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THE USE OF COLOUR MEASUREMENT IN RESEARCH INTO ART HERITAGE

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ABSTRACT

This investigation combines the use of the scientific method of measuring colour with the physical representation of the human perception of a particular colour within the Munsell colour-notation system. The aim is to assess and compare the appearance and use of that colour in two heritage sites. The research is grounded in the case-study of two seventeenth century post-Byzantine churches in Arbanassi, Bulgaria. Previous research on the site had been limited to verbal description of the colours used in the church interiors. This work employs the correlation between the colorimetric measurements collected from green-coloured sections of wall decoration and the Munsell colour-notation system to allow a reasonably accurate translation of colorimetric data for the purpose of art historical investigation. The closest colorimetric (CIEDE2000) match was selected.

INTRODUCTION

The town of Arbanassi, situated in the middle of Bulgaria, contains a large selection of domestic and ecclesiastical architecture built and decorated in the seventeenth century, thus presenting the opportunity for the assessment and the comparison of the use of architectural colour in that era. (Haritonov, Chohadžieva and Rutževa 2003). During the late 1970s and the 1980s the wall paintings in the examined churches were cleaned, which revealed the original colours of the paintings. (Prashkov 1979 and 1985) Consequent implementation of a conservation programme, including omission of direct sunlight and control of humidity and air pollution, ensured the subsequent maintenance of the coloured surfaces in good condition. Two scenes from the wall paintings of the churches of the Nativity of Christ and of St Atanass are shown in Figures 1 and 2.

Figure 1 (left). Church of the Nativity of Christ, Arbanassi, Bulgaria: Nave.
Figure 2 (right). Church of St Atanass, Arbanassi, Bulgaria: Nave.

From an art historical point of view, the use of colour is of considerable interest because colour is one of the main elements in the construction of any decorative composition, and it may even mark a symbolic significance that is expected to be deciphered by an informed viewer. (Gage 1999) There is a relatively frequent use of green in the iconographic tradition of the Eastern Church (Sendler 1999). In both the examined churches the colour green can be found in the lower half of the background to the images which, within the compositional context, directly refers to the use of the word 'green' in the Scriptures, 'yârâq' in Hebrew, as the colour of vegetation (Jeremiah 17:8; Isaiah 57:5; Psalms 37:35).

Previous research on the two churches had been limited to the traditional and meticulous but subjective assessment and verbal description of the colours used in their interiors. In the monograph on the Church of the Nativity of Christ colours are mentioned only in a brief indicative list of the generic names (red, blue, green, and so on). (Prashkov, 1979) Some remarks on colour can also be found in the iconographic and stylistic characteristic of the wall decoration in the interior of the Church of St Atanass. (Rutževa, 2005) In the latter, evocative and emotionally charged language is used to describe the appearance of a colour in an attempt to introduce a discussion on the style and psychology of the colours used in the wall paintings. However, no matter how perceptive, such an account of the pictorial colours is still no more than a personal observation of those colours. This inevitably introduces the perceptional deception of one's observation into the description of colours, due to the complexity of the processes by which the intricate interaction between light, the eye and the brain result in the recognition of colour (Lamb and Bourriau 1995; Gregory 1998). Moreover, as personal perception is historically and socially constructed, it is debatable whether the psychological make-up of the painter and the beholder in the seventeenth century would be similar to that of an art historian writing at the end of the twentieth century. Finally, verbal description of colour is far from unambiguous.

By contrast, the use of colour measurement can provide an unambiguous description, but one which provides an abstract concept of colour, which may be an alien form of representation when used in discussions of an artifact in an art historical context. The possibility of employing a physical colour system such as the Munsell system in the present research permits the making of the transition between conceptual and visual colour and at the same time avoids the loss of the necessary precise notation. That loss would have inhibited accurate communication of the experienced colour (Berns 2000). The availability of computational methods allows a reasonably accurate translation of colorimetric data into Munsell notation for the purpose of comparative art historical investigation into the appearance of colour and its use within a number of heritage sites. This is the subject of the paper presented here as part of ongoing research on the colours employed in the wall paintings of the churches of the Nativity of Christ and St Atanass (Tantcheva et al, 2008).

