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'No other sign or note than the very order'

Francis Willughby, John Ray and the importance of collecting pictures

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Between 1663 and 1665 Francis Willughby FRS collected over 200 drawings of birds and fish. These collections formed the basis of research that culminated in his colleague John Ray's publications Ornithologiae libri tres *(1676) and* De historia Piscium libri quartuor *(1686). This article aims to describe the collections and outline a rough chronology of their formation and use. It also highlights the significance of practices of collecting and arranging drawings. It is suggested here that in Willughby's collection, as in John Wilkins's idea of a philosophical language, where there was 'no other sign or note than the very order', pictures acquired meaning through their relationships with other pictures. The article concludes that recent historians have been only half right to claim that pictures enjoyed a privileged position in seventeenth-century scientific culture. The case of Willughby's collections suggests that it was only in the context of a collection that pictures began to take on epistemological significance.*

THERE are two aims to this article. The first is to describe two large collections of paintings, prints and drawings held in Nottingham University Library and to offer a rough chronology of when they were formed. The pictures are mostly of birds and fish, and were collected between 1663 and 1686 by Francis Willughby and John Ray, both founder-members of the Royal Society. Today the collections are known as the source for many of the engraved illustrations in Willughby and Ray's *Ornithologiae libri tres*, published 1676 (translated as *The Ornithology of Francis Willughby* in 1678) and *De historia Piscium libri quartuor*, published 1686, though the relationship of the collections to the publications is rather more apparent than proven.

The second aim is to ask why the collections came together. The article will propose a revised relationship of the collections to the publications. It will also offer a new assessment of the significance of collecting practices for natural historians in the light of current understandings about how natural historians valued pictures.

Nottingham University Library MS Mi LM 24 is a group of 170 paintings, engravings and manuscript fragments. Fols. 108–59 are engravings cut from seventeenth-century Dutch and Italian books. Fols. 170 and 171 are a portrait and a manuscript fragment. The remaining 116 sheets, fols. 1–107 and fols. 161–9 are paintings mostly of birds in watercolour and bodycolour. The paintings are the work of up to nine artists. By far the largest group is a body of eighty-three watercolours, each measuring *c*.35 × 23 cm with annotations in French and Latin.[1] A further seventeen paintings may be grouped together: nine of these are by the same artist, are of a similar size (*c*.30 × 12 cm) and have annotations in German and Latin,[2] and eight also contain annotations in a variety of German scripts.[3] It may be possible to identify this latter group with the 'large volume of pictures of birds drawn in colours' that Willughby purchased in Nuremberg in 1663, if 'large' is taken to refer to the size of the paintings rather than their number.[4] Eight other paintings constitute a group on the basis of stylistic similarities.[5] All the annotations in this group are in Willughby's hand, except fol. 80. Four more paintings of lizards, possibly acquired in Italy in 1663, may also count as a distinct group.[6] The remaining four sheets are paintings by anonymous artists, and a fifth sheet is a sketch for pl. 2 of the *Ornithology*.[7] The paintings in this

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collection can therefore be divided into four groups on the basis of stylistic similarities or what we can reasonably suggest about their acquisition, with five sheets that do not seem to fit with any categories.

The paintings are heavily annotated in a variety of hands and languages, mostly Latin, English, German and French. All but three of the hands that occur frequently are exclusive to one of the groups outlined above. These hands may shed some light on how the collection was formed and used. One of the hands is an unknown hand in Latin, and appears approximately seventeen times, annotating mainly the largest group, but also appearing on three of the 'Nuremberg' paintings, suggesting that it post-dates the acquisition of the paintings in 1663.[8] The second hand is English, and might belong to Phillip Skippon, companion of Willughby and Ray on their trip to the Continent. It appears thirteen times on the largest group and twice on two other groups.[9] But by far the largest number of annotations is by Willughby, appearing sixty-six times, always in Latin.[10] Willughby annotates a very wide range of paintings. The range of his annotations suggests that his aim was to bring some uniform classification to the collection; in many cases it is the only annotation, faintly written in pencil. A further suggestion might be that Willughby was familiar with the whole collection, whereas other annotators were, for whatever reason, not.

