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HENRY VIII'S TAPESTRIES REVEALED

Keywords; digital conservation, tapestry, multispectral imaging, photofading, recolouration, colour measurement, projector characterisation

ABSTRACT

The digital conservation and 'virtual restoration' of one of Henry VIII's *Story of Abraham* tapestries has integrated techniques from textile conservation, colour science and imaging science. The 500-year-old tapestry has suffered physical degradation, most significantly in the loss of colour from the dyed fibres and the tarnishing of metallic threads woven into the design. The conservation of a colour accurate image of the tapestry in a digital archive required the development of a multispectral imaging system to record the tapestry's current condition. The digital restoration of the tapestry involved the projection of a recoloured image onto the tapestry at the Hampton Court Palace *Tapestries Revealed* exhibition in order to convey to the public the tapestry's original colour and magnificence.

RÉSUMÉ

La conservation numérique et la « restauration virtuelle » d'une des tapisseries de *L'histoire d'Abraham* d'Henri VIII ont associé des techniques de conservation textile à la science des couleurs et de l'imagerie. Vieille de cinq cents ans, la tapisserie a subi des dégradations physiques, notamment une décoloration au niveau des fibres teintes et le ternissement des fils métalliques tissés dans le motif. La conservation d'une image avec les couleurs exactes de la tapisserie sous forme d'archive numérique a nécessité la mise au point d'un système d'imagerie multispectrale afin d'enregistrer l'état actuel de la tapisserie. La restauration numérique de la tapisserie incluait la projection d'une image recolorée sur la tapisserie lors de l'exposition *Tapestries Revealed* au Hampton Court Palace, afin que le public puisse apprécier la tapisserie dans

INTRODUCTION

In recent years, the digital conservation of cultural heritage has received significant attention with the digital archives produced serving as an important resource for conservators. These records allow the accurate tracking of the degradation of the materials used in the construction of these artefacts. The electronic resource enables the artefacts to be displayed and presented in different ways which present no risk to the condition of the original piece. Innovative presentation techniques in cultural heritage are constantly being developed to better engage and respond to the visitor and their changing awareness, knowledge and media responsiveness, but until now spectral imaging, measuring spectral reflectance information at each pixel location in an image, has mainly been used to digitally conserve paintings (Imai et al. 2001, Cotte and Dupraz 2006). This study uses spectral imaging technology on tapestries for the first time and has integrated techniques from textile conservation, colour science and imaging science to digitally conserve and 'virtually restore' one of the *Story of Abraham* tapestries, *The Oath and Departure of Eliezer*. This historically significant set of tapestries was commissioned by King Henry VIII in 1537, constructed by Willem de Kempeneer in Brussels, and are now held by the Royal Collection at Hampton Court Palace (HCP).

The tapestry has been digitally imaged, using a specially designed multichannel visible spectrum imaging system (MVSI), in order to create a digital record of the current condition of the tapestry and a highly accurate colour profile of the dyed yarns. This process has provided an archive of colour-calibrated images which will enable future generations to evaluate any further degradation of the tapestry or colour change of the dyes.

As part of the celebrations of the 500th anniversary of Henry VIII's accession to the throne, a representation of how *The Oath and Departure of Eliezer* would have originally appeared has been projected onto the tapestry itself, in the *Henry VIII's Tapestries Revealed* exhibition. This digital restoration of the tapestry requires a colour-calibrated image to be projected onto the front of the tapestry as it hangs on a specially constructed display stand in the light controlled environment of the Queen's Guard Chamber at HCP. The exhibition gives the viewer a realistic impression of how the tapestry would have appeared when first constructed and is virtually aged

toute sa magnificence, avec ses couleurs d'origine.

