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# Max Ernst's *Woman, Old Man, and Flower* (1923–24): Four Paintings in One Revealed by Technical Imaging

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**Abstract:** Examining the painting *Woman, Old Man, and Flower* (1923–24) by Max Ernst with macro-X-ray fluorescence scanning (MA-XRF), X-ray radiography (XRR) as well as photography under ultraviolet (UVF), infrared reflected (IRR) and transmitted (IRT) illumination revealed the existence and sequence of three distinct paintings concealed under the final composition. The study confirmed a known and previously documented intermediate composition and uncovered two additional states: a very first state exposed by XRR, and a third state revealed in the elemental distribution maps obtained by MA-XRF. The complimentary images document the insertion, mutation, and concealing of several human and anthropomorphic subjects across the four layers, expanding our understanding of the painting and of Ernst's collage-like pictorial development. In addition, a list of pigments is proposed based on the elemental information provided by MA-XRF, contributing to the technical literature devoted to the materials of Ernst's paintings during the transitional period between Dada and Surrealism.



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**Keywords:** Max Ernst; hidden paintings; technical imaging; macro-X-ray fluorescence mapping; noninvasive pigment identification

## 1. Introduction

Revelations of paintings hidden under other paintings always captivate the curiosity and imagination of scholars, conservators and general public alike [1–4]. Technical imaging has played a crucial role in these discoveries, from the more conventional techniques such as X-ray radiography and photography under raking light, ultraviolet or infrared illumination, to the more recently developed X-ray fluorescence and diffraction macroscale mapping or the hyperspectral imaging in the ultraviolet, visible and infrared spectral ranges [5–11]. Used in combination, these techniques provide a wealth of information on the artist process and materials, and on the history and condition of the object. Moreover, the scientific images created are visually compelling and easily interpreted by specialists in the cultural heritage field and by a broader audience. Most of these reports however refer to the reuse of painted canvases by artists, or changes in the composition by repositioning or effacing. The case reported here however is to the best of our knowledge, the first to report the presence of four distinct compositions layered in one single painting.

Max Ernst's *Woman, Old Man, and Flower* (1923–24) has been in the collection of The Museum of Modern Art (MoMA) since 1937 (Figure 1a). Ernst started the painting in Paris in 1923 soon after he had moved there from Germany, and completed it in Eaubonne in 1924, while living there with Paul and Gala Éluard [12]. A photograph of an earlier state of the painting (Figure 1b) was published in the *Dictionnaire Abrégé du Surréalisme* (1938) and recorded as such in the artist's catalogue raisonné [13]. An additional state was suggested by Jim Coddington and Suzanne Siano in 2000 after they examined the painting under infrared reflected and transmitted light [14].



**Figure 1.** (a) Max Ernst's *Woman, Old Man, and Flower (Weib, Greis und Blume)*, 1923–24, Oil on canvas, 96.5 × 130.2 cm, The Museum of Modern Art, New York. Purchase, 1937 © 2021 Artists Rights Society (ARS), New York/ADAGP, Paris. All reproductions of this work are excluded from the CC: BY License; (b) Max Ernst's *Weibs, Greis und Blume I*, 1923, reproduced as a “Tableau détruit” (Destroyed painting) in *Dictionnaire abrégé du Surréalisme* (1938) [13]; technical imaging of the painting including (c) XRR, (d) IRT, (e) IRR, (f) UVF and (g) zinc (Zn), (h) iron (Fe) distribution maps obtained by MA-XRF analysis © 2021 The Museum of Modern Art, New York.

The painting was included in a recent exhibition at MoMA: *Max Ernst: Beyond Painting* (2017–2018) organized by Anne Umland and Starr Figura with Talia Kwartler. It was brought to the conservation studio in advance of the show for additional technical examination with macro-X-ray fluorescence scanning (MA-XRF), X-ray radiography (XRR) and photography under ultraviolet (UVF) photography. The findings are summarized in this paper with an emphasis on the mutation of the different compositional elements across the four stages of the painting: the documented earlier state, two newly confirmed intermediate states, and the final state. A list of pigments is also proposed based on MA-XRF data, contributing depth to the limited body of scientific and technical literature devoted to the materials of Ernst's paintings [15–17].

## 2. Methods

MA-XRF scanning was carried out with the M6 Jetstream from Bruker AXS. The instrument has a Rh target microfocus X-ray tube (30 W, 50 kV maximum voltage, 0.6 mA maximum current) and a 30 mm<sup>2</sup> X-Flash silicon drift detector (energy resolution < 145 eV at Mn-K<sub>α</sub>) [18]. The painting (96.5 × 130.2 cm) was scanned from the recto in four sections and from the verso in two smaller sections (10 × 10 cm) at 50 kV and 0.6 mA and using a 0.55 mm step size, 0.4 mm spot size and a 5 ms/pixel dwell time. The MA-XRF data was collected and processed with the Bruker M6 Jetstream software package (v. 1.5.1.6) to obtain elemental distribution maps using the built-in fast deconvolution algorithm. The data was further processed with the SOLO + MIA software from Eigenvector Research Inc. (version 8.9.1) and using a Multivariate Curve Resolution—Alternating Least Squares (MCR-ALS) approach to extract the pigment distribution maps and their signature spectra [19]. The data cubes were compressed to the 1–14 keV range with a 50 eV spectral resolution followed by Poisson scaling, and MCR-ALS analysis was carried using non-negative constraints for both concentration profiles and signature spectra, and with contrast enhancement for the concentration. The element and pigment distribution maps were stitched together using GIMP (v. 2.8.10).

