburg for five years". *AIM* (1946), p. 103.

[18] A similar outdoor placement was chosen for the depiction of Tycho's great brass globe, even though it is known to have been situated in the library at Uraniborg; see *AIM* (1946), pp. 102-105. Globes had strong symbolic meanings in the period, reinforcing the interpretation that the outdoor setting carried special significance: globes are not normally found out-of-doors. For more on the role of globes in the Renaissance, see Elly Dekker, "Globes in Renaissance Europe," in *The History of Cartography*, Vol. 3: Cartography in the European Renaissance, edited by David Woodward (Chicago: University of Chicago Press, 2007), pp. 135-173; Elly Dekker, *Globes at Greenwich: a catalogue of the globes and armillary spheres in the National Maritime Museum* (Oxford: Oxford University Press, 1999), part 1; Peter van der Krogt, *Globi Neerlandici: the production of globes in the Low Countries*, translated by Elizabeth Daverman (Utrecht: HES, 1993).

[19] For ease of understanding, we will here use the term 'emblem' to describe Tycho's composition even though traditional emblem theory would reserve the term for the strict tripartite structure (motto, picture, epigram) favoured by the influential emblematist, Andrea Alciato. In this we follow Hans Böker and Peter Daly who use the term 'emblematic' in a much broader sense to refer to any feature that has an allegorical meaning. Recent scholarship has demonstrated that emblematic forms vary widely, even in so-called 'emblem books'. See Hans J. Böker and Peter M. Daly (eds.), *The Emblem and Architecture: Studies in Applied Emblematics from the Sixteenth to the Eighteenth Centuries*, Imago Figurata, Vol. 2, (Turnhout: Brepols, 1999). For more on emblem theory, see Mario Praz, *Studies in*

coloured copies of the *Mechanica*, this emblem was vividly highlighted in red and green and is given not one but two letter labels. Though the detail of the emblem is difficult to discern from the image alone, Tycho provides a very detailed description:

> In the picture one sees … a young man, wreathed by a laurel branch, sitting on a square stone near a tree which on one side is green and leafy. In one hand he is holding a celestial globe, in the other a book, and he is stretching his feet into green grass and herbs that cover the root of the tree. On the other, left, side of the tree the root is dried up and the branches withered and without leaves. Between them is a table covered with some of the things valued by men on this earthly stage, such as a box filled with coins, sceptres, crowns, coats of arms, golden chains, gems, finery, goblets, cards and dice, and the like. Around all this a skeleton, representing Death, is stretching its hands and feet, as if trying to snatch it.[20]

<fig. 3 here>

When the image is examined with a view to identifying those features mentioned in the description, it quickly becomes clear that the description is far more detailed than the illustration. It is difficult to know to what extent Tycho's illustration accurately reflects the emblem engraved on the physical instrument, or to what degree this description records that image. In any case, the illustration can only be regarded as a rather rough rendering of the somewhat elaborate picture verbally described by Tycho, reinforcing the importance of considering image and text in conjunction.

The lack of detail discernible in the actual depiction of the emblem in Tycho's printed illustration of

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Seventeenth-Century Imagery (Rome: Edizioni di Storia e Letteratura, 1964).

[20] *AIM* (1946), p. 14.

the instrument could be due to a number of factors. The relative size of the emblem compared to the instrument itself may simply have rendered the task of providing adequate detail too difficult on such a small scale. Furthermore, from a logistical point of view, Tycho may simply not have had sufficient time to amend the engraving, if indeed he was dissatisfied, given the time constraints under which he produced his *Mechanica*. On the other hand, the lack of clarity may also be seen as a potential advantage, granting Tycho additional freedom in his description of the emblem. Since the instrument no longer survives, we may never know the extent to which Tycho's description matched the physical object. Having said this, the description of this small quadrant sent by Tycho to the Landgrave of Hesse-Kassel in 1591 as part of a synopsis of instruments – later published in Tycho's *Epistolae astronomicae* (1596) – is consistent with the description given by Tycho in the *Mechanica*. Furthermore, given Tycho's intention to relocate to Prague with his instrument collection in tow, it is fair to assume that the written description given in the *Mechanica* did not deviate too far from the appearance of the physical object, including the emblem. Further evidence for the existence and appearance of the emblem can only be surmised from later accounts, such as the reproduction of the emblem by Gabriel Rollenhagen (see below), and a description of the emblem as it was depicted on Tycho's observatory building by the seventeenth-century author, Peder Hansen Resen, in his *Inscriptiones Haffnienses* (Haffniae: Henrici Gödiani, 1668), both of which agree with Tycho's own description.