The Willughby family collections came to Nottingham University in 1947, and MSS Mi LM 24 and 25 were originally bound in leather volumes.[11] To see how Willughby or Ray arranged and displayed the collection and what its original purpose might have been one has to examine the physical evidence of the paintings themselves and contemporary accounts of how the collections grew and changed. Of the 117 paintings in the collection, fifty-six have small pin-marks, usually one or two in the top-left corner of the sheet.[12] It is unclear how the sheets were pinned, or to what,[13] but the evidence of a corresponding collection, MS Mi LM 25, as well as contemporary collections of drawings such as that of Martin Lister, suggests that pins were used to 'stitch' the sheets to a backing sheet. In many cases a series of holes points to multiple insertions, indicating that a sheet was moved around within the arrangement, and that the classifications signified by the arrangement were only ever provisional. In the present case there is no evidence to explain why some sheets have pin-marks and others do not. Some of the sheets have numbers written in Willughby's hand, ranging from '3' to '209'.[14] Again, it is difficult to discern any logic to this numbering, which does not correspond to the arrangement of the collection in the volumes.

One explanation for the irregular pinning and numbering of the collection might be that Willughby's collections were fluid entities. They contained substantial amounts of material loaned from friends, and were constantly being altered with the addition of purchased or commissioned material. In addition to the five groups of pictures in MS Mi LM 24 identified above, Willughby also purchased a group of paintings by Leonard Baltner in Strasbourg, and had friends looking for specimens, and possibly pictures as well.[15] After Willughby's death in 1672, the collection continued to grow as Ray prepared his friend's manuscript notes and pictures for publication. This activity included the loan of paintings from Sir Thomas Browne of Norwich, as well as the acquisition of prints.[16] Neither Browne's pictures nor the Baltner group are now in the collection, and it is reasonable to suggest they were not in the collection when it was bound. Rather than see this as evidence of incompleteness, it is arguably more appropriate to suggest that the pictures were already in circulation amongst Willughby and Ray's friends and correspondents, as befitted the nature of the collection.

As Charles Raven noted in his indispensable biography of Ray, the collection of paintings of fish is considerably more varied than that of birds.[17] The collection consists of eighty-two paintings and drawings of fish and other marine life by about twenty-four artists, plus fifty-four Dutch engravings and 117 proof plates from Ray's 1686 publication on fish, *De historia piscium*. Forty of the paintings and drawings are by one artist.[18] All these paintings are annotated by one of two hands in Italian and Latin: the Latin hand is Willughby's, and the other is probably foreign. These hands are almost exclusive to this group, and in four of the seven instances they occur elsewhere, they are the only annotation.[19] A further four hands appear (one Italian, two Latin, one English) in this group. A second significant body of work is the fourteen drawings, often signed and dated, by associates of Willughby and Ray: Nathaniel Bacon (fol. 2), Joseph Johnson (fols. 26, 29), Francis Jessup (fol. 16), Phillip Skippon (fols. 12–15) and anonymous artists (fols. 8, 9, 44; 10–11; 20).[20] The hands that annotate this body

of work do not appear on any other paintings or drawings. A third, small group of monochrome globefish coheres on grounds of style and subject.[21] These are all annotated in English and may have been commissioned by Willughby.[22] Fols. 3–6 also cohere on stylistic grounds and share the same annotators with the globefish pictures, and can be compared with MS Mi LM 25 fols. 2, 4 with fols. 19, 23, and 24. It is difficult to see any meaningful patterns of style, subject matter or annotation amongst the nineteen remaining paintings by perhaps a total of fourteen artists, many of which are not annotated. This is perhaps the most striking feature of this collection: that in spite of its artistic diversity, the large numbers of hands that annotate it are never superseded by one predominant hand. After reviewing the previous collection, one would expect Willughby's hand to appear on the majority of the paintings. But the pattern is for annotations, from the numerous to the single, to appear on the work of only one artist, or in the case of the group of Willughby's associates, a closely associated group.[23] This said, the prevalence of annotations in English and the possibility that up to twenty-four sheets are by English artists means that either Willughby or Ray was directly or indirectly related to the production or annotation of around eighty per cent of the present collection.