RESUMEN

La conservación digital y la "restauración virtual" de uno de los tapices de la *Historia de Abraham* de Enrique VIII ha integrado técnicas de conservación de textiles, de la ciencia del color y de la ciencia de la imagen. El tapiz, de 500 años de antigüedad, ha sufrido un deterioro físico, en particular una pérdida de color de las fibras teñidas y una pérdida de brillo de los hilos metálicos tejidos en el diseño. La conservación de una imagen con colores exactos del tapiz en un archivo digital requería el desarrollo de un sistema de imagen multiespectral para registrar las condiciones actuales del tapiz. La restauración digital del tapiz implicaba la proyección en el tapiz de una imagen coloreada en la exposición del Palacio de Hampton Court, *Tapestries Revealed,* con el objetivo de poder transmitir al público el color original y el esplendor del tapiz.

to show the effects of photo- and thermal-ageing on the tapestry after 100, 200, 300 and 400 years. Originally, the *Abraham* set were purchased as a status symbol, to distinguish the King from his European counterparts and would have portrayed the enormity of Henry's wealth and power (Mariller 1931). The strong colours of the dyes used in the tapestry, along with the gold and silver threads, would have made a huge impression on whoever viewed the tapestries. It is this impact that the digital restoration recreates for the viewers of the exhibition.

TAPESTRY AND MATERIALS

The *Story of Abraham* set comprises ten Flemish tapestries, each measuring approximately eight metres across by five metres high and all are highly detailed, depicting scenes from the Old Testament. The tapestries were constructed from dyed wool and silk yarns and highly embellished with large areas of silver and gold threads which were woven into the design to enhance the magnificence of the images. Unfortunately, the tapestries have lost much of their original visual impact due to physical and environmental degradation, most significantly by exposure to sunlight. The dyed wool and silk fibres have photofaded and the metallic threads have tarnished leaving large areas of dark grey, with the result that the overall impression of the tapestries has diminished.

DETERMINING THE GAMUT OF COLOURS OF THE DYES USED IN *THE OATH AND DEPARTURE OF ELIEZER*

In order to determine the original colour appearance, a variety of methods were used including colour measurement of the front and reverse of the tapestry and colour measurement of a series of model dyed fabrics and metallic threads, both before and after accelerated photo-ageing.

Colour has been measured at a series of spatial scales. At the yarn level, a microscope spectrometer was used to measure the relative spectral reflectance functions; at the fabric level, a spectrophotometer (Datacolor Spectraflash (SF) 600); at the texture level, a multispectral imaging system; and the benchmark instrument was a telespectroradiometer (Photo Research PR-655). CIELAB was used as the device independent colourspace and both spectral values and CIELAB values were recorded at each pixel location by the MVSI.

Colour measurement of the tapestry

Due to the relatively low levels of photofading in comparison to the front, an impression of the original colours was gained from taking colour measurements of the reverse of the tapestry where protective linings have shielded the fabric from light exposure. Images of a section of the front and reverse of the tapestry, taken under the same lighting conditions using a Canon Digital IXUS 70, are shown in Figures 1 and 2, respectively. The tapestry was removed from display, laid out flat in the textile wash facility and the lining removed for the first time in around 70 years allowing the colourful reverse to be measured. Colour measurements were taken of the front and reverse of the Abraham tapestry using a portable Photo Research PR-655 Spectrascan telespectroradiometer (TSR) so that no physical sampling of the tapestry was necessary. A polytetrafluoroethylene (PTFE) white reference tile was used when capturing the spectral data. Measurements were taken of corresponding areas on the front and reverse to build up a database of the fading profiles of each of the dyes used in the tapestry. The entire front and areas of the reverse were imaged using the MVSI and a calibrated digital camera (Nikon D300), including areas of untarnished metallic thread on the reverse.

Figure 1
Section of *The Oath and Departure of Eliezer* tapestry (front)

Figure 2
Section of *The Oath and Departure of Eliezer* tapestry (reverse)

Colour measurement of model tapestry materials

In order to further establish the original colours of the dyed materials, measurements were taken of reproduction dyed tapestry fabrics, which were constructed by Hacke during the European Commission funded project, *Monitoring of Damage in Historic Tapestries* (MODHT) (Hacke 2006). Model tapestry fabric was woven from wool and silk yarns representative of historic tapestry materials. The yarns were dyed using medieval natural colourant formulations that would have been prevalent at the time of the *Abraham* tapestries construction. A list of the selection of MODHT samples that were used in this study, including the dyestuff and mordant combinations, is shown in Table 1.

