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HISTORIC AND TAXONOMIC IMPLICATIONS OF RECENTLY FOUND ARTWORK IN ARITHMETIC BOOKS OF STUDENTS OF ALEXANDER WILSON

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ABSTRACT.—In 1991, The Gutman Library of Harvard University received four handwritten arithmetic books dating from 1800–1803. Two of the books were decorated with stylized birds and a watercolor drawing of a bird was found in one of the books. We conclude that the drawing is of a juvenile Field Sparrow (*Spizella pusilla*), although other species are possible and are discussed. We further conclude that the artist was probably William Bartram. Notes found in the handwritten arithmetic books attribute the decorations to Alexander Wilson, but the evidence is circumstantial and open to alternative explanations. The decorations are mostly of stylized birds rendered in different colors of ink and completed before Wilson's decision to catalogue the birds of North America and his commitment to learn to paint birds under the guidance of William Bartram, an accomplished illustrator and naturalist. If Wilson's, the decorations indicate that he possessed considerable artistic ability and interest in birds prior to undertaking his remarkable "American Ornithology." *Received 15 Jan. 1993, accepted 2 April 1994.*

In November 1991, we learned that the Gutman Library, Harvard University, had received a set of handwritten arithmetic books belonging to Charles and William Wood who attended the school at Gray's Ferry taught by Alexander Wilson (1766–1813). The books had been decorated with birds and an undated, unsigned drawing of an unknown bird was found in one of the books. Notes added to the arithmetic books by descendants of Charles and William Wood attribute the decorations to Alexander Wilson whose nine volume "American Ornithology" (1808–1814) was the first systematic catalog of the birds of North America. To achieve his masterpiece, Wilson taught himself to sketch and paint birds under the tutelage of William Bartram, the foremost American naturalist of the late

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A portrait of a bird, probably a juvenile Field Sparrow, thought to have been painted by William Bartram and loaned to Alexander Wilson when he was learning to sketch birds. Image actual size.

eighteenth and early nineteenth centuries. In this context, the painting and decorations become important to our understanding of Wilson's artistic ability and development, but did Alexander Wilson paint the bird portrayed in the unsigned watercolor? When was the bird painted? And what species is portrayed? What about the decorations? Were they drawn by Alexander Wilson? Can they tell us anything about Wilson's artistic abilities and interests?

THE ARTIST

The painting (Frontispiece) is unsigned, but was in one of the handwritten arithmetic books from students at the school where Alexander Wilson taught. However, the composition and style are not consistent with Wilson's sketches and published portraits of birds. The Frontispiece contains a bird and a complete, anatomically correct gentian, probably *Gentiana andrewsii* or *G. saponaria* (D. Johnson, pers. comm.). Wilson portrayed 316 birds in his nine volume "American Ornithology," but only the portrait of the male Ruby-throated Hummingbird (*Archilochus colubris*) contains a flower, and that flower includes only a short section of stem and a single cluster of leaves. The flower appears to be a delphinium (*Delphinium* sp., D. Johnson, pers. comm.), but its lack of detail precludes positive identification. The bird in the frontispiece is perched on the blossom of the gentian, but the blossom could not support the bird, nor is the bird grasping the blossom. Wilson's songbirds firmly grasp branches that are capable of supporting them. The inclusion of a flower and a bird that is not grasping its perch are features sufficiently uncharacteristic of Wilson's work as to cast doubt on his being the artist.

If the painting dates from the time of the arithmetic books, which are dated 1800, 1801, 1803, and undated, who other than Wilson was painting birds? At the turn of the nineteenth century William Bartram (1739–1823) was the best known of America's naturalists. He had travelled and lived in the Carolinas, Georgia, and Florida (Harper 1958), and from 1773–1777 he illustrated the plants and animals of the southeast and kept a detailed journal on which he based his "Travels through North and South Carolina, Georgia, East and West Florida" (1791). Following the death of his father, John Bartram, in 1777, William returned to the family home at Gray's Ferry, just outside Philadelphia, where he spent the rest of his life writing, sketching, and caring for the famous botanical garden begun by his father. A few of William Bartram's illustrations can be seen in his "Travels," but most were sent to England to Peter Collinson or Dr. John Fothergill who funded Bartram's exploration of the southeastern United States. Some of these illustrations have been published by Ewan (1968), and many unpublished illustrations are in the archives of the Academy

of Natural Sciences of Philadelphia, American Philosophical Society, and Historical Society of Pennsylvania. Also active at this time was John Abbot (1751–1840), a British immigrant to Georgia and prolific painter of insects and birds for European patrons (Rogers-Price 1983). A collection of Abbot's watercolors of birds is at the Houghton Library, Harvard University. Wilson refers to the artistic pursuits of Ann Bartram Carr (1779–1858), William Bartram's niece and housekeeper, in no less than nine letters from 4 March 1803 to 22 May 1807 (Hunter 1983). We were unable to locate any of her original work but studied a microfilm copy of her only published illustration (Barton 1805). John James Audubon (1785–1851) began painting birds in 1805 (Davidson in Audubon 1966), probably after the portrait had been painted. Nonetheless, we compared the portrait to Audubon's published watercolors (Audubon 1966) on which the plates for his "Birds of America" (1827–1838) are based. Still later were Alexander Rider, who immigrated to America from Germany in 1810, and Titian Peale (1799–1885), illustrators for Bonaparte's "American Ornithology" (1825–1833). A selection of their work is at the Academy of Natural Sciences of Philadelphia. These artists and their works, along with Wilson's "American Ornithology" (1824) in the rare book collection at Beeghly Library, Ohio Wesleyan University, and his sketches and letters at the Houghton Library, Harvard University, Museum of Comparative Zoology (MCZ) Library, Harvard University, and the Academy of Natural Sciences of Philadelphia, form the basis for our analysis of the portrait.