As with the previous collection, the viewer is confronted with evidence that offers some suggestions for how the collection functioned. The boards and spine of the elegant leather volume remain, with 183 stubs, the first 101 of which bear traces of glue. These stubs have manuscript numbers that appear to be in Francis Willughby's bold slashing hand, although Thomas Willughby's signature appears on the inside of one board. The sheets themselves occasionally contain faint pencil numbers (e.g. fols. 46–58) that correspond to the place of each sheet when bound in the volume. As with the paintings of birds, it is clear that the current collection is only part of what was gathered under Willughby and Ray, and it is possible that the present arrangement and that of the volume does not reflect its original arrangement. One piece of evidence to support this suggestion is the prevalence of pin-marks in some of the drawings. Just under a third of the sheets have pin-marks, and in many of these instances the marks are in pairs, and sometimes there are two or three pairs or more. The presence of dual pin-marks points to the pin being used to 'stitch' the sheet to another rather than to tie a number of sheets together. The fact that there are often two or three pairs of holes points to sheet being 'stitched' a number of times. I suggest that as with the paintings of birds, this was a rearrangement of the display in response to revised classifications, or, more probably (given the scarcity of crossed-out annotations) to new acquisitions or more information reaching Willughby or Ray. For example, Martin Lister sent a picture of a 'Roetle' to Ray, who replied on 12 May 1686 'it confirms its identity with [Baltner's] Roetle, but that ours of the red orfus taken at Augsburg from the life is much better'.[24] Might the juxtaposition of the three pictures have entailed their display side by side, and the rearrangement of some pictures (given what we know from Browne about how long Ray kept loaned 'figures')? Yet not all of the sheets have pin-marks; whilst some may have been cut off, others – especially the pictures attributed here to English colleagues – seem never to have been pinned up. As these latter pictures were by close associates of Willughby and Ray and often contain a record of the artist and the date they drew the picture, their veracity may not have been questioned.[25] The display may have been for purposes of comparing paintings – which Ray's letter (cited above) shows was a point of some concern.

One simple reason for the high number of pin-marks on these sheets might be the rate at which the collection was altered by new acquisitions and loans. Willughby had purchased pictures of fish from Leonard Baltner in Strasbourg in 1663–4, which do not appear to be in the collection. The main body of paintings is annotated in Italian, and Raven has suggested that they were purchased in Rome, perhaps from the same collection as MS Mi LM 24 fols. 165, 167–9.[26] Willughby also acquired drawings by English artists. However, some of the collection as it now stands seems to have come together under Ray. He acquired or commissioned drawings by associates (e.g. fols. 26, 29) and started collecting pictures and specimens as soon as he finished the *Ornithology* in 1674.[27] In this he was assisted by colleagues in the Royal Society, as the decision was taken to publish a large work under the Society's imprint in March 1684.[28]

An analysis of the collections raises two important points: that they were organized according to a particular method, and that this organization preceded the decision to publish. A further and less pressing point is that Willughby and Ray seem to have played

quite distinct roles in the collection and arrangement of the paintings.

Historians have hitherto assumed that the collections were part of a prolonged and successful collaboration between Willughby and Ray, the happy outcome of which was the publication by the Royal Society of the *Ornithology* and *De historia piscium*. Charles Raven and Mary Welch both discuss the collections in the context of the publications.[29] Whilst they do not argue that the collections were formed with publication in mind, their interest in telling a history of the natural sciences means that the significance of the paintings is seen only in the light of their appearance as published works. A further consequence is Ray's prominence, as the man responsible for seeing the material through to publication. Sachiko Kusukawa has also discussed the publication of *De historia piscium*, but unlike Raven, she argues that the use of pictures needs to be explained historically.[30] In particular, Kusukawa sees a source for Ray's publishing project in John Wilkins's *An Essay Towards a Real Character and a Philosophical Language* (1668). Wilkins was an important figure and closely connected with Willughby. Moreover his philosophy of language is important in understanding how the collections functioned, and has itself drawn the attention of historians keen to explain the use of pictures by natural historians; and so it merits a paragraph of exploration.[31]