Table 1
Dye, mordant and substrate combinations used to create the model tapestry samples used in the study

Sample name	Weft Fibre	Colour	Dyestuff	Mordant
Undyed Wool	Wool	-	-	-
WAlum	Wool	-	-	Alum
WAlder	Wool	-	-	Alder Bark
WOak Gall	Wool	-	-	Oakgall
WIron	Wool	Black	Iron Sulphate	Oakgall
WCopper	Wool	Black	Copper & Iron Sulphate	Oakgall
WMadder	Wool	Red	Madder	Semelwater & Alum
WMadder 2	Wool	Red	Madder	Oakgall & Alum
WBrazil	Wool	Red	Brazilwood	Alum
WCoch	Wool	Red	Cochineal	Alum & Tartaric Acid & Sandalwood
WWeld	Wool	Yellow	Weld	Alum
WGweed	Wool	Yellow	Dyer's Greenweed	Alum
WWoad	Wool	Blue	Woad	-
Undyed Silk	Silk	-	-	-
SOak Gall	Silk	-	-	Oakgall
SIron	Silk	Black	Iron Sulphate	-
SBrazil	Silk	Red	Brazilwood	Alum
SMadder	Silk	Red	Madder	Alum
SCoch	Silk	Red	Cochineal	Alum & Copper Turnings
SWeld	Silk	Yellow	Weld	Alum
SGweed	Silk	Yellow	Dyer's Greenweed	Alum
SWoad	Silk	Blue	Woad	-

PHOTO-AGEING THE MODEL TAPESTRIES

The samples were photo-aged for a total of 500 hours in a Xenotest Weatherometer, which is the equivalent of around 500 years of exposure in typical museum lighting conditions. Colour measurements of these samples, prior and post accelerated photo-ageing, provide a set of fading profiles of known dyes which were matched to areas on the tapestry. Model metallic thread was also produced and artificially aged with the fabric samples to gain an understanding of the degradation of the metallic surface of the thread in the presence of dyed wool and silk. The various dye/mordant combinations were found to photofade at different rates, most notably the blue woad dye exhibited good light fastness whereas the red brazilwood dye was the most fugitive (Figure 3).

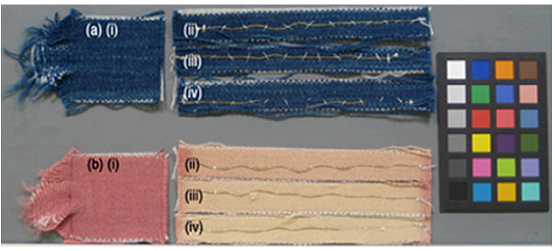


Figure 3
Samples of photo-aged fabric and metallic threads: (a) woad dyed wool sample *WWoad* (i) unexposed fabric, (ii) 100 hour exposure, (iii) 300 hour exposure, (iv) 500 hour exposure, (b) brazilwood dyed silk sample *SBrazil* (i) unexposed fabric, (ii) 100 hour exposure, (iii) 300 hour exposure, (iv) 500 hour exposure

MATCHING THE DYES USED IN *THE OATH & DEPARTURE OF ELIEZER* TAPESTRY TO MEDIEVAL DYE RECIPES

The areas of colour on the tapestry were matched to the natural dyes used for the model tapestry samples by comparing the colour difference between the front and reverse to the gradual fading profiles of the dyes. This information was used in the recolouration process to identify distinct areas of dyes and to shift the colour distribution information of these areas towards the colours of the dyes. It was particularly important to identify those areas on the front of the tapestry that were completely photofaded and to recolour them according to the colour data of the corresponding dye.