XRR was performed with a 200 kV Portable Industrial NDT X-Ray Imaging System (35 kV, 4.5 mA, 2.5 m distance and 190 s exposure). The radiographic image was recorded with a CareStream INDUSTREX XL Blue Digital Imaging Plate (36 × 43 cm), which was scanned with a CareStream HPX-1 Computerized Radiography (CR) System. Images were visualized and processed using the Carestream Industrex Digital Viewing Software.

The UVF imaging was carried out with a Canon EOS 5D Mark II (Zeiss Makro-Planar T\* 2/50 ZE lens). The standard infrared filter was replaced by a 2E and a Peca #918 UV blocking filters. UV illumination was provided by two Altman Spectra Cyc UV lamps, a 100 Watt cyclorama/wall wash luminaires with high output 365 nm UV LED emitters. The camera was calibrated with an X-rite Color Checker Passport and a UV Innovation Target-UV™. Infrared reflected and transmitted photography were done using an Inframetrics INFCAM camera equipped with a calcium fluoride (CaF<sub>2</sub>) lens with a 1.1 to 5 mm range and a 256 × 256 PtSi array [14].

## 3. Results

Figure 1 compares the images of the current and known earlier state of *Woman, Old Man, and Flower* with the images of the painting obtained by normal, IRR, IRT and UVF photography, XRR and MA-XRF. The technical examination confirms and documents the known earlier state, while providing evidence of two additional states: a very first composition visible in the X-ray image, and a third composition most noticeable in some of the elemental distribution maps obtained by MA-XRF. A more continuous evolution of the composition emerges, as the images help retrace when figures and other compositional elements were introduced, changed, and painted over across the four distinct yet interconnected stages.

### 3.1. A New First State

Due to the penetrative nature of X-rays, the information provided by XRR and MA-XRF relates not only to the material on the surface, but also to that from the underlayers, down to the pictorial support, depending on the radio opacity of the paints. The image revealed in the radiography of *Woman, Old Man, and Flower* (Figure 1c) is related to the published earlier state to some degree (Figure 1b), but it is also decidedly different, implying an even earlier stage or first state of the painting. The composition in this newly discovered layer depicts three male and two female figures. A mustached, older man at center-left is seated with splayed-out, footless legs, holding a woman in his arms (Figure 2a). Scholars have stated the resemblance between this recurrent older male figure, also present in *Pietà or Revolution by Night* (1923), and the artist's father [20]. The small female figure resting on his forearm, the "woman", evokes Diego Velázquez' *Toilet of Venus* [13,20]. A male figure with a gaunt face is present more to the center of the image (Figure 3a) possibly wearing a hat. A third man with a twisted mustache, suit, bowtie, and clasped hands is seen on the right side of the composition (Figure 4a). He is also visible in the IRT (Figure 4b). A second female figure appears along the bottom of the canvas (Figure 5a), partially cropped and in a prostrate position, her feet resting on the seat of an armchair. The radiography shows very limited detail in the background except for the outline of mountains in the horizon (Figure 6a) and highlights of clouds that relate to the final composition.

