Achieving colour-accurate images: challenges and solutions

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Colour is a powerful communication element of graffiti and many other forms of cultural heritage. This importance of colour notwithstanding, the documentation of cultural heritage typically only focuses on the geometrical aspects and seldom on the spectral characteristics of the object. This is party because colour and the science of colour – called colourimetry – are non-trivial. In addition, it remains tough to capture accurate colour data with standard digital cameras, certainly when the illumination conditions are constantly varying, like in outdoor photography. As a result, not many research teams have furthered accurate colour data acquisition with regular photo cameras for spectrally documenting cultural heritage. Given the importance of colour in graffiti, obtaining correct image colours is essential from an analytical and digital preservation point of view. As such, the acquisition of colour-accurate digital images is one of the primary research topics in the international graffiti project INDIGO.

The problem with colour is that it is a matter of perception. In other words: colour is subjective. In addition, the colour data registered by consumer digital cameras (usually in the well-known RGB colour model) are not strictly colourimetric. The camera's built-in imaging sensor does not satisfy the Luther-Ives condition, which means that its three spectral sensitivity curves (one for Red, one for Green and one for Blue) do not entirely mimic those of the human eye. Moreover, these spectral curves are device-dependent; in other words: they differ from camera to camera. Finally, every camera brand processes the images in their proprietary way to yield a pleasing photograph, not a colour-accurate one.

A digital camera is thus not suitable for rigorous colour determination without any colour correction procedure. Due to all the challenges involved, INDIGO has set itself two aims: 1) to develop a rigorous colourimetric image processing workflow and 2) to implement it into an intuitive, user-friendly and open-source toolbox. This toolbox will provide any user complete control when processing images into colour-accurate products. At the same time, users can also learn about each processing step. We are confident that this research will benefit future graffiti and other heritage documentation projects, as well as any application where digital cameras play a fundamental role in acquiring correct colour values.