Table 2
CIELAB values for model dyed fabric samples prior and post photo-ageing

	Unaged			100 hours				300 hours				500 hours			
Sample	L*	a*	b*	L*	a*	b*	dE*	L*	a*	b*	dE*	L*	a*	b*	dE*
WUndyed	77.9	-0.2	12.0	80.7	-0.6	12.7	2.9	81.1	-0.9	14.7	4.3	80.7	-0.7	14.6	3.8
WAlum	84.2	-0.2	12.7	86.4	-0.5	11.1	2.7	84.9	-1.3	15.1	2.8	84.9	-1.4	17.3	4.8
WAlder	54.8	5.7	23.4	60.7	5.6	24.1	5.9	64.2	4.6	23.4	9.5	67.2	3.7	22.1	12.6
WOakgall	63.8	2.9	23.5	62.8	5.0	30.2	7.1	64.3	4.5	27.9	4.7	66.5	4.0	25.9	3.8
WIron	25.8	1.4	2.1	29.7	1.6	5.0	4.8	29.3	1.4	5.6	4.9	30.1	0.9	6.3	6.0
WCopper	32.2	1.1	12.6	36.8	1.2	15.3	5.2	37.8	0.9	17.0	7.1	40.9	0.6	17.9	10.2
WMadder	33.9	31.5	21.9	40.6	31.0	21.7	6.7	46.4	28.1	20.9	13.0	50.0	25.5	19.4	17.4
WMadder2	39.6	23.6	22.9	46.1	21.4	22.9	6.9	52.5	15.9	20.9	15.1	55.2	13.8	20.5	18.6
WBrazil	48.3	21.9	7.9	65.9	9.3	18.0	23.9	70.8	5.9	20.0	30.1	74.5	3.9	20.4	34.1
WCoch	41.1	37.3	9.4	47.1	28.7	5.5	11.2	53.9	20.9	7.1	20.9	60.3	15.0	8.7	29.4
WWeld	67.8	3.1	63.0	71.3	2.6	43.3	20.1	74.2	1.7	33.8	30.0	75.2	1.7	28.9	34.9
WGweed	58.3	1.8	40.1	63.1	2.1	32.0	9.4	66.2	1.7	27.6	14.8	68.6	1.5	23.2	19.8
WWoad	28.0	-3.4	-13.8	31.4	-3.5	-13.4	3.4	29.3	-3.2	-14.4	1.4	29.5	-3.5	-14.5	1.6
SUndyed	84.7	0.8	8.4	84.0	0.6	11.9	3.6	83.2	0.8	16.3	8.1	82.9	1.2	18.3	10.1
SOakgal	72.8	2.4	18.4	68.9	3.6	27.1	9.6	70.6	3.4	27.2	9.2	68.9	4.1	27.2	9.8
SIron	20.9	1.1	-1.2	21.5	0.9	-0.9	0.7	21.3	1.0	-0.2	1.1	21.3	0.6	0.6	1.9
SBrazil	56.2	15.5	0.9	68.2	5.9	14.9	20.8	73.4	3.8	16.5	26.0	76.1	2.6	16.7	28.5
SMadder	60.9	25.2	12.0	66.3	19.3	12.6	8.0	71.0	13.9	14.3	15.3	72.3	12.5	15.5	17.4
SCoch	43.2	30.2	10.4	44.0	25.1	7.2	6.1	47.8	20.0	7.4	11.6	48.8	17.4	7.9	14.2
SWeld	72.3	-3.0	51.5	71.2	1.1	42.3	10.1	73.0	1.0	33.9	18.0	74.2	1.1	30.8	21.1
SGweed	68.7	-0.8	41.8	69.7	1.8	32.7	9.5	71.9	1.9	27.2	15.1	72.5	2.1	24.3	18.1
SWoad	41.7	-7.3	-9.1	44.2	-7.8	-8.7	2.5	48.0	-8.8	-6.0	7.2	49.7	-8.1	-4.7	9.1

The Datacolor SF600 spectrophotometer was used to measure the reflectance spectra of the dyed fabric samples before ageing and after 100 hours, 300 hours and 500 hours of photo-ageing. The samples were measured using a small aperture, with Ultraviolet (UV) and specular components excluded (Table 2). CIELAB values with ΔE^*_{ab} colour differences were calculated using the dyed unaged fabric as the standard, and the aged samples (after 100, 300 and 500 hours light exposure) as the batches. L* values give the lightness of the sample and as the samples were exposed to optical radiation, photofading of the dyes resulted in increased lightness values. The a* and b* values indicate the amount of colour present in the sample. A light fast dye, such as woad, exhibits relatively constant values for L*, a* and b* (WWoad sample), while in contrast, the brazilwood dyed wool (WBrazil) becomes lighter and more neutral when exposed to greater levels of light. The highest ΔE^*_{ab} values, and therefore the most fugitive dyes, are found for brazilwood and weld.