METHOD

Before taking the measurements the coloured surfaces were cleaned from dust and any loose particles by using a soft brush and hand-held pump. For the collection of the colorimetric data we employed a hand-held Minolta CM-2600d spectrophotometer (8mm measurement area). All data were processed in the Colour Measurement Laboratory at the University of Leeds. It provided spectral reflectance factors for each sample (these were averaged from 16

measurements) at intervals of 10nm and these were converted to CIELAB values (using the CIE 10º observer and the D65 illuminant). For each colour measurement, the closest Munsell sample was found and the Munsell notation of that sample recorded. However, two metrics for similarity were used; one based on the closest spectral match and the other based on the closest colorimetric (CIEDE2000) match. In both cases, the match criterion was the least-square error metric.

RESULTS

The CIELAB values of the green colours for the churches of the Nativity and St Atanass are presented in Table 1.

Table 1: CIELAB values for the colours of the churches of the Nativity and St Atanass.

	L*	a*	b*
Nativity	47.58	-7.77	4.45
St Atanass	41.60	-5.89	4.48

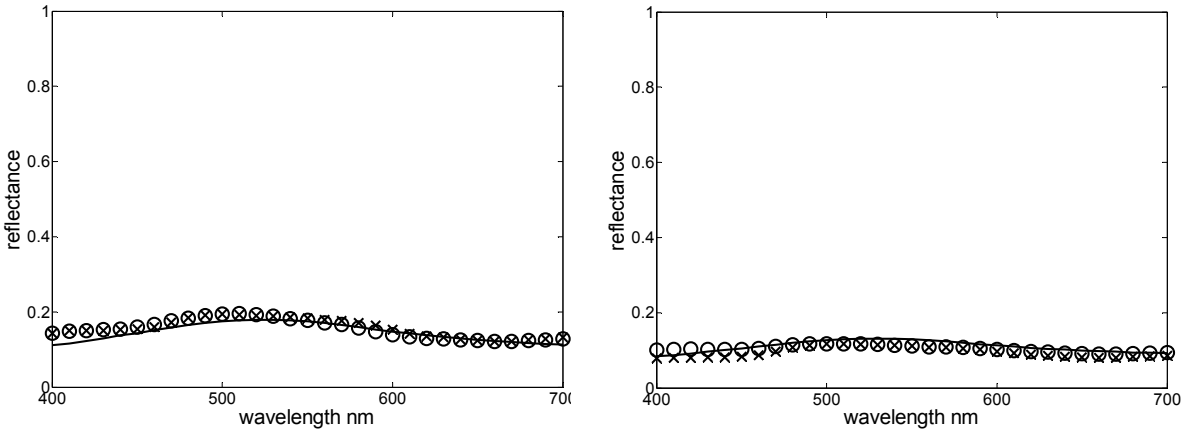

Figure 3: Spectral data for target (line) with spectral (circle) and colorimetric (cross) Munsell matches for the churches of the Nativity (left) and St Atanass (right).

The spectral data for the samples from the target churches and their corresponding spectral and colorimetric Munsell matches are shown in Figure 3. Although it indicates that both spectral and colourimetric matches are very close to the originals, the colorimetric matches should be considered the better representation of the appearance of the colour green in each of the churches. This is because these are the matches that correlate directly to human colour perception and not just to the properties of the coloured surfaces. Figure 4 shows an illustration (using sRGB representation but subject to the vagaries of colour management) of the spectral and colorimetric matches for the green colours from the two churches.

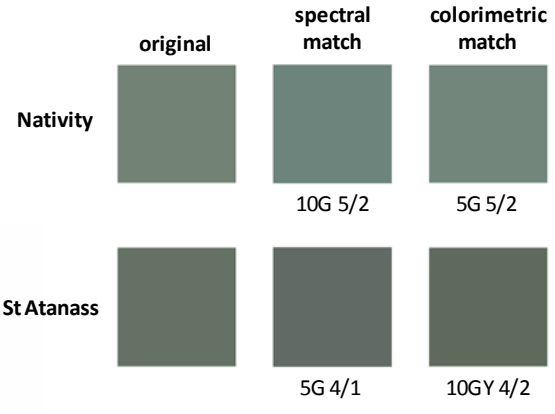

Figure 4: sRGB representation of the green shades.

DISCUSSION

This is the only Bulgarian historical site in which this method of colour comparison has been used in art historical research and is part of an ongoing investigation. The results of this examination contribute to the generation of a full set of colorimetric Munsell matches that will be representative of the artistic palette of both church interiors. Moreover, the manner of presentation allows the comparison of colours not only from these two sites but theoretically from an unlimited number of different sites by overcoming problems linked to colour vision, colour memory and colour reproduction in print. Thus the results presented here can be considered to be the beginning of the formation of the basis for further investigation into the use of colour in seventeenth century Bulgarian wall painting.

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