The presence of an anatomically correct gentian (Frontispiece) suggests that Bartram, who was a knowledgeable botanist and whose bird portraits usually include one or more plants, was the artist. Furthermore, the gentian grows from ground strewn with miniature mushrooms, rocks, and grasses. Such miniaturized objects are a common feature in the foregrounds of Bartram's illustrations. The bunch of bent and twisted grass in the lower left (Frontispiece) resembles bunches of grass found in many of Bartram's foregrounds. Abbot, like Bartram, employed miniaturized foregrounds, and he occasionally included flowers and grasses, but his flowers are not anatomically correct, and his grasses are neither bent nor twisted. Carr's Brown Creeper (*Certhia americana*) is too large for its tree, but miniaturized plants and objects are absent. Wilson included foregrounds in only 42 of the 76 plates in "American Ornithology," but miniature objects are entirely lacking. Occasionally, Wilson included a bunch of grass, but it is not bent and twisted as in the portrait and in Bartram's illustrations. Audubon, Rider, and Peale provide only naturalistic settings that are in proportion to their birds.

The twisting of the bird's head is unusual, but the same posture occurs

in nine of 16 (56%) bird illustrations by William Bartram (Ewan 1968). Abbot used the posture in 15 of 61 (25%) illustrations, but Wilson used a similar posture in only 24 of his 316 portraits (8%). Among the later natural history illustrators, only Rider used the posture (7 of 46 illustrations [15%]).

The anatomy and proportions of the bird are characteristic of Bartram's bird illustrations. For example, the bird's eye is too close to the bill (Frontispiece), a universal feature of Bartram's birds. Wilson placed the eye farther back in its correct position, as did John Abbot, Ann Bartram Carr, and other artists of the period. The prominent, semi-circular plumage pattern of the auricular area (Frontispiece) occurs on most of Bartram's birds, on the creeper of Carr, but not on the birds of Abbot, Wilson, Rider, Peale, or Audubon. The pointed scapular feathers that overlap the wing (Frontispiece), are found only on the bird portraits of Bartram and Carr. The primary coverts of the portrait are aligned with the primaries (Frontispiece). Such alignment occurs in the portraits by Bartram, Carr, and Abbot, but Wilson and later illustrators curve the primary coverts, which is correct. The hallux on the raised foot of the portrait is extended back, but when a bird lifts its leg the hallux relaxes toward the other toes not backward. Occasionally Wilson and Audubon portrayed a bird with its foot raised, and in every portrayal the hallux hangs forward. More importantly the legs of the bird in the Frontispiece lack detail. They are outlined and the scales indicated by a few cross lines. Such approximation is characteristic of Bartram, Abbot, and Carr, but not Wilson whose draftsmanship is described by Charles Robert Leslie (Cantwell 1961), one of Wilson's early colorists and later court painter to Queen Victoria:

“We worked from birds which he had shot and stuffed, and I remember the extreme accuracy of his drawings, and how carefully he had counted the number of scales on the tiny legs and feet of his subject.”

The portrait's tail is twisted to give us a dorsal view. Such a view can be found in several of Bartram's sketches. A less extreme twist occurs in some of Abbot's bird portraits and in Carr's creeper, in only a few of Wilson's early illustrations, and in none of the portraits by Rider, Teale, or Audubon. In composition, style, anatomy, and proportion, the portrait (Frontispiece) is consistent with the known work of William Bartram, less consistent with the single known work of Ann Bartram Carr, and inconsistent with the known works of Alexander Wilson, John Abbot, Alexander Rider, Titian Peale, and John James Audubon. However, the watercolor might be Wilson's early rendering of a portrait by Bartram.

Alexander Wilson met William Bartram sometime in 1802 (Hunter

1983), soon after he became master of the school at Gray's Ferry. Wilson's interest in drawing and birds is first expressed in an undated letter, believed to be from 1803 (Hunter 1983) in which he requests advice from Bartram on several "rough draughts" of birds. Later in a letter dated 17 November 1803 Wilson writes:

"I have taken the liberty of sending you another Specimen of attempts to imitate your beautiful Engravings, presuming on your goodness."

Could the newly found watercolor represent the only surviving copy of a Bartram engraving sketched by Alexander Wilson during the period when he was learning to draw and paint birds under Bartram's tutelage? The gentian lacks detail (Frontispiece), which is uncharacteristic of Bartram whose plants are detailed, even in his illustrations of birds. However, by mid-1803 Wilson had decided to illustrate all of America's birds (Hunter 1983), and if Wilson was copying Bartram's drawing, the greater detail of the bird relative to the gentian might reflect Wilson's interest in understanding avian anatomy and proportion.