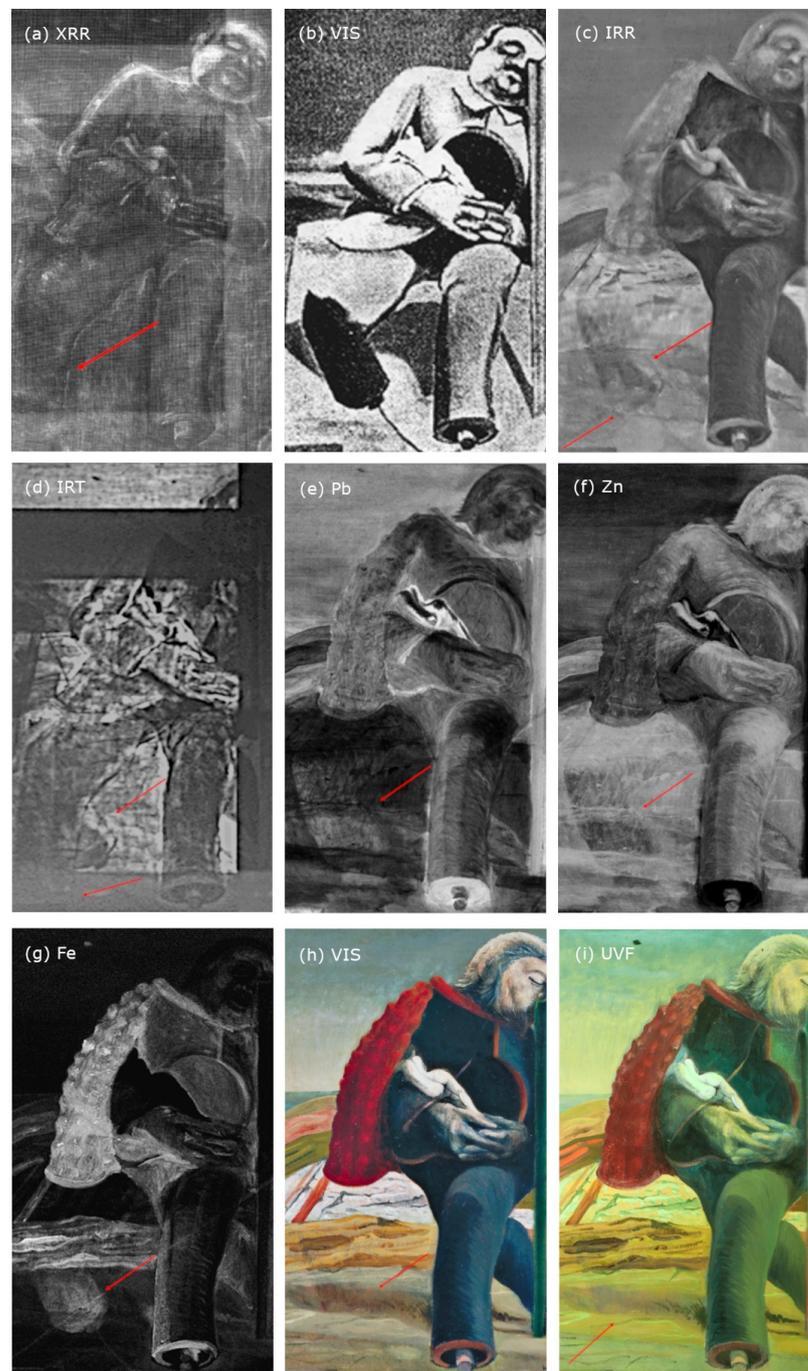
### 3.2. Second State

The layer historically documented as the first state (Figure 1b) and confirmed by the different imaging techniques is actually an intermediary second state, in which Ernst retained some of the compositional elements from the state below. The older man is still present but his right leg is bent further back and connected to the other leg by a string, while his head rests on a stake planted in the landscape and his left eye is no longer visible (Figure 2b). Evidence of the covered leg is clearly visible in the lead (Pb), zinc (Zn) and iron (Fe) distribution maps obtained by MA-XRF (Figure 2e–g). Ernst transformed the other two men as well, but into more abstract figures. He replaced the gaunt-faced man in the middle with a rotund figure that appears made of bricks with a spinning top-like lower body and his head between its hands (Figure 3b), a subject resembling that found in the contemporaneous painting *Ubu Emperor* (1923). The hands are visible in the XRR (Figure 3a) suggesting Ernst used a lead white paint. This feature is more difficult to discern in the lead white map (Figure 3g). MA-XRF was carried out at a lower energy and is thus less penetrative than XRR. Evidence of the *Ubu* body on the other hand appear clearly in the Fe map (Figure 3e) suggesting he might have used an iron oxide-based pigment, possibly red as in *Ubu Emperor*. Details of the head and body are also clearly visible in the infrared images (Figure 3c,d) and even in the final composition (Figure 3f). The elegant mustached man on the right side of the composition was replaced by a masculine figure wearing a cape without arms and a hollow body (Figure 4c). The abstracted figure's head is covered with an inverted ceramic-like vessel, its legs overlap the man painted below and so does its bowtie (Figure 4a). Ernst also preserved the background, with a gradient sky and mountains along the horizon painted in a light color containing lead white and thus clearly visible in the radiography and in the Pb map (Figure 6a,c). In contrast to the male subjects, Ernst left his two female figures unchanged in this second state.