Though a potential prototype for Tycho's emblem has thus far remained elusive, there is ample evidence from contemporary artistic representations that the individual pictorial components of Tycho's emblem were well established in the iconography of the period. For example, Tycho's astronomer, with his book and celestial globe, is represented with the attributes traditionally associated with the profession, while images of Death snatching at tropes of wealth and power abound in emblem books and elsewhere. Examples can be seen in Hans Holbein's famous representation of the *Danse macabre*, a series of forty-one woodcuts published in 1538 and

reproduced frequently throughout the period (fig. 4). While we do not know the exact origin of Tycho's emblem, interestingly, there is evidence that the iconography persists, with Gabriel Rollenhagen opening his *Nucleus emblematum* of 1611 with an emblem bearing striking resemblance to that described by Tycho (fig. 5).[21]

<fig. 4 here>

<fig. 5 here>

Consistent with the use of emblems to convey symbolic meaning, Tycho confirms his emblem was "modelled as an ornament … in order that its inscription might offer some instruction."[22] This didactic function may seem slightly surprising; one could initially assume that this feature was merely a decoration befitting Tycho's wealth and demonstrating his erudition and refined taste, yet it is clear from this statement that Tycho intended it to impart some kind of message in its own right. Tycho was at pains to fully explain the message of the emblem. He points out that:

> above the whole of the picture is a hemistich, explaining the allegorical meaning: "By spirit we live, the rest will belong to death" [*Vivitur ingenio caetera mortis erunt*]. This is placed in such a way that the first part of the hemistich, on the right, green side of the tree, where the philosophizing young man is sitting, is hanging down from the branches

[21] Rollenhagen's father, Georg, was an astrologer with whom Tycho corresponded; Alain Segonds has discussed the possible relationship between these two versions of the emblem; Alain Segonds, "A Propos d'un emblème de Tycho Brahe dans les *Mechanica*," in *Learning, Language and Invention: essays presented to Francis Maddison*, edited by W. D. Hackmann and A. J. Turner (Aldershot & Paris: Variorum and the Société Internationale de l'Astrolabe, 1994), pp. 261-72, pp. 266-269. This image was further propagated by George Withers in his English translation of Rollenhagen, *A Collection of Emblemes, Ancient and Moderne* (London: Augustine Mathewes, 1635) and persists even in the late seventeenth century in *Delights for the Ingenious* (London: Nathaniel Crouch,1684), by an author known simply as 'R.B.' Interestingly, scholars of Rollenhagen's *Nucleus* have highlighted the apparent originality of certain of his images, using the opening emblem as an example that "seems to epitomize the philosophy of both the author and the artist"; Tycho's emblem seems to refute this supposedly originality; I. Veldman and C. Klein, "The Painter and the Poet: the *Nucleus emblematum* by De Passe and Rollenhagen," in *Mundus Emblematicus: studies in Neo-Latin emblem books*, Imago Figurata, Vol. 4, edited by Peter M. Daly (Turnhout: Brepols, 2003), pp. 267-300, p. 278.

[22] *AIM* (1946), p. 14.

as on a slip of paper, while the rest of the hemistich is on the other side.[23]

The motto Tycho here describes would have been invisible to the readers of the *Mechanica*, who were, therefore, completely dependent on his report. He confirms the didactic meaning, continuing, "My intention has been to suggest that sure science [*solidam doctrinam*], especially the sublime knowledge of celestial things, bestows eternal life and remembrance on this earth, while everything else is worthless and transient, perishing with the human body."[24]

With its rather striking iconography of the half-flourishing, half-decaying tree and the presence of Death snatching at terrestrial signs of wealth, this emblem clearly belongs to the genre of the *memento mori*, reminding the viewer of the transience of life. Yet while the right side of the image represents the limited value of material possessions, which will ultimately belong to Death, the left side of the image offers a potential route to immortality. Although the message of Tycho's hemistich is rather general, asserting that through spirit, or genius [*ingenio*], we live, crucially in this instance, this more esoteric contribution is represented by an *astronomer*. Thus, while criticising the pursuit of material wealth, Tycho's emblem is also a celebration of the worth of knowledge – significantly the kind pursued by Tycho himself. Implying an ability to transcend death, Tycho's emblem thus serves to elevate the status of astronomy; it becomes sublime, immortal, and superior to material possessions. The emblematic picture seems to have held special significance to Tycho since it was found not merely upon the small quadrant (and subsequently published in the *Mechanica*), but was also depicted on the wall of his subterranean observatory, Stjerneborg.[25] The superiority of astronomy over terrestrial wealth and power is reinforced also by Tycho's preface to the *Mechanica*, where "divinely entrusted" astronomy "is by far the most prestigious, insofar as what is celestial and sublime certainly surpasses what is terrestrial and