Two lines of evidence weigh strongly against this exciting possibility. Close examination of the original suggests that the painting was done entirely in watercolor. Along their length the lines vary slightly in width and intensity of color, as if done by a brush with more or less pressure applied. A collection of his works at the American Philosophical Society shows that Bartram occasionally sketched entirely in watercolor, whereas examination of more than 100 of Wilson's bird portraits housed at the MCZ at Harvard indicates that Wilson outlined his bird subjects in pencil and then rendered them with pen-and-ink, often adding watercolor secondarily. Furthermore, Wilson's earliest drawings for his "American Ornithology" were strictly pencil or pen-and-ink sketches. The coloring was done only after the engraving was completed. Not until later volumes did Wilson supply fully colored drawings to his engraver (Christy 1926). This suggests that Wilson's use of watercolor, such as seen in the portrait, came later, not earlier, in his artistic development, but Wilson's later portraits are better proportioned and more anatomically detailed than his earlier portraits and the bird in the Frontispiece.

The second line of evidence comes from the paper used in the portrait. When light shines through the paper a coarse grid of vertical and horizontal lines is evident along with an incomplete watermark. The grid indicates that the portrait is painted on "laid" paper, a type of paper made and used widely until the very early 1800s (Hunter 1952). "Wove" paper, which replaced "laid" paper, lacks the grid. It was developed in England in the mid-1700s and introduced to the United States in 1795. Because

of its more uniform surface, “wove” paper was preferred by printers and calligraphers, and by 1815 “wove” paper predominated (Hunter 1952). The archives of the American Philosophical Society have 57 drawings by Bartram, of which 34 (60%) are on “laid” paper and 23 on “wove” paper. By contrast all of Wilson’s 120 drawings housed in the MCZ at Harvard are on “wove” paper, although Wilson occasionally used “laid” paper for his letters as late as 2 October 1807 (letter to Samuel Bradford concerning subscriptions to “American Ornithology”).

The watermark is an incomplete shield surrounding the base of a fleur-de-lis. Below the shield is a 4, and below that three initials, a very clear VG, and the top of what might be an L to the left of the V. The only match is the watermark of Lubertus Van Gerrevink, a famous Dutch papermaker of the 18th century who owned mills throughout western Europe (Gravell and Miller 1983). We can find no record of the watermark after the 1790s. Among Bartram’s sketches at the American Philosophical Society are four on “laid” paper with the watermark of Lubertus Van Gerrevink exactly as found in the portrait.

Because Wilson’s technique differs from that used in the portrait and because the portrait is on “laid” paper, whereas Wilson used only “wove” paper for his bird portraits, we conclude that the painting is neither an early sketch by Alexander Wilson nor Wilson’s copy of Bartram’s work. Based on the presence of an anatomically correct gentian, the miniaturized foreground with its bent and twisted bunch of grass, the anatomy and proportions of the bird, the exclusive use of watercolor on “laid” paper of late 18th century Dutch origin, paper known to be used by William Bartram, we conclude that the portrait artist was indeed William Bartram.

SPECIES IDENTIFICATION OF THE PORTRAIT

William Bartram, and the naturalist-illustrators of the late 18th and early 19th centuries based their paintings of birds on specimens, which means the bird in the painting is based on a real bird collected from the wild. Bartram spent his long life in southeastern Pennsylvania, except for his travels and natural history studies in the southeastern United States from 1773–1777. Therefore, the species portrayed probably comes from southeastern Pennsylvania or possibly the southeastern states.

The heavy bill suggests that the bird is a bunting (Emberizidae, Cardinalinae) or sparrow (Emberizidae, Emberizinae), but the coloration and pattern of color do not match that of any eastern species. We have compared the portrait to specimens of eastern North American emberizines and have shown colored photocopies to colleagues for their identification of the portrait. Several species and one hybrid have been suggested as

possibilities (Table 1). We have examined specimens of these species at the Carnegie Museum of Natural History, Harvard Museum of Comparative Zoology, and the University of Michigan Museum of Zoology. We compared the colors and patterns of the possible species to the painting and then compared physical measurements and proportions. We consider the species in taxonomic sequence.

The general brownish color and lack of distinctive field marks suggests a female Indigo Bunting (*Passerina cyanea*), but the Indigo Bunting lacks the faint eye-ring and wing bars seen in the portrait (Frontispiece, Table 1). Furthermore, the female bunting's brown dorsum is not finely streaked as in the unidentified portrait (Frontispiece, Table 1) nor is the dorsum as dark as in the portrait nor the dorsal-ventral contrast as great (Frontispiece). Furthermore, female buntings have blue edges to the primaries and rectrices (Table 1), a feature not found in the portrait. Because of its similar coloration the female Indigo Bunting cannot be completely ruled out as the subject of the portrait, but the many differences in detail make it an unlikely subject.

