

## Analysis of seventeenth-century church interiors using the Munsell system

*Elza Tantcheva, Vien Cheung<sup>†</sup> and Stephen Westland<sup>†</sup>*

*Department of History of Art, School of Humanities, University of Sussex (UK)*

*<sup>†</sup>School of Design, University of Leeds (UK)*

*E-mail: [etan711@talktalk.net](mailto:etan711@talktalk.net)*

### Introduction

The aim of this research was to record and compare the colours used in works of art in a form which would provide an unambiguous record but which would also be more familiar to the scholar working in the art historical field. In the latter context, importance is placed on visually perceived colour rather than on colorimetric notation. The investigation is grounded in the case-study of four post-Byzantine churches in Arbanassi, Bulgaria. The town of Arbanassi, situated in the middle of Bulgaria, contains seven churches built in the seventeenth century. The interiors of four of these are completely covered with frescoes which were executed between 1612 and 1681 and have been shown by scholars to be preserved in their original state [1]. During the late 1970s and the 1980s the frescoes of all of the examined churches were cleaned. Images of two of the frescoes are shown in Figures 1 and 2.



*Figure 1 (left): Church of the Archangels Michael and Gabriel, Arbanassi, Bulgaria: Nave.*

*Figure 2 (right): Church of the Nativity of Christ, Arbanassi, Bulgaria: Depiction of the tree of Jesse painted in the seventeenth century.*

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. There is a relatively high frequency of the use of reds in the iconographic tradition of the Eastern Church from very early days up to the seventeenth century [2-4]. According to some authors the colour red has particular symbolic meaning within a conventionally accepted

visual code; meaning is derived from the esoteric tradition of mysticism in the Eastern Church which has its roots in late Antiquity and in particular in the Neo-Platonic school of thought. In this tradition colours are not applied by following any of the usual rules of colour harmony, but instead are employed according to a system of theological symbolism. In the Neo-Platonic tradition it is the Spirit that informs the form and not vice versa. That is why it is asserted by theological writers on iconography that chromatic circles are not needed for the construction of visual harmonies, but that the harmony is instead a cognitive one, to be displayed within each religious painting.

In the art of the Eastern Church red is mainly associated with the Messiah, the Archangel Michael and some of the others in the angelic orders, royal figures, some martyrs and the Last Judgment. However, it appears that most of the presumed symbolic associations of reds that can be traced in the Arbanassi frescoes derive primarily from the theological link between blood and redemption, which made it a popular choice in the artistic palette of the iconographers [4].

Previous research on the site had been limited to the traditional and meticulous, but subjective, assessment and verbal description of the colours used in the church interiors [2, 5]. However, this methodology has significant limitations 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 [2, 6]. By contrast, the use of analytical methods 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 artefact in art historical context. The possibility of employing a physical colour system such as the Munsell system in the present research permits the transition between conceptual and visual colour to be made and at the same time avoids the loss of the necessary precise notation. That loss would have inhibited accurate communication of the experienced colour [7]. The availability of computational methods allows a reasonably accurate translation of colorimetric data into Munsell notation for the purpose of art historical investigation and this is the subject of the paper presented here.

## **Experimental**

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 Konica-Minolta Colour Imaging Laboratory at the University of Leeds. The instrument is easy to use, precise and highly portable. 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 10° 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 match. In both cases, the match criterion was the least-square error metric. Frescoes with a similar theme and composition from each of the churches were identified and employed in the experiment in order to create a further base for comparison of colour in the different churches.

## Results and Conclusions

Initial examination of the images revealed negligible differences between the bright reds, but a very considerable perceived difference between the dark reds. The CIELAB values of the dark reds are presented in Table 1.

Church	$L^*$	$a^*$	$b^*$	$C^*_{ab}$	$h_{ab}$
Nativity of Christ	49.27	11.74	14.14	18.38	50.30
St Dimitr	38.23	14.12	9.86	17.22	30.93
Archangels M&G	44.65	26.83	16.67	31.59	31.85
St Atanass	53.60	27.05	17.91	32.44	33.51

Table 1: CIE coordinates for dark reds in different churches

Figure 3 shows the reflectance spectrum for the dark reds in different churches (solid line). The spectral properties of the closest spectral (circle) and colorimetric (cross) Munsell matches are also shown.