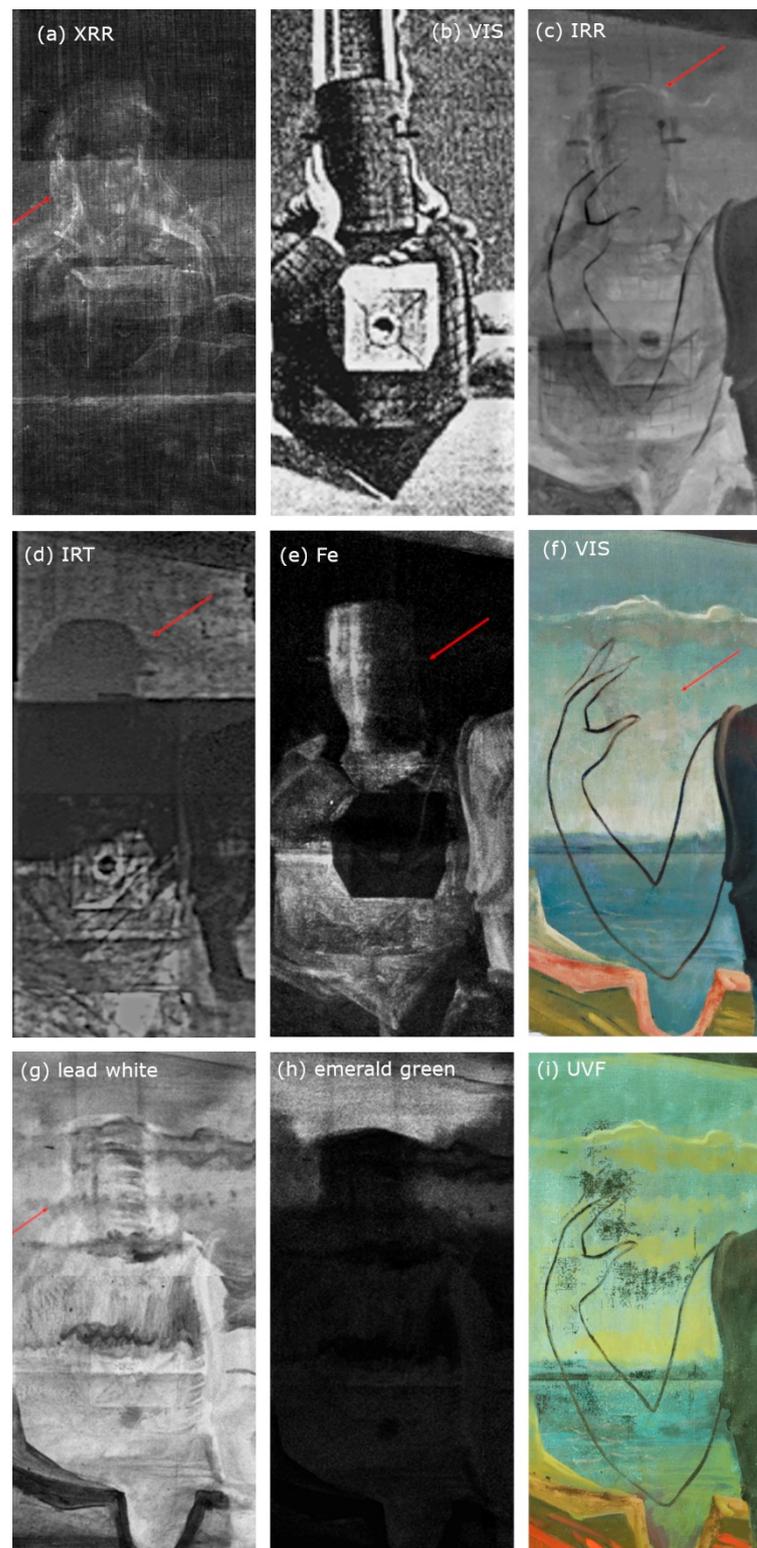
### 3.3. Third State

Coddington and Siano had already hinted at the existence of this intermediate state based on the IRR image (Figure 1e) [14]. Features that do not overlap with the mustached man on the right seen in the first state nor with the figure hooded in a cape in the second state become clearly apparent in the MA-XRF mapping (Figure 1g,h) confirming a third state. A woman appears, seated in profile on a chair, wearing a pleated dress with her arms lifted in front of her face and her hair in a bun. The scale of this figure is disproportionate in comparison to the older man on the left, and Ernst positioned her at the edge of the

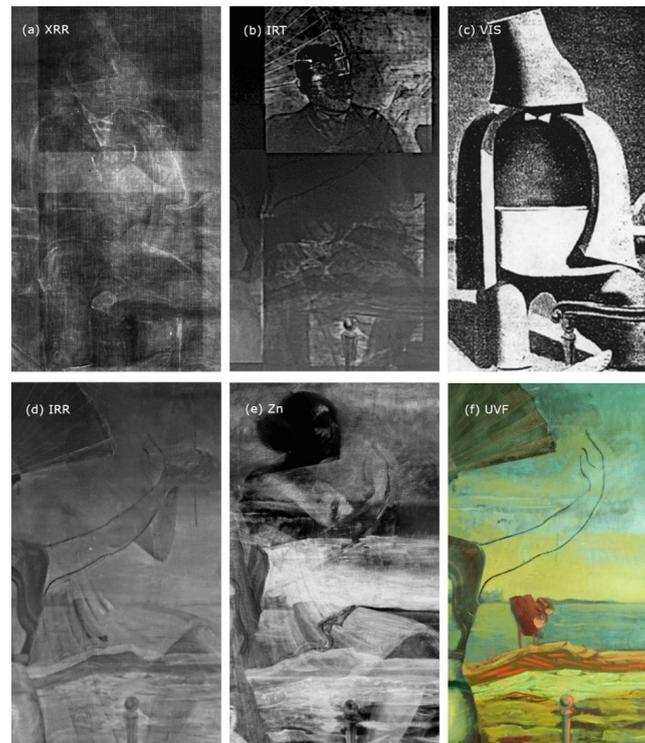
painting and cropped her feet. Her legs were painted with a zinc white based paint (see Zn map in Figure 5d) over the extended leg of the female figure at bottom edge of the painting seen in state one and two. He also introduced more detail in the mountains in the background and in the sky, with a sun peeking through clouds, all clearly visible in the Zn and Pb maps (Figure 6c,d).



**Figure 2.** Detail of older man holding the small female figure and his transformation across the four stages of the painting revealed by the different examination methods: (a) XRR, (b) VIS for earlier state (c) IRR, (d) IRT, (e–g) MA-XRF, (h) VIS for final state (© 2021 Artists Rights Society (ARS), New York/ADAGP, Paris. All reproductions of this work are excluded from the CC: BY License), and (i) UVF. The arrows are pointing to the splayed out (XRR, IRT) and slightly bent back left leg (XRR, IRT, IRR, UVF, VIS and Pb, Zn, Fe maps).