The dark face, gray-brown back, and light venter suggest a juvenile Rufous-sided Towhee (*Pipilo erythrophthalmus*). However, the towhee differs in many details. For example, the towhee has no eye-ring, its wing-bars are more prominent than those of the portrait, its outer tail feathers have large patches of white, and its legs and bill are brown, not pink (Table 1). The dominant ground color of the portrait is brown, whereas that of the juvenile towhee is cinnamon (Frontispiece, Table 1). The dissimilarities of color and pattern (Table 1) far outnumber the similarities and suggest that a juvenile towhee is not the subject of the painting.

The pink bill and legs combined with the faint wing-bars and indistinct markings of the breast suggest a juvenile Field Sparrow (*Spizella pusilla*). Furthermore, details of color and pattern tend to agree (Table 1). The portrait and the juvenile Field Sparrow have faint eye-rings and areas of brown that are finely streaked with darker brown. These fine streaks are formed when the vane near the rachis is darker than the outer edge of the vane. The artist illustrates this with fine dark brush strokes as can be seen on the back of the bird in the painting. The bird is perched with its side to the viewer with its head turned away so that it can look at the viewer with its right eye over its left shoulder. We suggest that the gray between the breast and the head is the color of the upper back and nape where the neck twists around. The white throat visible below the bill indicates that the pinkish buff breast leads to a white throat and is not crossed by gray. The pattern of light belly, slightly darker breast, light throat, and darker neck and nape is the pattern of a juvenile Field Sparrow (Table 1). The juvenile Field Sparrows we examined had fine streaks on

TABLE 1
COMPARISON OF COLOR AND PATTERN BY TOPOGRAPHIC SURFACE OF THE UNIDENTIFIED PORTRAIT AND ITS POSSIBLE SPECIES

Topography	Portrait	Indigo Bunting (female)	Rufous-sided Towhee (juvenile)	Field Sparrow (juvenile)	Lincoln's Sparrow (juvenile)	White-throated Sparrow (juvenile)	White-throat × Junco (adult, male)	Dark-eyed Junco (juvenile)
Crown	Reddish brown	Brown	Cinnamon, dk. brown streaks	Brown	Chestnut, small black streaks	Dk. brown, light central stripe	Dark gray-brown	Gray-brown, dk. brown streaks
Forehead	Dark brown	Brown	Cinnamon, dk. brown streaks	Brown	Chestnut, small black streaks	Dk. brown, light central stripe	Dark gray-brown	Gray-brown, dk. brown streaks
Eyebrow	Reddish brown	Brown	Dark brown, light flecks	Brown	Gray	Lt. brown, yellow near bill	Dark gray, bit of white near bill	Gray-brown, dk. brown streaks
Eye line	Brown	Brown	Dk. brown	Brown	Dk. brown	Gray	Dk gray	Gray-brown, dk. brown streaks
Eye-ring	Lt. brown, faint line	Brown	Dk. brown	Lt. brown, faint line	Lt. brown, faint line	Gray	Dk gray	Gray-brown, dk. brown streaks
Auricular	Gray brown	Brown	Dk. brown	Brown	Gray	Gray	Dk gray	Gray-brown, dk. brown streaks
Nape	Dk. brown	Brown	Dk. cinnamon, dk. brown streaks	Brown	Gray-brown, dk. brown streaks	Dk. brown, lt. central stripe	Dk. brown, gray	Gray-brown, dk. brown streaks

TABLE 1
CONTINUED

Topography	Portrait	Indigo Bunting (female)	Rufous-sided Towhee (juvenile)	Field Sparrow (juvenile)	Lincoln's Sparrow (juvenile)	White-throated Sparrow (juvenile)	White-throat X Junco (adult, male)	Dark-eyed Junco (juvenile)
Back	Brown, small, dk. brown streaks	Brown	Dk. cinnamon, dk. brown streaks	Brown, dk. brown streaks	Gray-brown, dk. brown streaks	Brown, dk. brown streaks	Brown, dk. brown streaks	Gray-brown, dk. brown streaks
Scapulars	Brown, dk. streaks, light edges	Brown	Dk. cinnamon, dk. brown streaks	Dk. brown with light edges	Gray-brown, dk. brown streaks	Dk. brown with light edges	Dk. gray	Gray-brown
Rump	Gray-brown	Brown	Dk. cinnamon, dk. brown streaks	Gray-brown	Gray-brown, dk. brown streaks	Cinnamon	Gray-brown	Gray
Uppertail coverts	Gray-brown	Brown	Dk. cinnamon, dk. brown streaks	Gray-brown	Gray-brown, dk. brown streaks	Cinnamon	Gray-brown	Gray-brown, narrow dk. brown streaks
Tail	Dk. gray-brown	Blue-brown	Black, white outer corners	Dk. brown	Dk. brown	Dk. cinnamon	Dk. brown, white outer feathers	Dk. brown-black, white outer feathers
Mustache	Lt. line, gray line below	Gray	Cream	Gray, no contrast	Dk. brown, buff, dk. brown	Dk. brown, white above	Dk. gray	Gray-brown, small dk. brown streaks
Throat	White	White	White, brown spots	White to gray, varies	White	White	White	Lt. gray, dk. edges