Wilkins aimed to restore the universal language that had been lost as a result of God's punishment for mankind's presumption in building the Tower of Babel, in Genesis 11. Wilkins envisaged this language as a body of symbols whose signifying power would be universal, that is, the same to all people in all places. He saw that the use of different words to signify the same mental concepts inevitably led to misunderstanding, and in the study of nature it led to the multiplication of species: when identifying flora or fauna Ray lists all their known names, Latin and vernacular, precisely to avoid any misunderstanding. Taking the Baconian view that man's senses were universal, his solution was to devise a language each of whose lexical units 'would refer to a single, scientifically observed phenomenon or philosophically constructed concept'.[32] 'For example, *de* means element; *deb*, the first of the elements, fire; *deba*, a portion of the element of fire, a flame'.[33] The result would be a language where the relationship between signifier (the word), concept (the mental image) and reality was immediately signified by the word's structure, rather than being the product of purely conventional relationships.[34] As Wilkins himself wrote, '[i]f to every thing and notion there were assigned a distinct mark, together with some provision to express grammatical derivation and inflections; this might suffice as to one great end of a *Real Character*, namely, the expression of our conceptions by marks which should signify things not words'.[35]

The key to Wilkins's proposal was the development of symbols that were 'isomorphic with the categories of reality'.[36] To achieve this, Wilkins's grammar 'had therefore to provide rules for the construction of words whose *modus significandi* … corresponded with the *modi intelligendi* … or the *modi essendi* (manner of being) of entities'.[37] As Ann Bermingham has pointed out, this does not mean that Wilkins wanted to replace written characters with pictograms; instead, he wanted to devise words whose internal properties signified the concept that the reader had in his mind.[38] For Wilkins, the efficacy of the language depended on the principle that if observed under the same conditions, each person's concept or recollection of an object thus observed would be identical. In an important observation at the outset of *An Essay Towards a Real Character*, Wilkins stressed that the structural nature of language was based on the perceived framework of Nature herself: the 'great foundation' of his design, he said, was 'a regular enumeration and description of all those things and notions, to which marks or names ought to be assigned according to their respective natures … it being the proper end and design of the several branches of philosophy to reduce all things and notions unto such a frame as may express their natural order, dependence and relations'.[39]

Bermingham has argued that, 'the ideal language [Wilkins and others] imagined conformed to a pictorial ideal'.[40] His interest in words that act as 'universal, transparent signifiers' suggests that this is true. But if this has been seen as giving an enhanced philosophical status to pictures, it is important to recognize that the basic premise to Wilkins's thesis was that the structural relationships in nature could be replicated in language. The isomorphic quality of his philosophical language lay in the internal structure of each word, and Wilkins was clear in stating that the signifying power of words was activated by the degree to which their internal structure was part of a wider framework embracing the whole of the natural world: 'in speech

that is suited to natural structure and syntax', he wrote, 'there ought to be no other sign or note than the very order'.[41]

The distinction being made here, between the signifying power of words, and the signifying power of their relationships, might seem to be of minor importance. But since the publication of Svetlana Alpers' book *The Art of Describing*, historians have seen naturalistic styles in seventeenth-century pictures as a characteristic of a 'Dutch-like cult of visual objectivity' which had its basis in Bacon's reliance on the senses as the key to inductive reasoning.[42] Unlike Alpers, subsequent accounts have explained claims to visual objectivity historically. Nevertheless, their understanding of the philosophical importance given to pictures by Bacon and especially by the Royal Society has given the single image a prominence that arguably it does not deserve. If pictures were a model for how language could successfully replicate the structure and relationships of the natural world, it makes sense to suggest that we have to conceive of pictures functioning relationally, as well as singly, for the thesis to work. Indeed, many of the pictures discussed by historians as evidencing a 'cult of objectivity', most notably those from Robert Hooke's *Micrographia*, are not isolated engravings, drawings or paintings, but are taken from published and unpublished collections.

It is plain to see that people like Ray saw pictures as enjoying a unique epistemological status, as he makes clear in the introduction to the superbly (and expensively) illustrated *Ornithology*.[43] But I want to argue that it is only when we acknowledge the linguistic nature of collections, as well as the pictorial nature of language, that we can get a truer idea of how pictures were understood, seen and used by people like Willughby and Ray. Moreover, when we see the structural nature of collections we can get a more accurate assessment of the relationship of the collections to Wilkins's *Real Character* and to the *Ornithology* and *De historia piscium*.