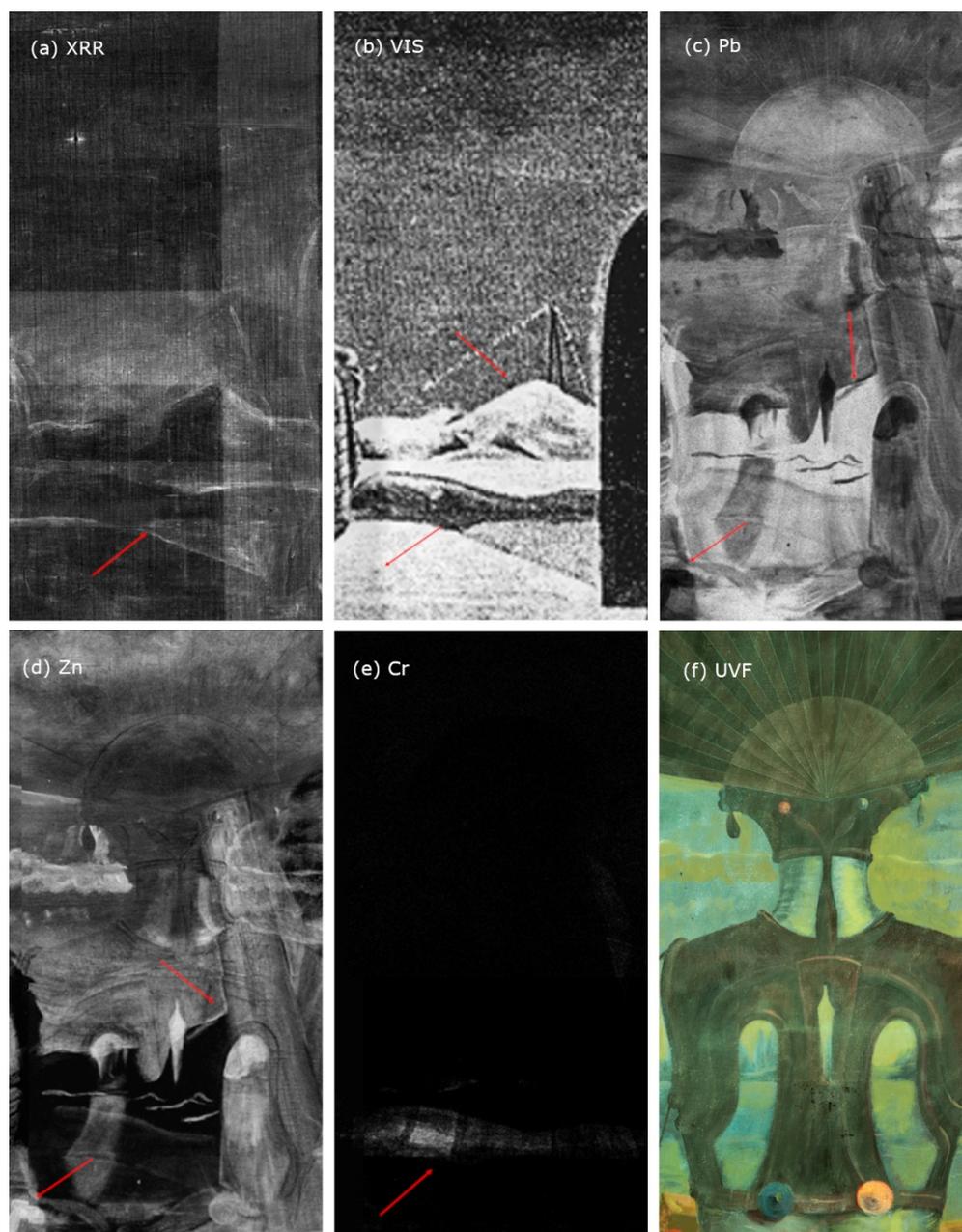
**Figure 3.** Detail of man in the center and its transformation into the Ubu character, and subsequent deletion examined with the different techniques: (a) XRR, (b) VIS for earlier state, (c) IRR, (d) IRT, (e,g,h) MA-XRF, (f) VIS for final state (© 2021 Artists Rights Society (ARS), New York / ADAGP, Paris. All reproductions of this work are excluded from the CC: BY License) and (i) UVF. The arrows mark the hands possibly holding the face and the head of Ubu (XRR), possible evidence of a bowler hat (IRT), evidence of Ubu's tower head (IRR, IRT, Fe map) and evidence of the overpainted Ubu head in the final composition (VIS).



**Figure 4.** Detail of man figure on the right side of the painting examined with the different techniques: (a) XRR, (b) IRT, (c) VIS for earlier state, (d) IRR, (e) MA-XRF and (f) UVF, and its transformation into a figure with a cape, then a seated woman and ultimately deleted. The arrows indicate the evidence of the inverted ceramic-like vessel (XRR) and seated woman's arms, leg and dress (IRT, IRR and Zn map).



**Figure 5.** Detail of female figure at the bottom of the composition examined with the different techniques: (a) XRR, (b) VIS for earlier state, (c,d) MA-XRF and (e) UVF. Arrows point to the upper torso of the female figure (XRR) and leg of the man on the right side of the composition (XRR, UVF).



**Figure 6.** Detail of the horizon line examined with the different techniques: (a) XRR, (b) VIS for earlier state, (c–e) MA-XRF and (f) UVF. Arrows point to the mountains in the landscape.