[23] *AIM* (1946), p. 14.
[24] *AIM* (1946), p. 14.
[25] As recorded in Peder Hansen Resen, *Inscriptiones Haffnienses Latinae Danicae et Germanicae* (Copenhagen: Henricus Gödianus, 1668), pp. 344-45.

inferior."[26] Perhaps surprisingly therefore, though the emblem on the small brass quadrant is astronomically-themed, it is not concerned with conveying scientific information about the motion of the heavens, but instead provides a moralistic comment on the worth of astronomy and the pursuits that should engage men during their short time on earth.

This concept of the superiority of astronomy may have particularly resonated with Tycho due to his social circumstances. As a member of the Danish nobility, with military leaders dominating one side of his family and royal councillors the other, it was expected that Tycho should follow a similar path as a royal courtier. Therefore, despite the support of the Danish king, Tycho's intellectual pursuits were often criticised and discouraged by his kinsmen.[27] Thus, for Tycho, the message of his emblem may have been particularly poignant not just because it celebrated the discipline to which he had dedicated his life, but also because it seemingly vindicated his decision to pursue astronomy in the first place. While others of his family pursued terrestrial wealth and power, Tycho could be content in the knowledge that his contribution to astronomy would survive him and immortalise him for posterity.[28]

In the context of the *Mechanica*, the emblem was also a particularly salient demonstration of the *worth* of astronomy, offering further encouragement to Tycho's potential patrons to invest in his work. Not only was astronomy presented as more important than material wealth, the opportunity for remembrance to posterity was a prime motivation behind many patronage relationships in the period, and thus this emblem could surely not have harmed his chances for financial investment.

[26] *AIM* (1996), p. 3.
[27] For more on Tycho's family background, see John Robert Christianson, *On Tycho's Island: Tycho Brahe, science, and culture in the sixteenth century* (Cambridge: Cambridge University Press, 2000), pp. 8-11; Thoren, *Lord of Uraniborg* (cit. note 4), ch.1; *AIM* (1996), p. 117. For an indication of the resistance Tycho encountered in his pursuit of astronomy, see the autobiographical account in the *Mechanica*; *AIM* (1996), pp. 117-20; Thoren, *Lord of Uraniborg* (cit. note 4), ch.1, esp. pp. 28-29; Tycho Brahe, *Tychonis Brahe Dani Opera Omnia*, 15 vols., edited by J. L. E. Dreyer and Eiler Nystrøm (Amsterdam: Swets & Zeitlinger, 1913-1929, rpt 1972), 7:3.
[28] This concern with one's enduring reputation, or *fama*, was a common preoccupation in the period, particularly for those like Tycho of noble status.

The motto used by Tycho, "By spirit we live, the rest will belong to death," suggesting that intellectual contribution has the ability to outlast the individual, was also widely used by other authors and artists in the period. A well-known adage ascribed to Virgil (though it can also be found attributed to Ovid), the application of this motto reflects the humanistic tendencies of the age.[29] In its Latin form, "*Vivitur ingenio caetera mortis erunt*," this motto appears on the title pages of several books, such as Francis Meres' *Palladis tamis* (London: P. Short, 1598) and Henry Peacham's emblem book, *Minerva Britanna* (London: Wa. White, 1612). The function of the motto on these title pages is seemingly to serve as a kind of justification for publication and indicates an expectation that the author will be remembered through these books. The expression is similarly found on a 1524 portrait of Willibald Pirckheimer by Albrecht Dürer, an artist to whom Tycho explicitly refers in his correspondence, thereby suggesting some acquaintance with his work (fig. 6); in this instance, the motto seemingly serves to identify the subject as an intellectual, who will therefore be remembered for his contribution to knowledge.