Ray and Willughby were very familiar with Wilkins's theory of language. Wilkins, who knew Willughby at Oxford and possibly Ray at Cambridge, asked the former to contribute tables of birds and plants to his *Real Character* in October 1666.[44] There were forty tables in all, whose aim was, in Wilkins's words, 'to reduce all things and notions unto such a frame as may express their natural order'.[45] The practical requirements of Wilkins's system restrained Willughby and Ray, and the work was not widely seen as successful.[46] However, in *A Catalogue of English Birds* published in 1674, and two years later in the *Ornithology*, Ray used tables similar to those he and Willughby devised for Wilkins's *Real Character*, but with the taxonomic criterion being the anatomical structure of each bird rather than its habitat.[47] (The fact that the criterion for classification changed so fundamentally shows the arbitrary nature of categorizing the natural world, as Jorge Luis Borges has pointed out.)[48] There is clear evidence therefore that the classification of birds and the arrangement of plates in the *Ornithology* were conceived on grounds that owed much to Wilkins's notion that there should be 'no other sign or note than the very order', requiring us to see the plates *in toto* rather than singly.

If Wilkins's *Real Character* had an impact on Ray's publications, can it be said to have any meaningful relevance to the collections of paintings? It is important to recall that Wilkins approached Willughby to contribute to his *Real Character* more than three years after the bulk of the collections was formed, and indeed it seems to be more in keeping with Willughby's polymathic interests than Ray's narrower botanical studies.[49] It is also important to remember that the subsequent publications were at Ray's initiative and post-date most of the present collections by ten and twenty years. The collections themselves belonged to Willughby and stayed in his family's possession after his death in 1672. Instead of seeing the *Real Character* as influencing the taxonomic principles of natural history as Bermingham and Kusukawa have done, it is worth approaching the collections as an independent entity conceived by Willughby as having an essentially linguistic structure. In doing so I hope to draw attention to the importance that collections had for Willughby's circle, and also to counter the assumption that the relationship of such collections to subsequent publications is self-explanatory.

As I hope to have shown above, there is a great deal of evidence to suggest that Willughby saw the pictures cohering as an inter-related structure. In the paintings of birds (MS Mi LM 24), he annotates sixty-six of 116 paintings, and perhaps more importantly, appears to have annotated at least one picture from all the component groups in the collection, suggesting both that he was familiar with the entire collection as we know it today, and that he aimed to bring some uniform principle of order to it.[50] The paintings of

fish (MS Mi LM 25) do not reveal a similar campaign of classification, but as mentioned earlier, Willughby's hand annotates many of the paintings and it is likely that he had personal knowledge of the production of others.

As well as the annotations, the presence of pin-marks in many of the paintings would seem to point to the arrangement and rearrangement of the pictures in some kind of order. A comparison with Lister's manuscript volume of drawings made by his wife Susannah and daughter Anna for his publication *Historia Conchyliorum* (1685–92) is illuminating.[51] The volume contains hundreds of careful line-drawings of shells, varying in size. Many of the drawings have sets of pin-marks, suggesting that they were attached and reattached to a display surface on a number of occasions. The significance of this mobility becomes apparent when one sees the publication resulting from these studies (unlike Willughby, Lister and his family seemed to have compiled the collection with a view to publication). The *Historia Conchyliorum* consists of four books in two volumes, comprising almost 1,000 plates in total. It is remarkable for having no typeset print: its short introduction, tables of classification and abbreviations are all printed intaglio, that is, engraved on copper. The volumes present a breath-taking spectacle of images economically displayed, two to a plate, without the addition of any text. Lister clearly conceived of his arrangement as having an internal structural logic: the pictures have significance when they are placed together for purposes of comparison. The book is designed to elicit careful visual attention. The use of pictures as the primary mode of signification is enacted through the exclusion of text, a *modus significandi* that his Royal Society colleagues would have been more familiar with, but that was, as they would have been aware, an arbitrary and localized system of signs that had no true correspondence to the essence and appearance of the objects, unlike pictorial images. The drawings made by Susannah and Anna Lister might therefore be seen to reveal the same logic at work as the collection grew and the drawings were moved around as their significance was reassessed in the light of new arrivals. It is arguable that, although the process of rearrangement seems to have been less vigorously pursued, Francis Willughby's collections had the same logic of ordering and were subject to similar processes of revision. Indeed, it is likely that Lister knew Willughby's collection from its very early stages, and he and Ray corresponded closely throughout the period Ray was organizing Willughby's material for publication in the *Ornithology* and *De historia piscium*.[52]