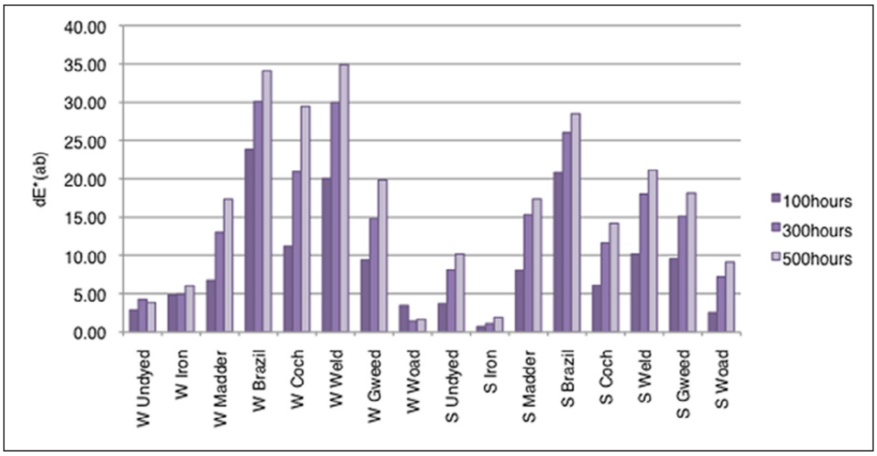
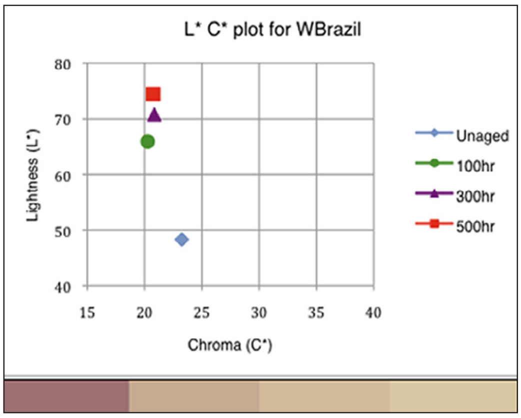


Figure 4
Colour differences of dyed wool and silk samples calculated after 100, 300 and 500 hours of photo-ageing

Figure 4 displays the colour differences between the unaged dyed fabric and the fabric samples after 100, 300 and 500 hours of accelerated photo-ageing. The dyes were selected as being most representative of the coloured areas of the tapestry. The woad dyed wool WWoad exhibits the smallest change in ΔE^*_{ab} demonstrating a high level of light fastness, whereas woad dyed silk has a lower fastness than on wool. Brazilwood and weld dyed wool and silk fabrics have poorer light fastness. The brazilwood and cochineal dyed wool (WBrazil and WCoch) have comparable fading rates; WBrazil has a high ΔE^*_{ab} value after 100 hours and a relatively small colour change after 300 and 500 hours whereas the colour differences in WCoch are more evenly distributed over time. This effect is represented using CIELAB L* (lightness) plotted against C* (chroma) in Figure 5 for WBrazil and Figure 6 for WCoch. Underneath each plot is a representation of the colour fading profiles for each dye after 0, 100, 300 and 500 hours obtained by transforming CIELAB values to sRGB under illuminant D65. It can be seen that after 100 hours the brazilwood fabric has faded significantly and by 500 hours little of the original colour has remained. The fading of cochineal fabric is more gradual with some colour remaining after 500 hours.



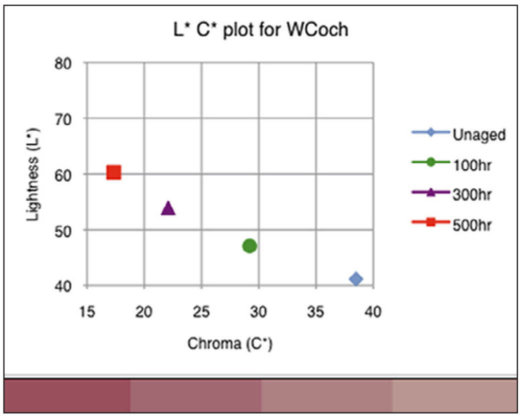


Figure 5
A plot of lightness (L*) against chroma (C*) for sample WBrazil after 100, 300 and 500 hours of photo-ageing

Figure 6
A plot of lightness (L*) against chroma (C*) for sample WCoch after 100, 300 and 500 hours of photo-ageing