TABLE 1
CONTINUED

Topography	Portrait	Indigo Bunting (female)	Rufous-sided Towhee (juvenile)	Field Sparrow (juvenile)	Lincoln's Sparrow (juvenile)	White-throated Sparrow (juvenile)	White-throat × Junco (adult, male)	Dark-eyed Junco (juvenile)
Breast	Pinkish brown, fine streaks	Buff, gray-brown streaks	White, brown streaks	Brown wash, fine streaks	Buff, fine dk. brown streaks	Gray, fine dk. edges on feathers	Dk. gray	Gray, dk. brown streaks
Shoulder	Brown, dk. streaks, lt. feather edges	Brown	Dk. brown	Brown, darker streaks	Gray, dk. brown streaks	Gray	Dk. gray	Gray
Wing bars	Two, lt. edges of coverts	None, brown	Two, buff to white	Two, lt. brown	Two, faint, buff feather edges	Two, buff	Two, white feather tips	None, dk. brown
Flank	White	Buff	Gray-buff, dark streaks	Lt. brown, dk. brown streaks	Buff, dk. brown streaks	Lt. brown	Gray	Gray
Belly	White	White	White	White	White	White	White	White
Primaries	Dk. brown	Dk. brown, blue edges	Dark brown, edged in white	Dk. brown	Dk. brown	Dk. brown, cinnamon edges	Dk. brown	Dk. brown-black
Undertail coverts	White	White	Lt. brown	White	Pale buff	White	White	White
Tarsi	Pink	Black	Brown	Pink	Lt. Brown	Lt. brown	Lt. brown	Pink
Bill	Pink	Black	Dk. brown	Pink	Dk. brown	Lt. brown	Lt. brown	Lt. brown

the breast and flanks (Table 1), which are not seen in the portrait. However, Sutton (1935) describes the juvenal plumage as having spots or flecks on the under parts, a description that closely fits the pattern seen in the portrait. Alternatively, the fine marks on the breast of the bird in the portrait may be the artist's way of indicating the edges of feathers rather than an indication of streaking. General and detailed similarities of color and pattern (Table 1) make the juvenile Field Sparrow a likely subject of the portrait.

The buff tint to the upper breast, gray on the neck, and the faint wing-bars suggest a juvenile Lincoln's Sparrow (*Melospiza lincolnii*). Like the Field Sparrow, the similarities extend to details of color and pattern (Table 1); for example, the faint eye-ring and the white belly, buff breast with fine, dark streaks, and white throat. However, the streaked forehead of the juvenile Lincoln's Sparrow is absent in both the juvenile Field Sparrow and the portrait, and the streaking of the breast and flanks is more pronounced in the juvenile Lincoln's Sparrow than in the juvenile Field Sparrow or the portrait. Furthermore, the tarsi and bill of the juvenile Lincoln's Sparrow are brown, not pink as in the Field Sparrow (Table 1) and the portrait. Nonetheless, the juvenile Lincoln's Sparrow is a possible subject of the portrait.

The white throat and gray upper breast suggest a juvenile White-throated Sparrow (*Zonotrichia albicollis*). This identification assumes that the gray across the upper breast represents the upper breast and not the sides of the neck as it twists toward the turned head. The white throat bordered by a gray line which is bordered in turn by a light line strongly suggests the throat pattern of a juvenile White-throated Sparrow, but the head stripes, the cinnamon color of the lower back, the gray face, and the brown bill and legs that characterize the White-throated Sparrow (Table 1) are not characteristics of the portrait. Like the towhee, the White-throated Sparrow is an unlikely model for the bird in the portrait.

Unlike the White-throated Sparrow, the portrait lacks head stripes. However, hybrid White-throated Sparrow \times Dark-eyed Juncos have gray-brown plumage in place of the sparrow's prominent head stripes (Table 1), but retain the white throat (Townsend 1883, Stone 1893) also present in the portrait. In addition, the gray-brown rump and upper tail coverts of the hybrid match the painting better than does the cinnamon color of the White-throated Sparrow. The upper breast of the hybrid is gray (Table 1), which may be the color of the upper breast in the portrait, but alternatively the gray across the upper breast of the portrait may represent the sides and back of the neck where the head is turned away from us. The hybrid lacks the faint eye-ring and pink bill and legs of the portrait, and is too gray overall (Table 1). Most importantly, the hybrid has white outer

tail feathers not seen in the portrait. Taken together the similarities make the hybrid a more likely subject than the White-throated Sparrow, but the dissimilarities make it less likely than the Indigo Bunting, Field Sparrow, and Lincoln's Sparrow.

The dark face, gray-brown back, and light venter suggest a juvenile Dark-eyed Junco (*Junco hyemalis*). However, like the hybrid, the general similarity of the junco and the portrait cannot withstand detailed comparison. The head of the portrait lacks the junco's fine streaks and has an eye-ring which the junco lacks (Table 1). The junco also lacks the white throat and wing bars of the portrait (Table 1), and the portrait lacks the white outer tail feathers of the junco. Although the legs of both are pink (Frontispiece, Table 1), the junco's bill is light brown (Table 1) whereas the bill in the portrait is pink. The Dark-eyed Junco bears a general resemblance to the portrait, but many differences in detail make it an unlikely model for the portrait.