<fig. 6 here>

Perhaps more surprising, however, is the presence of the motto in Vesalius's *De fabrica* of 1543, where it is inscribed on a tomb upon which an articulated skeleton leans as if deep in thought (fig. 2). Though it is hardly surprising that images of skeletons are to be found in this anatomy book, the realistic posture, naturalistic landscape, and accessory props such as the tomb render the image rather more symbolic and recalls the iconographic association of the skeleton with death and transience. Like Tycho's emblem, the motto and symbolic representation of Death remind the viewer of the transience of life and the importance of using one's limited time on earth fruitfully – it almost appears that the skeleton itself is pondering this deep philosophical quandary as it leans upon

[29] For attribution of the motto to Virgil, see Veldman and Klein, "The Painter and the Poet" (cit. note 18), p.278; cf. Virgil, *Elegiae in Maecenatem*, 38. The saying is alternatively attributed to Ovid on the title page of Francis Vernon's *Detur pulchriori, or a poem in praise of the University of Oxford* (Oxford: s.n., 1658). See also Segonds, "A Propos d'un emblème" (cit. note 18), pp. 265-270, who also discussed the motto in detail.

the tomb. In his discussion of Vesalius's use of landscape, Jonathan Sawday has drawn attention to this *memento mori* function and the possible moralised readings of the Vesalian plates. What we see in Tycho is a comparable moralised reading of an instrument, with similar use of landscape to remove the object from its usual context, thereby encouraging special reflection on its meaning. [30]

Though Tycho's emblem serves to elevate the status of astronomy and justify his own philosophical endeavour, there is indeed another message conveyed by the image, and one that is not found in the version seen in Rollenhagen. Continuing with his description of the emblem, Tycho states:

> But when we consider the eternity of heaven, then the very things that are now on the green side of the tree pass over on to the other side; for between the finite and the infinite there is no relation. And then the hemistich of the inscription is changed and now runs as follows: "In Christ we live, the rest will belong to death" [*Vivimus in Christo caetera mortis erunt*], so that the first part corresponds to the green tree, and the second to that which is withered. But within the green picture of the tree there is an inscription alluding to the life and teachings of Christ. The rest remains unchanged as before, only that human sciences and inventions now point to the back and left side of the tree, viz. the withered side.[31]

Although this additional symbolic meaning renders the device more difficult to visualise, the religious connotation is apparent. Though reference to God is not particularly prevalent in Tycho's publications, this emblem highlights that he was clearly imbued with the Protestant faith that guided Danish society (and Northern Europe more generally) during the period.

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[30] A similar outdoor placement of the globe may also be intended to convey some symbolic meaning (cf. note 18). On Vesalius, see Jonathan Sawday, *The Body Emblazoned: dissection and the human body in Renaissance culture* (London: Routledge, 1995), pp. 114-116; Susan Dackerman (ed.), *Prints and the Pursuit of Knowledge in Early Modern Europe* (Cambridge MA: Yale University Press, 2011), esp. the Introduction.

[31] *AIM* (1946), p. 14.

This secondary message adds a layer of complexity to the emblem. Under the influence of this second hemistich, the human sciences, which were originally the route to immortality, now move over to the withered, decaying side of the tree, to be replaced by the teaching of Christ under the flourishing branches. Ensuring the complicated message of his emblem is adequately conveyed, Tycho again provides an explanation:

> With this we indicate that nothing can make man happy and give him eternal immortality except the merits of Christ, God's son and our Saviour, and the contemplation of his life and teaching.[32]

While the initial meaning of the emblem clearly raises the status of learning above mere material possessions, this secondary meaning undermines the significance of intellectual pursuits in the context of religious faith.

The message of the emblem then appears to be twofold: knowledge, especially contemplation of celestial matters, offers an opportunity of remembrance to posterity, thus outlasting the transient benefits of material wealth. Yet only duty to God ensures true immortality – the salvation of the soul after death. This inferiority of astronomy to divine authority is also referenced in the preface to the *Mechanica*, where Tycho states that "The majesty of the highest and thrice-greatest God is surely so great that the wisdom of his works can not be exhausted by any of his creatures."[33] Thus the additional message of the quadrant emblem is rather revealing about Tycho's own conception of the world; it is a world in which the immortality of one's name relies on knowledge rather than power, and the immortality of the soul relies on spirituality rather than knowledge. In this sense, the emblem invokes a kind of hierarchy, with earthly treasures at the bottom, intellectual pursuits in

[32] *AIM* (1946), pp. 14-15.
[33] *AIM* (1996), p. 3.

the middle, and God Almighty at the top.[34]

