Digital reconstructions from spectral data: The collection and interpretation of synchrotron macro XRF data from oil paintings

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Synchrotron based technologies for measuring x-ray fluorescence data from artwork surfaces pose challenges in interpretation of large and complex data sets. In particular signal from multiple image layers poses particular problems. The ability to collect data has become financially viable, efficient and reliable, however the challenge is increasingly how to understand and make the best use of collected data.

This presentation will discuss the challenges and current activities being undertaken to enable effective use of synchrotron macro XRF data sets. Scans of relatively simple systems can reveal in strong contrast lower image layers. By making judgments about elemental ratio and co-location it has been possible to develop custom software that allows a false colour representation of an underlying image. Possible pigment candidates can be calculated and virtually mixed to give a plausible representation of an obscured artwork. However simple image extraction is highly dependent on the underlying image generating strong signal in proportion to an upper obscuring layer. A common situation is a data set of complex spectral signal from upper and lower image layers, including features where upper and lower layers contain the same element. Current work to use computational methods to recreate underlying images by estimating individual pixel level attenuation and using adjacent pixel signal for calculating a plausible unobscured signal will be described. These calculation methods are showing progress in separating otherwise indecipherable data sets.

Recent experimental methodology improvements and experiment outcomes will be presented, and the possible application of data sets to practical conservation, authentication and cultural understanding of artworks will be discussed. The considerable public interest in the outcome of these types of experiments means that improvement in the technology is in high demand. Currently our ability to reliably collect data exceeded our ability to make meaningful conclusions from it, and this represents one of the largest challenges and opportunities from this area of research.