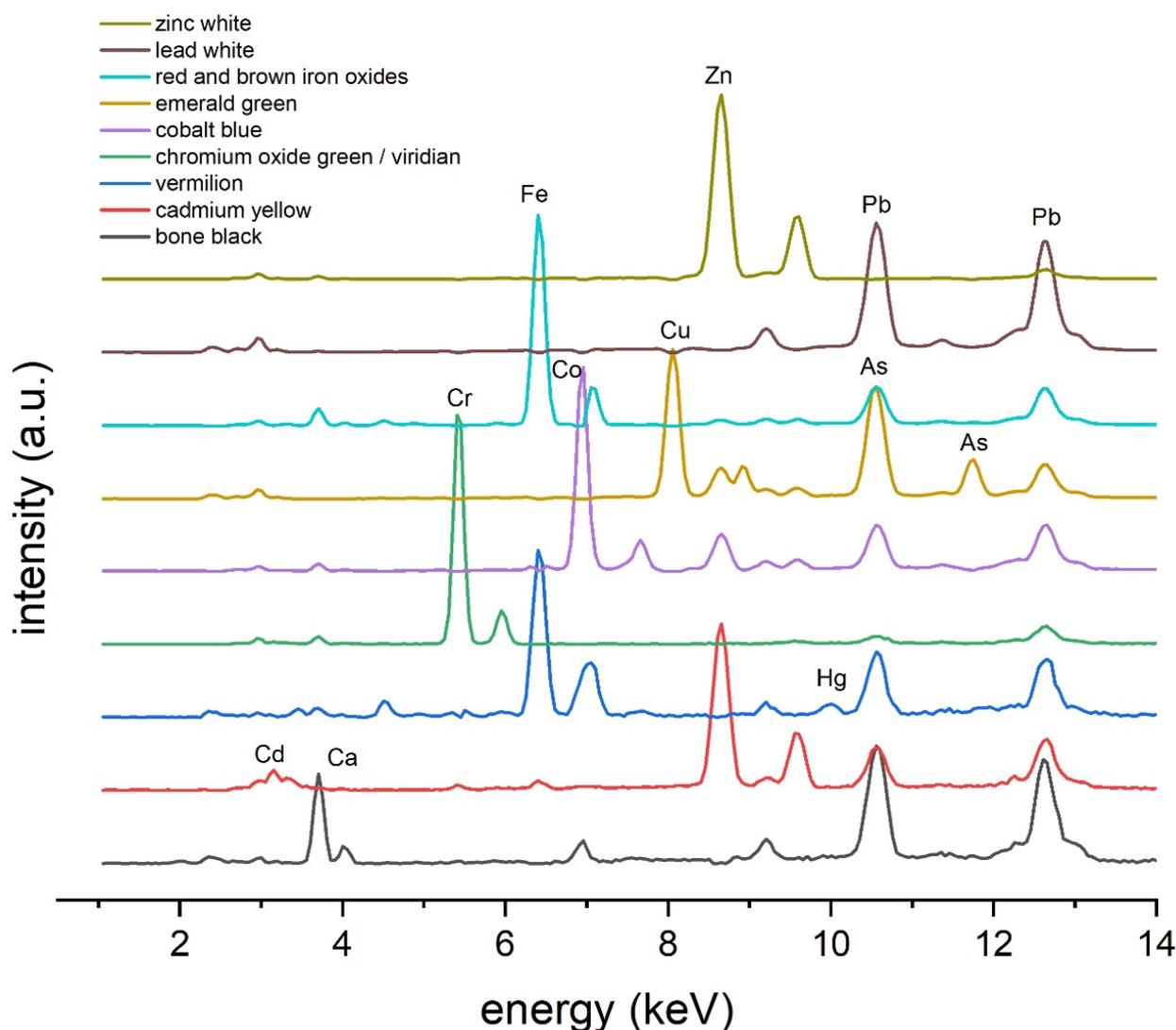
### 3.4. Fourth and Final State

In the final state (Figure 1a), Ernst introduced a mysterious and partially transparent figure presumably the “flower” in the title: an androgynous subject in the foreground facing the landscape with their back to the viewer. The lower torso and legs of the flower figure are muscular, while their upper body is composed of a semi-transparent armored corset and the outline of arms. The head is replaced by a fan, an element that Ernst had used in earlier collages, including *The Chinese Nightingale* (1920) and *Santa Conversazione* (1921). The fan is thinly painted over the sky and the mountains, as confirmed by the Pb and Zn distribution maps (Figure 6c,d). Ernst reworked the sky extensively to conceal the seated woman seen in the previous state using a light blue paint rich in zinc white (see Zn map in Figure 4e) that fluoresces strongly under UV (Figure 4f). Nevertheless, the seated woman is still detected in IRR (Figure 4d) and the flower’s extended right arm

appears to retrace the right arm of the woman below except for the position of the traced hand (Figure 4d,e). The red tubular forms below the right arm of the flower figure are, in fact, the remainder of the seated woman's dress, which Ernst incorporated into the final composition (Figure 4e,f). He also repainted the lower part of the composition where the figures initially stood, replacing the ground by a shore more akin to a colorful geographical cross section found in his collages from this period like *Stratified Rocks* (1920). Ernst also transformed the old man on the left into a figure with a furry face who, although now in profile, retains the outline of an eye that echoes of those of the original face (Figure 2a). Moreover, this male figure is now standing, with his right leg crossed behind the left one. He also wears a cape that covers his right arm and the elbow that is still clearly visible in IRT (Figure 2d). The small female figure reclining in the old man's arms is the only compositional element that curiously remained unaltered throughout the four stages of the painting.