The processes of annotating the paintings and revising their arrangement point to an important truth about the collections: that if pictures were understood as 'universal transparent signifiers' (and there is no doubt that they were), the isomorphic relationship between reality, perception and signification was achieved in the context of a methodical arrangement, as the power of a picture to signify was activated by its placement next to other pictures. The pictorial nature of Wilkins's philosophical language should not be recognized at the expense of acknowledging the linguistic nature of collecting and display. Willughby's early acquaintance with Wilkins and the fact that most of MS Mi LM 24 and the majority of MS Mi LM 25 were gathered and arranged by him suggests that he readily conceived of his collections as having sufficient signifying power through its 'very order' before the publication of the *Real Character*. In any event, its significance for Ray's subsequent work is evident, and it is reasonable to suppose that his incorporation of further pictures into the collections were made with regard to Wilkins's method and with awareness of the work of contemporaries such as Lister.

To draw this description and discussion to a conclusion: the paintings, drawings and engravings currently in Nottingham University Library were collected mostly in Germany, France and Italy by Willughby in 1663–4. They were annotated by Willughby and some of those who travelled with him, such as Skippon, and were arranged by Willughby, who possibly bound some of them in large volumes. Ray supplemented the collections with loans after 1672, and maybe he lent some of the pictures, since some images that were in the collection are now missing.

The collections seem to have taken only a small part of Willughby's attention. His interests were extremely wide-ranging, and I have argued that his collections of paintings should be seen as congruent with these other pursuits. Such congruence points to the provisional nature of the collections. Like many of Willughby's observations and activities, the collections can be said to be experimental in the sense that they are not ends in themselves. The relationship of the collections to Ray's well-known publications is remote and should be seen as a consequence of Willughby's death as much as his life.

Additionally, an interpretation of the collections that places them amongst Willughby's other interests suggests much about the use of pictures amongst natural historians and philosophers. His extensive annotations imply that, like Ray, he had a firm faith in the power of pictures to transparently signify the precise concept of the fauna they depicted. However, there is no evidence that he valued pictures because he conceived of them as enjoying a self-explanatory, one-to-one transparent relationship to the object represented. Instead, it is arguable that Willughby thought that a picture functioned only as an efficient signifier when it was placed in a wider structure – a collection – that replicated the organization of nature. To see this, we should remember a point made earlier, that the principles of classifying nature are arbitrary: we saw how Ray radically changed his taxonomic principles between 1668 and 1674, yet retained the principle of taxonomy – that nature can be arranged into different classes. If we see Ray as being inconsistent, or failing to follow scientific methods, we risk missing the important point, which is this: what was important for Willughby, Ray and their circle was not the arbitrariness or otherwise of their classifications, but the fact that nature could be studied and classified at all. It mattered to them that the natural world had a structural coherence that could be explored and explained. In the same way, what mattered to Wilkins was not that there was a necessary *a priori* relationship between the word *deba* and the concept of a flame, but that he could produce a binding and logical relationship of the two under the artificial conditions of an invented language. I would suggest that Willughby collected pictures not just because he thought they were a reliable mode of description, but also because he thought of them, like Wilkins thought of his language, as having an intimate relationship to nature conceived as a structure. Pictures, in Willughby's collections, have a structural relationship that he took to be capable of signifying, in a transparent and immediate sense, the structural coherence of nature.

Historians have seen Willughby's collections in the light of Ray's more famous publications; alternatively, they have emphasized the trust placed by natural historians in pictures *per se*, without explaining the understanding of nature that determined the collecting practices of major figures such as Willughby, Ray and Lister. This article has tried to describe Willughby's collections and suggest that they need to be explained as historical entities, and that it is only as part of the collections that the pictures become historically and epistemologically significant.