In addition to color and pattern, the size and proportions of the portrait may indicate its identity. Most of Bartram's illustrations are life-size (Porter 1989, pers. obs.), and Wilson's songbirds are life-size and properly proportioned (Leslie as cited in Cantwell 1961). The total length of the bird in the painting cannot be measured accurately because of its turned head, but the lengths of the wing, tail, tarsus, and culmen were measured with steel calipers. The wings of specimens were measured by slipping a steel ruler under the wing and reading the chord length. The wing on the portrait was measured from the intersection of the leading edge and the overlying scapular feathers to the wing tip. The tail was measured from where the outermost tail feather emerged from the uppertail coverts to its tip. This was the greatest length of the tail in the painting and minimized error. The tarsus was measured from the base of the middle toe on the left foot to the outer bend of the left leg. The culmen was measured from the base of the right nostril to the tip of the bill (Table 2).

The juvenile Lincoln's Sparrow most closely matches the portrait for wing length, although the juvenile Field Sparrow and female Indigo Bunting are also very close. The tail length of the portrait is most similar to that of the female Indigo Bunting and only slightly less similar to the tail length of the juvenile Lincoln's Sparrow. The other species have considerably longer tails. The portrait has a shorter tarsus than any of the specimens, but the female Indigo Bunting and juvenile Field Sparrow have the most similar tarsal length, with the juvenile Lincoln's Sparrow being only slightly longer. The culmen length is short and differences slight, but the portrait and the juvenile Field Sparrow have the same length, while the female Indigo Bunting, juvenile Lincoln's Sparrow, and juvenile Dark-eyed Junco are only 0.5 mm longer. To estimate overall agreement

TABLE 2
COMPARISON OF MEASUREMENTS (MM) AND (IN PARENTHESES) PROPORTIONS BASED ON THE RATIO OF THE LENGTH OF THE WING CHORD, TAIL, OR BILL TO THE LENGTH OF THE TARSUS FOR THE UNIDENTIFIED PORTRAIT AND ITS POSSIBLE SPECIES OR HYBRID

Measurements (mm)	Portrait	Indigo Bunting (female)	Rufous-sided Towhee (juvenile)	Field Sparrow (juvenile)	Lincoln's Sparrow (juvenile)	White-throated Sparrow (juvenile)	White-throat × junco (adult, male)	Dark-eyed Junco (juvenile)
Wing chord length	59 (4.21)	64.5 (4.03)	89 (3.07)	63 (3.94)	60 (3.53)	72.5 (3.29)	76.5 (3.64)	77 (4.05)
Tail	43 (3.07)	41 (2.56)	87 (3.00)	55 (3.44)	48 (2.82)	66 (3.00)	61 (2.90)	59 (3.10)
Tarsus	14	16	29	16	17	22	21	19
Culmen	6.5 (0.46)	7 (0.44)	10.5 (0.36)	6.5 (0.41)	7 (0.41)	9 (0.41)	8 (0.38)	7 (0.37)
Total deviation from measurements of portrait ^a		10	93	18	9.5	37	44	39.5

^a The total deviation is calculated by taking the absolute value of the difference between the wing, tail, tarsus, or culmen length of the species or hybrid and the same measurements of the portrait, then summing all values for the column.

of measurements, we took the absolute value of the difference in the length of the wing, tail, tarsus, and culmen between the portrait and each species or hybrid. We then summed the differences for that species or hybrid to provide a quantitative estimate of the match. The juvenile Lincoln's Sparrow is the best overall match to the portrait, but the female Indigo Bunting matches almost as well (Table 2). The juvenile Field Sparrow was an excellent match to the portrait except for its tail, which was much longer than that of the bird in the painting (Table 2). The juvenile White-throated Sparrow, juvenile Dark-eyed Junco, and hybrid are all larger than the bird in the painting (Table 2), particularly in the wings and tail. The juvenile towhee is much too large (Table 2).

The portrait is smaller than all possible species and the hybrid, but its proportions might match closely one of the suggested identifications. To test this possibility, we took the tarsus as our standard and calculated the other measurements as a ratio of tarsal length (Table 2). The proportions of the juvenile Dark-eyed Junco are the most similar to those of the portrait with the proportions of the juvenile Field Sparrow and the female Indigo Bunting being only slightly less similar (Table 2). The proportions of the juvenile Rufous-sided Towhee, juvenile White-throated Sparrow, and hybrid are the least well matched to the portrait (Table 2).