### 3.5. Pigment Identification

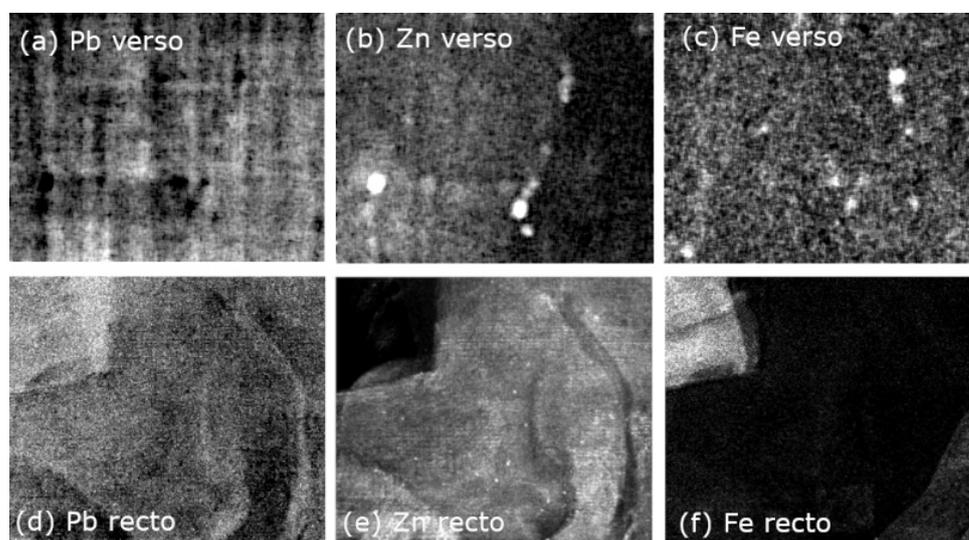
MA-XRF scanning can provide meaningful preliminary information about an artist's palette when sampling is not possible or desirable. The pigments present can be inferred based on the elements detected and their distribution, even though it becomes more challenging for the under layers when the paint color is not visible. Analysis of the average and maximum pixel intensity spectra for the four MA-XRF data cubes corresponding to the four areas scanned, indicates the presence of the following chemical elements: aluminum (Al), silicon (Si), phosphorus (P), sulfur (S), potassium (K), calcium (Ca), titanium (Ti), chromium (Cr), manganese (Mn), iron (Fe), cobalt (Co), copper (Cu), zinc (Zn), arsenic (As), cadmium (Cd), selenium (Se), tin (Sn), barium (Ba), mercury (Hg) and lead (Pb) (the distribution maps of the most abundant elements are provided in Figure S1 in the Supplemental Material). Only a few of these elements can be attributed to a single pigment, like for example Hg to vermilion or Se to cadmium red, while the remaining elements can be present in one or more pigments, for example Cd can be present as cadmium yellow as well as cadmium red. Moreover, it can be difficult to distinguish and map the contribution of chemical elements with overlapping features in the X-ray fluorescence spectra like for example K (K lines) and Cd (L lines). Instead of mapping individual elements, it can be more informative to map elements that occur simultaneously as they pertain to the same pigment or paint [19,21]. This was achieved by processing the MA-XRF data using an MCR-ALS approach to extract components more directly representative of the artist palette. Ten distinct components were extracted representing a total of eleven different pigments. The distribution maps of the most representative pigments are provided in the supplemental material (Figure S2) and their signature spectra are provided in Figure 7. Lead is present in all the spectra as it pertains mostly to the lead white in the priming layer and could not be extracted as a separate component. Additionally, the contribution of pigments that were used in only a few passages in the hidden layers, namely vermilion and possibly cerulean blue, could not be extracted separately. In summary, the analysis of the MA-XRF data indicates that Ernst's overall palette was composed of at least twelve pigments based on the presence of key chemical elements: lead white (Pb), zinc white (Zn), cadmium yellow (Cd), cadmium red (Cd, Se), red and brown iron oxides (Al, Si, K, Ti, Mn, Fe), bone black (P, Ca), emerald green (Cu, As), chromium oxide green and/or viridian (Cr), vermilion (Hg), cobalt blue (Al, Co) and possibly cerulean blue (Co, Sn). The paints do not seem to contain significant amounts of extenders and are seldom mixed. Previous studies by Joyce Townsend and Annette King on paintings by Ernst from the same period concluded that he used high quality artists' oil paints [16]. The palette is also very similar to the one he used for other works in the 1920s [16,17].



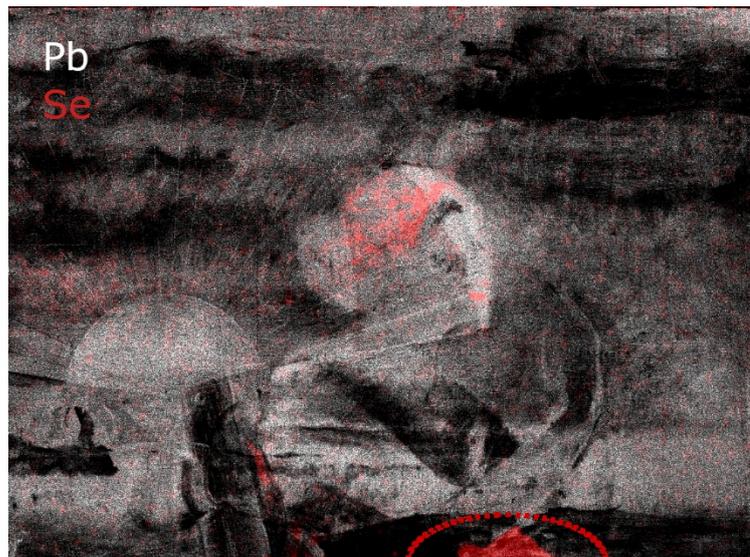
**Figure 7.** MCR-ALS loadings extracted from the MA-XRF data cubes and representing the signature spectra of nine distinct pigments.