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Notes and references

1 Nottingham University Library, MS Mi LM 24 fols. 3, 4, 6, 7–10, 12, 14–25, 27–30, 32–5, 37, 40, 42, 44–66, 68–78, 81, 84–6, 88–90, 93–101, 103, 106. It is doubtful whether these paintings constitute the volume of pictures Willughby is recorded as having bought in Strasbourg from Leonard Baltner in his European tour with Ray in 1663–4 (see Mary Welch, 'Francis Willughby, FRS (1635–1672)', *Journal of the Society for the Bibliography of Natural History* 6 (1972), pp. 71–85). One of them (24 fol. 60) contains a note by Willughby referring to 'ye Strasburb book'. Moreover, this book is recorded as being a collection of paintings of waterfowl, whereas the present paintings are nearly all of passerines (birds with three forward toes and one pointing backwards).

2 These are MS Mi LM 24, fols. 1, 2, 11, 13, 31, 36, 92, 96, 104.

3 MS Mi LM 24, fols. 5, 26, 42, 43, 67, 82, 87, 107.

4 Charles E. Raven, *John Ray, Naturalist: His life and works* (Cambridge, 1950), p. 342; cf. MS Mi LM 24, fol. 107, a painting measuring approximately 65 × 41 cm.

5 MS Mi LM 24, fols. 38, 79, 80, 105, 161, 164–6. However, the subject matter of these pictures varies, including a goat and a flying squirrel.

6 MS Mi LM 24, fols. 163, 167–9. These paintings are not part of the original collection of paintings of birds, and it is probably due to binding the paintings in volumes in the late seventeenth century that they appear in the same sequence of the birds. I am grateful to Dorothy Johnson for pointing this out.

7 MS Mi LM 24, fols. 39, 41, 83, 93, 162.

8 MS Mi LM 24, fols. 20, 26, 33, 34, 43, 50, 53, 57, 58, 62, 63, 68, 71, 72, 87, 88.

9 MS Mi LM 24, fols. 3, 9, 24, 29, 49, 57, 59, 62, 76, 86; fols. 161, 163; cf. also fol. 105.

10 MS Mi LM 24, fols. 2, 3, 7, 8, 10, 12, 17–19, 21, 22, 25, 26, 29, 32, 35, 36, 38, 40, 42, 45, 46, 48–53, 55, 57, 58, 60, 63–71, 73, 75, 76, 82, 94, 104.

11 The bindings were done under either Francis Willughby or his son Thomas, whose signature and library shelf-mark appears on the inside cover of the volume for MS Mi LM 24. The binding stubs for MS Mi LM 25 have Francis's manuscript notes, however.

12 As many of the sheets have been cut down it is possible they originally had more.

13 But see MS Mi LM 24, fols. 164, 166–9 for a case where identical multiple marks indicate they were pinned together.

14 MS Mi Lm 24, fol. 13, 87; but see fols. 167–9, '654'.

15 Raven, op. cit. (note 4), pp. 342, 317.

16 On Browne see Raven, op. cit. (note 4), pp. 337–8; *The Letters of Sir Thomas Browne*, ed. Geoffrey Keynes (London, n.d.), p. 250. On the prints see *The Correspondence of John Ray*, ed. Edwin Lankester (London, 1848) (hereafter *Correspondence*), p. 105.

17 Raven, op. cit. (note 4), p. 370.

18 MS Mi LM 25, fols. 1, 18, 31, 33, 35–43, 45–8, 50, 52–7, 59, 60, 62, 65–8, 70–4, 76–9.

19 MS Mi LM 25, fols. 2, 18, 25, 51, 58, 63, 64; cf. fols. 17, 20, 75.

20 On the attribution to Skippon, see Welch, op. cit. (note 1), p. 80.

21 MS Mi LM 25, fols. 19, 21–4, 27.

22 For Willughby's commissioning of pictures, see Raven, op. cit. (note 4), p. 321.

23 An exception to this is the untidy script that annotates fols. 4, 5, 19, 23, 24, 28, 40, 42, 54.

24 Raven, op. cit. (note 4), p. 351.

25 See especially the inscriptions on MS Mi LM 25, fols. 10, 12–15, 16, 20, 26, 29.

26 Baltner's pictures nevertheless appear in the *De historia piscium*, e.g. fig. Q10. On the paintings from Rome, see Raven, op. cit. (note 4), p. 370.