On the basis of color and pattern, overall size, and proportions, the juvenile Field Sparrow, juvenile Lincoln's Sparrow, juvenile Dark-eyed Junco, and female Indigo Bunting match the portrait most closely. The juvenile Rufous-sided Towhee, juvenile White-throated Sparrow, and hybrid White-throated Sparrow × Dark-eyed Junco are relatively poor matches. If the portrait was painted by William Bartram, the bird probably was collected in southeastern Pennsylvania, where he lived and observed birds, or in the southeastern states where he had travelled and studied extensively. Dark-eyed Juncos and Lincoln's Sparrows winter in these areas, but they breed farther north and west. In Lincoln's Sparrow the juvenal plumage is replaced by the first winter plumage during a partial molt that is completed by early August (Dwight 1900), well before early September when the first Lincoln's Sparrows arrive in Pennsylvania (Wood 1958). The Dark-eyed Junco acquires its first winter plumage during a partial molt that occurs in August and early September (Dwight 1900), whereas the first juncos arrive in southeastern Pennsylvania in mid-to late September (Eaton 1968). Based on the breeding range, the timing of molt, and the arrival of fall migrants in southeastern Pennsylvania, Bartram would have been unlikely to encounter juvenile Lincoln's Sparrows or Dark-eyed Juncos.

We conclude that the portrait is that of a juvenile Field Sparrow, a common breeding species in southeastern Pennsylvania. We base our conclusion on the similar size and proportions and the close match in color and pattern of the juvenile Field Sparrow and the portrait and on the Field Sparrow's status as a common breeding species in southeastern Pennsylvania.

We suggest that the portrait was loaned or given to Alexander Wilson to copy. We know from Wilson's correspondence with Bartram that this was a common learning technique early in Wilson's artistic development. However, the importance of the painting transcends its value as a teaching tool and confirmation of a teaching method alluded to in Wilson's letters to Bartram. Alexander Wilson is credited with having discovered and described the Field Sparrow (AOU 1983); however, he attributes its discovery to William Bartram (Brewer 1854, p. 174). On page 291 of his "Travels" (Harper 1958), Bartram lists the "Little Field Sparrow" (*Passer agrestis*) among the "Granivorous Tribes" and indicates that it is a summer resident in Pennsylvania, but otherwise does not describe the species or its biology. The type specimen pictured in Wilson's "American Ornithology" (1808–1814), plate 24, is at the Harvard Museum of Comparative Zoology, but if the painting is a juvenile Field Sparrow, it represents an earlier specimen of a Field Sparrow collected and portrayed by William Bartram exactly as stated by Alexander Wilson. The portrait

(Frontispiece) is the iconotype of Bartram's (*Passer agrestis*) and, by Wilson's own attribution, the iconotype of the Field Sparrow (*Spizella pusilla* [Wilson]).

CALLIGRAPHY

In a letter from G. J. O'Connell, executor of the will of Dorothy M. Smith, to M. Canavan, Harvard University, written 13 July 1990 the University was notified that it would receive "all handwritten arithmetic books (circa 1800) of Charles Wood and William Wood, one of the books having been illustrated by Alexander Wilson while he was the teacher of Charles and William." Ann T. Tarr accepted "three handwritten arithmetic books (circa 1800) of Charles Wood and William Wood . . ." in Common Pleas Court in Philadelphia County on 26 June 1991. That is the description of the books in the legal documents pertaining to the gift. In fact, four handwritten, arithmetic books were included in the bequest and two of these are illustrated.

Two of the books bear the name of Charles Wood. One of these contains decorated, calligraphic headings, and its cover is dated 9 Sept. 1800. The other contains block-letter, undecorated headings and its cover is dated 10 Mar. 1803, but a page part way through the book is dated 19 Feb. 1802. The cover dates appear to be the dates on which the books were completed (R. Mathiesen, pers. comm.). The handwriting is the same in both books, presumably the handwriting of Charles Wood. The decorated calligraphy in the 1800 book is markedly different from the block-letter headings of the 1803 book, but very similar to the decorated calligraphy in the arithmetic book of William Wood, which is dated 3 Jan. 1801. The handwriting in this book differs from that in the two books by Charles Wood, thereby confirming that this book was indeed written by a different student. The similarity of the calligraphy and particularly the decorations in lesson books written by different students with different handwriting suggests that the teacher or an assistant was the calligrapher. Two notes in the decorated book of Charles Wood state that Alexander Wilson was that teacher and calligrapher. The larger note states:

"School Book of Charles Wood—dated 9th Sept. 1800

"Alexander Wilson, the Scottish ornithologist, was school master of the school at Darby Rd. and Greenway Lane, near Sorrel Horse Tavern, at this period.

"The school book, prepared and decorated by the schoolmaster, became the property of Charles Wood, then about 12 years old, who attended this school.



FIG. 1. "Of Money" is an exquisite example of linked lettering in blue and yellow with red and brown flourishes. The ten birds are in blue, yellow, and red outlined in black with red and brown interior detail.

"Charles Wood married Mary Walters, a quakeress at Old Swede's in 1811"

This note is hand-printed in black ink on white card stock, appears to be relatively recent, and was probably used to label the book for a display. The second label is much smaller, is yellowed from age, and the back has patches of dried glue and paper where the label was glued to some surface and later removed. This label states: "This book decorated by Wilson Ornithologist."

The will and the labels attribute the decorations to Alexander Wilson, but these were written long after the decorations were drawn. However, the design of the decorations (Fig. 1) also supports the conclusion that Wilson was the calligrapher. The letters contain many curls from which sprout tiny, colored leaves. Among the curls and leaves are birds with multicolored bodies shaped like inverted tear drops (Fig. 1). The design resembles a traditional paisley print, a pattern that would have come easily to Alexander Wilson who was born in Paisley, Scotland, and worked as an apprentice, and later journeyman weaver from 1779–1794 (Hunter 1983).