Interestingly, this reflects something of the Philippist natural philosophy taught in the Lutheran universities of Northern Europe in which astronomy was afforded particularly high status. With the perceived order of the heavens considered a manifestation of God's Providence in nature, Melanchthon's natural philosophy strongly advocated astronomy as an important mechanism by which to gain knowledge of the Creator. Tycho echoes this concept, asserting that "the honor and majesty of the best and greatest God … shines in celestial things more than in other aspects of this great world theater."[35] This metaphor directly borrows from the beginning of Ptolemy's *Almagest*, and justifies the elevation of astronomy above terrestrial matters.[36] Tycho's frequent reference to the "sublime" or "divine" nature of astronomy further encourages this privileged status.

It is within this context that we can more fully appreciate the half-flourishing, half-decaying tree featured on Tycho's emblem – a motif that was prominent in Lutheran art.[37] Aside from offering a potential source of iconography for Tycho, this genre of artistic representation may also have provided the inspiration for this second didactic message. As Sachiko Kusukawa has highlighted in her extensive work on the post-Reformation transformation of natural philosophy, the theology propounded by Martin Luther (and the Philippist natural philosophy that it inspired), was one based on the concept of justification by faith alone. According to this doctrine, good deeds and other indulgences were insufficient for salvation; only faith in the crucified Christ, as taught by Gospel, was sufficient for the salvation of the soul. True understanding of the Gospel could only be

[34] This sentiment is also echoed in the writing of John Dee, who draws on the Neo-Classical philosophy of Proclus to ascribe the mathematical arts an intermediate level between matter and spirit. See Stephen Johnston, "The Identity of the Mathematical Practitioners in Sixteenth-Century England," in *Der 'mathematicus': zur entwicklung und bedeutung einer neuen berufsgruppe in der zeit Gerhard Mercators*, Duisburger Mercator-Studien, Vol. 4, edited by Irmgard Hantsche (Bochum: Brockmeyer, 1996), pp. 113-114; Nicholas H. Clulee, *John Dee's Natural Philosophy: between science and religion* (London: Routledge, 1988), ch. 6.
[35] *AIM* (1996), p. 10.
[36] Liba Taub, *Ptolemy's Universe: the natural philosophical and ethical foundations of Ptolemy's astronomy* (Chicago: Open Court, 1993), pp. 19-37, esp. 25-37; see also pp. 146-155.
[37] For example, Hans Holbein the Younger, *An Allegory of the Old and New Testaments*, in the collection of the National Galleries of Scotland, accession number NG 2407.

achieved, however, by knowledge of 'Law' – that fallen man was unable to merit salvation on his own.[38] This Lutheran theology was represented visually by Lucas Cranach in his *Verdämnis und Erlösung* (1529), which significantly features the motif of the half-flourishing, half-decaying tree (fig. 7). Here, under the decaying branches of the tree, a group of Old Testament prophets observe the 'Tables of the Law,' while Death and the Devil drive a naked man towards the pits of Hell. In the background, Adam and Eve stand before the tree of knowledge. On the other, flourishing side, John the Baptist points out the crucified Christ to a praying man, who is in turn blessed by Christ as He ascends. As Kusukawa has emphasised, the imagery under the decaying branches thus represents sin, death, and damnation, as highlighted by the Law; conversely, the flourishing side represents salvation and eternal life through faith in the crucified Christ. The image is thus a visual representation of Lutheran theology: only faith in Christ, guided by the knowledge of the Law, offers salvation.[39]

<fig. 7 here>

The composition of this image is remarkably similar to Tycho's emblem, with the motif of the half-flourishing, half-decaying tree employed to impart a moralising message. And although Tycho has replaced the respective images either side of the tree with an astronomer and a personification of Death, the message conveyed by Tycho's second hemistich is reminiscent of the Lutheran message, as imparted by Cranach. Thus, although astronomy could offer a means of immortality through remembrance to posterity, in the context of Lutheran theology, only faith in Christ, as taught by the Gospel, was sufficient to ensure the salvation of the soul. It is in this context that we understand not only Tycho's assertion that "Through Christ we live", but also his encouragement of the

[38] This was the basis for the rejection of indulgences and other 'good deeds' promoted by the Catholic Church as a means to achieve salvation.
[39] Sachiko Kusukawa, *The Transformation of Natural Philosophy: the case of Philip Melanchthon* (Cambridge University Press, 1995), pp. 31-32.