Examination of the Pb and Zn distribution across the four scanned areas indicates that these elements are present in significant amounts throughout the whole painting and therefore present in the ground layer in the form of lead white ( $2\text{PbCO}_3 \cdot \text{Pb}(\text{OH})_2$ ) and zinc white ( $\text{ZnO}$ ). The Pb map obtained from the verso (Figure 8a) reproduces the canvas weave pattern, while the small defects in the canvas are filled with a Zn based painting containing also Ca and Fe (Figure 8b,c). This suggests a double priming, first a layer of lead white, conceivably a commercially applied ground as proposed for other contemporaneous paintings by Ernst [16], and a second layer applied possibly by the artist, containing zinc white, calcite or gypsum, and tinted with an iron oxide-based pigment, an approach that has been reported for his later painting *Forest and Dove* (1927) [16]. Lead white and zinc white are also part of the palette. Ernst painted the woman resting in the old man's arms using lead white with highlights in zinc white. The distinction is clear in the Pb and Zn maps (Figure 2e,f) but also under UV illumination (Figure 2i) with the strong yellowish green fluorescence of zinc white contrasting with the bluish fluorescence of lead white [22]. The cadmium yellow used by Ernst also fluoresces bright red under UV [22] (Figure 1f) and appears in the stake on which the head of the male figure rests, the yellow button on the flower figure's torso, the yellow inside of the red tubes, and in the green-yellow stones in the coast line. Cadmium red is also present (Figure S2) and can be detected through

the presence of Se. It is mostly present in the hair and dress of the seated woman in the third state (Figure 9) but also in the torso of the reclining woman in the first state and in highlights of the red cape on the top layer. The Fe distribution map (Figure 1h) reflects the presence of iron oxide red and brown pigments in the final composition, especially in the fan and torso of the flower figure, but also in the figures from layers below. The abundance of Fe in the pants of the male figure is related to their original brown paint still visible under the thinly painted blue top layer. A red iron oxide paint was used for his cape and pants trimming and possibly in the body of the *Ubu* character. The Fe map was also key to identifying the seated woman in the third state with iron oxide pigments present in her red dress, in flesh tones of her arms, face, legs, and lips. When present as a red, iron oxide contains a small amount of vermilion, detected through the presence of Hg, and Ba, possibly present as barium sulfate. Ernst also used cobalt blue ( $\text{CoO}\cdot\text{Al}_2\text{O}_3$ ) (see Co and cobalt blue maps in Figures S1 and S2) in the hair and fur-like face of the old man, in the upper sky, in the water and in mountains in the background. He used emerald green ( $\text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2\cdot 3\text{Cu}(\text{AsO}_2)_2$ ) (see Cu and emerald green map in Figures S1 and S2) in the mid-section of the sky, in the green belt of the central figure of the final composition, and in the right leg of the old man. Chromium oxide-based green appears to be present in two different paints (Cr map in Figure S1): a bright olive green, possibly ( $\text{Cr}_2\text{O}_3$ ) in the stake planted in the ground and belt of the flower, as well as a bluish green, possibly viridian ( $\text{Cr}_2\text{O}_3\cdot 2\text{H}_2\text{O}$ ) which he also used in *Celebes* (1921) [16]. Ernst used this color extensively in the male figure's pants and jacket, and in the body of water behind him. Bone black (see Ca and bone black maps in Figures S1 and S2) was found in the black paint that Ernst used to outline the arms of the figure in the foreground, in the old man's hollow chest and mixed with the brown in the torso and fan of the flower figure. Cerulean blue ( $\text{CoO}\cdot n\text{SnO}_2$ ) appears to have been used exclusively in parts of the head and body of the *Ubu* character (see cobalt blue map in Figure S2) where iron oxide was also mapped. The two pigments might be mixed or layered.



**Figure 8.** Elemental distribution maps obtained by MA-XRF for Pb, Zn and Fe from the verso ( $72 \times 57$  mm) and recto of the painting ( $150 \times 140$  mm) (detail of two different areas).



**Figure 9.** Elemental distribution of Se (in red) overlapped with the Pb (white) for the seated woman. The space between her elbows matches the spaces between the elbows of the mustached man in the first stage.

#### 4. Conclusions

The use of complementary imaging techniques made it possible to visualize the known earlier state of *Woman, Old Man, and Flower*, but also to discover two additional states, a first state visible only in the X-radiograph, and an intermediate third state fully revealed by MA-XRF. The visualization of these underlying layers provides a better understanding of the way Max Ernst reworked this painting over four distinct, though interconnected, compositions, through a complex layering, morphing and covering of human and anthropomorphic figures and other compositional elements. It also revealed that his palette at that moment was made up of lead white, zinc white, bone black, emerald green, cobalt blue, chromium oxide green, iron oxide red and brown, cadmium yellow, cadmium red, vermilion and cerulean blue. These new insights into Ernst's pigments and painterly approach—particularly during this transitional moment between Dada and Surrealism—will make it easier for future scholarship to consider how his innovative and unusual pictorial technique developed across the broad arc of his career.

**Supplementary Materials:** The following are available online at <https://www.mdpi.com/article/10.3390/heritage4030125/s1>.

**Author Contributions:** A.M. carried the MA-XRF examination and analysis of the data. E.D. carried out the XRR and UVF imaging. A.M. drafted the manuscript and E.D. and T.K. provided significant input through edits and revisions. All authors have read and agreed to the published version of the manuscript.

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**Conflicts of Interest:** The authors declare that they have no competing interests.

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