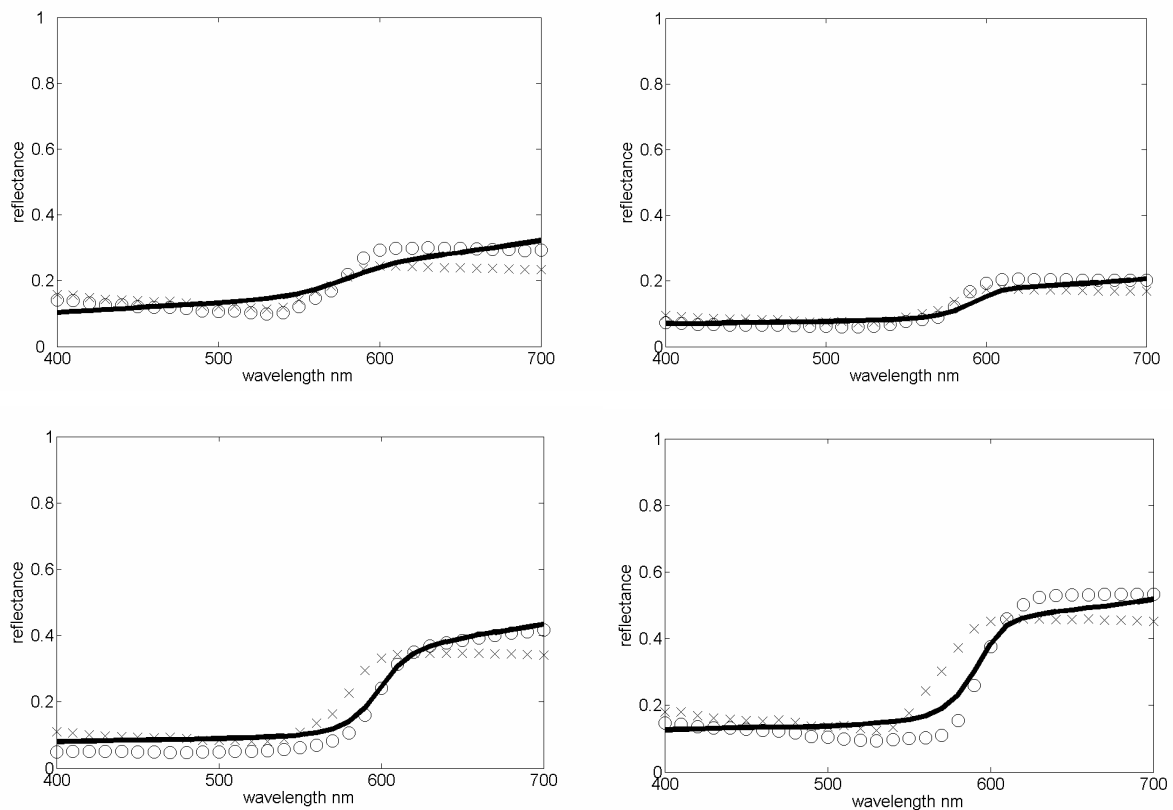


Figure 3: Spectral data for target (line) with spectral (circle) and colorimetric (cross) Munsell matches for the churches samples: Nativity of Christ (top left), St Dimitr (top right), Archangels M&G (bottom left) and St Atanass (bottom right).

Figure 4 shows an illustration (using sRGB representation but subject to the vagaries of colour management) of the spectral and colorimetric matches for the dark reds in each of the four churches. We suggest that the colorimetric matches are closer to the originals.

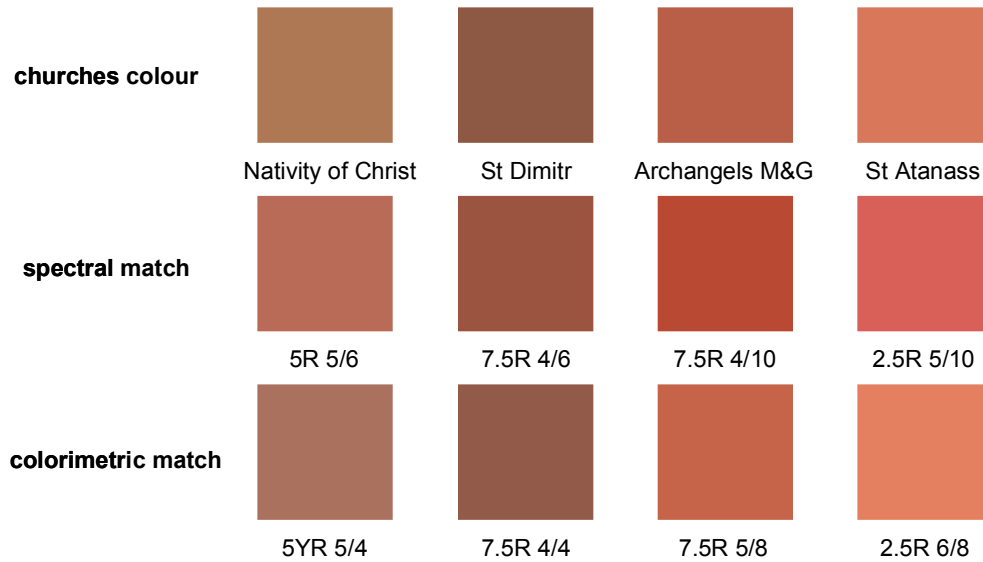


Figure 4: Visual representations of red shades.

This is the first time that this method of colour comparison has been used in art historical research connected to a Bulgarian historical site in particular. This research provides a possible basis for further investigation into the use of colour in seventeenth century Bulgaria. Furthermore the manner of presentation allows the comparison of colours from different sites by overcoming problems linked to colour vision, colour memory and colour reproduction in print.

## References

1. Haritonov H, Chohadžieva G and Rutževa S (2003), *Arbanassi, Borina* (in Bulgarian).
2. Lamb T and Bourriau J (ed.) (1995), *Colour: Art and Science*, Cambridge University Press.
3. Sendler E S J (1999), *The Icon, Image of the Invisible. Elements of Theology, Aesthetics and Technique*, Oakwood Publications.
4. Gage J (1999), *Colour and Culture. Practice and meaning from Antiquity to Abstraction*, Thames and Hudson.
5. Prashkov L (1979), *Church of the Nativity of Christ*, Bulgarski Hudožnic (in Bulgarian).
6. Gregory R (1998), *Eye and Brain*, Oxford University Press,
7. Berns, RS (2000), *Billmeyer and Saltzman Principles of Color Technology*, John Wiley & Sons, Inc.