contemplation of His life and teaching.[40]

This attention to both the value of astronomy and of Christianity may have been influenced by Tycho's personal relationship with his professor, David Chytraeus. Chytraeus was a professor at the University of Rostock while Tycho was a student there (likely 1566-68) and the two men corresponded during the remainder of Chytraeus' life. Chytraeus' work displayed his own dual interest in astronomy and theology. He was well known as a prolific theological author; Tycho may have known his book, *De morte et vita aeterna*, first published in Wittenberg in 1581, with another printing in 1583.[41] It was again published in 1590 with a work by the theologian Georg Oemler (Georg Aemilius), in which woodcuts based on the Holbein images of the *Danse macabre* were reproduced; it is possible that Tycho was familiar with this edition, and seeing the work published alongside the Holbein images may have made an impression on him.[42] In addition, Chytraeus wrote about the new star of 1572, the same new star that played a decisive role in Tycho's own career; Chytraeus was also one of numerous authors who published an account of the comet of 1577.[43]

Given the complexity of the image, it is little wonder that Tycho dedicates so much space in his *Mechanica* to an explanation of this emblem. Indeed, of the hundred lines devoted to the small gilt

[40] For more on the Lutheran concept of justification by faith alone, see Kusukawa, *The Transformation of Natural Philosophy* (cit. note 35), esp. ch. 2.
[41] We are grateful to Dr Sachiko Kusukawa for bringing Chytraeus' book to our attention.
[42] *Libellus Davidis Chytraei de morte, et vita aeterna. Editio postrema: cui additae sunt Imagines mortis, illustratae epigrammatis D. Georgii Aemylii* (Wittenberg: M. Welack, 1590).
[43] That Chytraeus made a positive impression on Tycho is clear from their continued correspondence. Tycho was in touch with some of his former acquaintances in Rostock upon his arrival in Germany in June 1597, including Chytraeus, who on 16 June "wrote a friendly letter, regretting that the state of his health prevented him from paying his respects to Tycho." J. L. E. Dreyer, *Tycho Brahe: a picture of scientific life and work in the sixteenth century* (New York: Dover Publications, reprint with corrections 1963; originally published Edinburgh: Adam and Charles Black, 1890), p. 242; cf. Tycho Brahe, *Opera Omnia* (cit. note 24), 8:3,21-24. David Chytraeus, *De stella inusitata et nova, quae mense Novembri, anno 1572, conspici coepit. Et de comato sidere, quod hoc mense Novembri anno 1577 videmus. Commonefactiones in schola propositae* (Rostock, 1577). See also C. Doris Hellman, *The Comet of 1577: its place in the history of astronomy* (New York: AMS Press, 1971; original publication 1940). The influence of Chytraeus on Tycho's emblematic thought would be an interesting avenue for further research, though is sadly beyond the scope of this study.

brass quadrant, thirty-two are given over to discussion of the emblem. The description is somewhat juxtaposed to the rest of the instrument detail, with the shift between emblem discussion and more technical specification somewhat stilted. Clearly this decoration was sufficiently important to Tycho to warrant not only a detailed description of the composition, but also the explicit explanation of the iconography, at the expense of other more technical details.

Yet despite the space dedicated to discussion of the emblem, Tycho rather dismissively asserts that "All this I have wished to present here in detail on account of the added picture, even though it is perhaps irrelevant."[44] This seems surprising, especially since on many occasions Tycho is content to let his illustrations do the work, encouraging the reader to examine the accompanying picture for details beyond the textual account. Furthermore, throughout the *Mechanica*, Tycho frequently laments the lack of space and time, which causes him to cut short the discussion of several other instruments, or refer the reader to other publications for further information.[45] Given the attention afforded to the emblem, despite the constraints on time and space, we can consider the apparent 'irrelevance' of the emblem description as a rhetorical device, a method of expressing a sense of modesty over this non-scientific yet otherwise highly important feature of the instrument. Tycho employs a similar tactic in his discussion of the famous mural quadrant image, where Tycho states that "The pictures that can be seen within the circumference of the quadrant are only added for the sake of ornament, and in order that the space in the middle should not be empty and useless."[46] Despite downplaying the importance of these iconographical elements, the fact that Tycho labelled these decorative features in his instrument illustrations suggests that he clearly intended to describe them, whilst their lengthy descriptions in the accompanying text confirm their importance to an overall understanding of the instruments and his collection more generally.