27 Raven, op. cit. (note 4), p. 339.

28 See Raven, op. cit. (note 4), p. 350–1; Ray's letters to Tancred Robinson, in *The Further Correspondence of John Ray*, ed. Robert W. T. Gunther (London, 1928), pp. 143–53, 287–90; *Correspondence*, pp. 135, 183; Sachiko Kusukawa, 'The Historia Piscium (1686)', *Notes and Records of the Royal Society of London* 54 (2000), pp. 179–97.

29 See Raven, op. cit. (note 4), pp. 311ff., 339ff.; Welch, op. cit. (note 1).

30 Kusukawa, op. cit. (note 28). I have drawn on Kusukawa's excellent synopsis of Wilkins's theory in the following paragraph.

31 On Wilkins in general, see Barbara Shapiro, *John Wilkins 1614–1672: An intellectual biography* (Berkeley and Los Angeles, 1969).

32 Shapiro, op. cit. (note 31), p. 209.

33 Jorge Luis Borges, 'John Wilkins's analytical language', in *The Total Library: Non-Fiction 1922–86*, ed. & trans. Eliot Weinberger *et al*. (London, 2001), pp. 229–32. I would like to thank Charles Ford for showing me this insightful essay.

34 Wilkins's concern that a language based on arbitrary conventions could foster disagreement rather than unity should also be seen in the light of Britain's recent Civil War: see Marjory C. Jacob, *The Newtonians and the English Revolution* (Hassocks, 1976).

35 Wilkins, quoted in Frederic Dolezal, *Forgotten but Important Lexicographers: John Wilkins and William Lloyd* (Tubingen, 1985), p. 14.

36 Vivian Salmon, ''Philosophical' grammar in Wilkins's "Essay"', in *John Wilkins and seventeenth century British Linguistics*, ed. Joseph Subbiondo (Amsterdam and Philadelphia, 1992), p. 209.

37 Salmon, op. cit. (note 36), p. 220.

38 Ann Bermingham, *Learning to Draw: The cultural history of a polite and useful art* (New Haven and London, 2000), p. 72.

39 John Wilkins, *An Essay towards a Real Character and a Philosophical Language* (London, 1668), p. 1.

40 Bermingham, op. cit. (note 38), p. 72.

41 Wilkins, quoted in Salmon, op. cit. (note 36), p. 229.

42 Bermingham, op. cit. (note 38), p. 67. See Svetlana Alpers, *The Art of Describing: Dutch art in the seventeenth century* (London, 1983): Alpers' thesis is that practices of making and looking are the outcome of a 'cultural ambience' (p. 26). Historians who agree with Alpers that pictures had a privileged cultural position include Bermingham, op. cit. (note 38), and Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle and the experimental life* (Princeton, 1985).

43 See John Ray and Francis Willughby, *The Ornithology of [Francis Willughby] … Translated into English, and enlarged with many additions … To which are added, Three discourses, I. Of the Art of Fowling. II. Of the ordering of Singing birds. III. Of Falconry* (London, 1678), sig. A3v.

44 Raven, op. cit. (note 4), pp. 181, 322.

45 Wilkins, op. cit. (note 39), p. 1.

46 See Raven, op. cit. (note 4), pp. 181–2.

47 Raven, op. cit. (note 4), p. 182.

48 See Borges, op. cit. (note 33).

49 On Willughby's interests see Welch, op. cit. (note 1), and David Cram, Jeffrey L. Forgeng and Dorothy Johnston (eds.), *Francis Willughby's Book of Games: A seventeenth century treatise on sports, games and pastimes* (Nottingham, 2003).

50 Raven records Ray's statement that Willughby 'formed it into some order of his own, etc': Raven, op. cit. (note 4), p. 309.

51 Bodleian Library, Oxford, MS Lister 9.

52 For Lister and Ray, see Raven, op. cit. (note 4), pp. 137–40.