The calligraphy also shows a strong German influence (Fig. 2, R. Mathiesen, A. Aninger, pers. comm.), which is not surprising, considering the strong Pennsylvania Dutch (German) presence in the Philadelphia area. Wilson lived with a Pennsylvania Dutch family during his years at



FIG. 2. The man's Hessian pigtail and clay pipe reflect the Pennsylvania Dutch influence. Note the patterned detail of the letters and the figures, also the leaf-like marks on the flourish encircling the rightmost bird. The "E" overlaps two lines of writing above the heading. The "P" and "L" overlap the line of writing below the heading. Newspaper clippings were glued into the book at a later date.

Milestown (Cantwell 1961), and his letters indicate that he had learned to read, write, and speak German during this period. He also taught penmanship, so that calligraphy was certainly known to him.

The decorated calligraphy of the arithmetic books (Figs. 1 and 3) is unique. It is not typical *fraktur*, the term generally applied to the decorative style developed by the Pennsylvania Germans during the latter part of the eighteenth and first half of the nineteenth centuries. Examination of over 900 photographs of *fraktur*, by over 300 artists, in the files of the Winterthur Museum, Wilmington, Delaware, and nearly 300 pieces from the Free Library of Philadelphia (Weiser 1976) produced nothing similar to the calligraphy of the arithmetic books. Of 275 *fraktur* photographs, 85 contain birds, but all are whole birds, none are bird heads, and none of the birds are based on the tear drop motif. Thus, the calligraphy of the arithmetic books, although strongly Germanic, is neither true *fraktur* nor traditional Pennsylvania Dutch. Its unique decorations suggest the abstract, curved shapes of the palmette motif in Paisley fabrics. The will and the labels point to Alexander Wilson as the artist and Wilson brought both the Germanic and Paisley influences to his position at Gray's Ferry school.

The problem with attributing the calligraphy to Alexander Wilson is that he became schoolmaster of the Gray's Ferry school attended by



FIG. 3. "Of Add(ition)" combines linked lettering decorated with birds, interior detail, large and small flourishes, and black, broken lettering.

Charles and William Wood on 1 March 1802, and all the calligraphy decorated with birds appears to precede that date. We believe that William and Charles Wood did attend the Gray's Ferry school, since a William Wood, presumably the father of William and Charles, is listed on the tax roles of the township from 1780 to after 1800 (J. T. Fry, pers. comm.). Hence there is little chance that the Wood brothers attended the Milestown school where Wilson taught from 1796 to 1801 (Cantwell 1961, Hunter 1983).

Could Wilson have done the calligraphy at a later date? All the calligraphy was done after the lesson on the page had been completed. In all cases where the calligraphy contacts the writing above or below it, the calligraphy is uppermost (Fig. 2), and, thus, was written after the lesson. It was common practice for a schoolmaster or his assistant to reward excellent work by adding decorations. Thus the calligraphy may have been added the same day as the lesson was completed, or shortly thereafter (R. Mathiesen, pers. comm.). However, Wilson could have added the calligraphy at a much later date, after he became schoolmaster at Gray's Ferry school where the Wood brothers wrote their arithmetic books.

One damning piece of evidence makes this unlikely. One decoration is dated "13th Oct. 1800" (Fig. 4), and this is more than sixteen months before Wilson became schoolmaster. Possibly this calligraphy, which is



FIG. 4. “Examples 13th Oct. 1800.” Though unadorned “Examples” shows the skillful control of line width and curvature that characterizes all the calligraphy. The interlocking letters and the flourishes are characteristic of fraktur, but are skillfully done. By contrast the date is relatively sloppy. The lines have uneven transitions of width, the “o” is not round and the zeros are not oval.

not decorated with birds, was done by someone else and Wilson later penned the bird-decorated calligraphy. We find this unlikely since all the calligraphy appears to be in the same hand. Another possibility is that the calligraphy and the date were written by different persons at different times. Whereas “Examples” (Fig. 4), though undecorated, is skillfully done, the date is less so. As the lines of the date turn around the letters and numbers the width changes unevenly. The capital “O” is not round, and its flourish crosses the top of the letter. The zeros are not oval. These differences in quality could indicate that a student dated the lesson and a teacher decorated it at a later time. We conclude that the decorated calligraphy of the arithmetic books attributed to Alexander Wilson by notes and in the bequest may not have been done by him. However, if the calligraphy and decorations were done by Alexander Wilson, they indicate a strong interest in birds prior to his association with William Bartram and prior to his conceiving the “American Ornithology.” Furthermore, the decorations indicate a very considerable artistic talent, which would help account for Wilson’s phenomenal development as an artist. Prior to 1803, he had no artistic training. From 1803 until his death in 1813, Wilson’s only teacher and critic was William Bartram, yet he produced 316 portraits of birds, some of which are outstanding (Abbott 1943). However, the authorship of the bird-decorated calligraphy remains a fascinating enigma.

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