[44] *AIM* (1946), p. 15.
[45] For example, describing his medium sized quadrant, Tycho advises "there [in his *Progymnasmata*] he will also find more about the mechanical construction of this and other instruments, which could not be dealt with here for lack of space," *AIM* (1946), p. 19; Again: "The use of this globe is similar to that of other astronomical instruments. I intend to write about this in a special book, when I have the time, for it cannot be done in a few words," *AIM* (1946), p. 105.
[46] *AIM* (1946), p. 49.

What is perhaps most surprising about this deeply symbolic decoration, is that it was included on a scientific instrument in the first place. The presence of this emblem, as well as the limitations of Tycho's small quadrant as an observational tool, suggests that Tycho's astronomical instruments were not always solely concerned with observation or measurement, but could be used for a variety of different purposes. In this case, the iconography of the emblem was employed to impart a moralising lesson to the learned viewer, while Tycho's lengthy description in the *Mechanica* ensured that the message would not be lost due to the lack of clarity in the accompanying engraving.

Though modern scholars would consider the small quadrant to be by no means exemplary of Tychonic instrumentation, the fact that Tycho chose to open his *Mechanica* with this very instrument suggests that he had a far different opinion of its merits. Whether or not he had been aware from the outset that the small quadrant would not yield results of the accuracy he demanded, he was certainly aware of it at the time that the *Mechanica* was published. The decision to place this instrument first in his book therefore represents a deliberate prioritisation of symbolic meaning over the accuracy and innovation that he stresses throughout the rest of the book. Furthermore, it represents a deviation from an earlier synopsis of his instruments sent to Landgrave Wilhelm IV of Hesse-Kassel in 1591, which opened with a description of an azimuth semicircle.[47] This reordering of instruments for the *Mechanica* lends further weight to the supposition that the small quadrant was highly significant to Tycho.[48]

Although Tycho describes the organisational scheme of the *Mechanica* such that among those devices first explicated, "the smaller and less important instruments come first," it is our suggestion

[47]The quadrant is described near the end of the *Synopsis*, at number 25. See Tycho Brahe, *Opera Omnia*, (cit. note 24), 6:284-285.

[48] Interestingly, this azimuth semicircle also featured prominent iconography pertaining to the relationship between the mathematical arts. Tycho's employment of iconography beyond the small brass quadrant will be the subject of a forthcoming study.

that this too is a rhetorical device, referring solely to the technical capabilities of the instruments. Indeed, those that follow "are greater and grant more exact precision." This is a clear reference to the scientific merits of the instruments and one that fails to take into account any possible alternative function of the tools.[49] This is again consistent with the apparent 'irrelevance' of any description of iconographical features throughout the instrument book. As with these 'digressions', if Tycho did not think these instruments worthy of inclusion, he would surely not have included them in his account at all. And the very fact that Tycho engraved the image of the small quadrant *specifically* for the purpose of inclusion in the *Mechanica*, suggests that despite undermining its importance as an astronomical tool, it was in fact highly important to Tycho.

Technologically inferior to the majority of the other instruments illustrated in the *Mechanica*, the defining feature of the small quadrant is its capacity to impart Tycho's own attitudes to the reader and thus create an understanding of his whole philosophical programme. By choosing to introduce us first to this technically underwhelming instrument, Tycho evidently intended not to impress the reader with his skill as an instrument maker, but rather to impress upon his audience the very ideologies behind his astronomical undertaking, as represented by the emblem added as an "ornament". After all, Tycho could have chosen another means by which to order his book – such as opening with the visually and technologically striking mural quadrant – yet he chose as a means of creating a first impression this rather diminutive little quadrant with its rather more grandiose didactic moral. It was by placing this instrument at the opening to his book, an instrument representative of his personal ideologies, that Tycho was able to set the parameters by which his whole programme was to be understood, thus enabling an even greater appreciation of the effort and skill that had gone into some of his more technologically impressive instruments.[50]

[49] *AIM* (1996), p. 7.

[50] Previous versions of this paper were read at conferences; we are grateful to colleagues for their questions and suggestions. We particularly thank Sachiko Kusukawa, Nick Jardine, and Adam Mosley for their insightful comments on earlier drafts, along with the editors of this thematic issue for their generous and considered feedback. Thanks also to Srishti Krishnamoorthy and Newnham College for their help and support in sourcing the images reproduced here. Emma Perkins' research was made possible through the generous support of an AHRC doctoral award.

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