CREATING THE RECOLOURED IMAGES

An image of the tapestry hanging in place in the Queen's Guard Chamber was captured using a calibrated Nikon D300 digital camera from a point as close to the projector's viewing angle as possible. Deformation of this image was performed to account for the angle of imaging and projection. The image size was 1920 × 1080 pixels. A series of masks were created using clustering algorithms using MATLAB, which located each individual dye colour in the image. Although this procedure was automated, some of the masks needed to be completed by hand. The spatial and colourimetric characteristics (in each plane of the CIELAB colourspace) of pixel populations sampled from the reverse of the tapestry were then mapped onto the appropriately masked area of the image of the front of the tapestry. This effectively shifted the L*, a* and b* distributions of individual colours to their unfaded counterparts. This image was manipulated, taking into account the remaining colour present on the tapestry, to create a final image which, when projected onto the tapestry, produced the recoloured effect. The effect of the metallic threads was generated using texture mapping. The completed image was then modified by the appropriate linear transform for projection.

The resulting projected image forms the basis of the *Tapestries Revealed* show, which features a narrative explaining the history and significance of the tapestry, the role of the individual characters in the design and a virtual fading demonstration of the tapestry materials over its lifetime.

COLOUR CHARACTERISATION OF THE DLP PROJECTOR

Device calibration attempts to set an imaging device to a known state and ensures that the device is producing consistent results. Characterisation is the relationship between device-dependent coordinates usually RGB and some device independent colour space such as CIE XYZ. The Gain-Offset-Gamma (GOG) model is a physical model of a visual display unit based on a cathode ray tube (CRT) that has been used for the characterisation of many display devices (Berns et al. 1993a, 1993b). The GOG model linearises the relationship between the voltage applied to the CRT's phosphors and the displayed luminance. Once the GOG model has linearised, the DAC values linear transformations can be applied to generate a linear mapping between device dependent (RGB) coordinates and device independent coordinates (XYZ).

$$R = \left(\frac{ad_r}{\left(2^N - 1\right)} + (1 - a) \right)^{\gamma} \qquad \text{Equation 1}$$

Equation 1 shows a GOG model equation used to normalize and linearise the red channel where the system gain and offset are assumed to be unity.

Once the GOG model has been used to linearise the DAC values, the values can be related to CIE tristimulus values using a simple linear transform as seen in Equation 2.

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} X_{r,\max} & X_{g,\max} & X_{b,\max} \\ Y_{r,\max} & Y_{g,\max} & Y_{b,\max} \\ Z_{r,\max} & Z_{g,\max} & Z_{b,\max} \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix} \qquad \text{Equation 2}$$

Although the GOG approach has been adopted in the literature when characterising projectors (Kwak and MacDonald 2000) more recent work suggests that including the white CIE Tristimulus values when calculating the transfer matrix may be beneficial when attempting to characterise a DLP based projector (Wyble and Rosen 2004, Wyble and Rosen 2006).

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} X_{r,\max} & X_{g,\max} & X_{b,\max} \\ Y_{r,\max} & Y_{g,\max} & Y_{b,\max} \\ Z_{r,\max} & Z_{g,\max} & Z_{b,\max} \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix} \qquad \text{Equation 3}$$

The Wyble model (see Equation 3) uses RGBW basis vectors in order to calibrate DLP projectors. Both types of transfer matrix were applied in this study.

TEMPORAL LUMINANCE STABILITY OF THE PANASONIC PT-DW10000 DLP PROJECTOR

A white full screen patch (full intensity) was measured at regular intervals of 30 seconds for 60 minutes. The output of the projector stabilized at 416 cd/m^2 (±1 cd/m^2) after 30 minutes of measurement.

SPATIAL HOMOGENEITY TESTS OF THE PROJECTOR

In order to correct for luminance differences across the image, the spatial homogeneity of the projector was measured. The projector projected a white field onto a white screen from a distance of five metres after an initial warm up time of 30 minutes when the luminance values had stabilised. The ambient light measured in the room was 0.31 cd/m^2. Table 3 shows the luminance values in cd/m^2 at selected points across the image. The field was brightest in the centre (40.8 cd m^2) and darkest in the top right corner (27.3 cd/m^2). The measurements were repeated three times at each point and the results averaged. This information was used to modify the lightness values in the projected image.

Table 3

Selected spatial luminance uniformity measurements of a white field, of dimension 8 metres by 5 metres, projected by the Panasonic PT-DW10000 DLP projector from a distance of 5 metres (candelas/m^2)

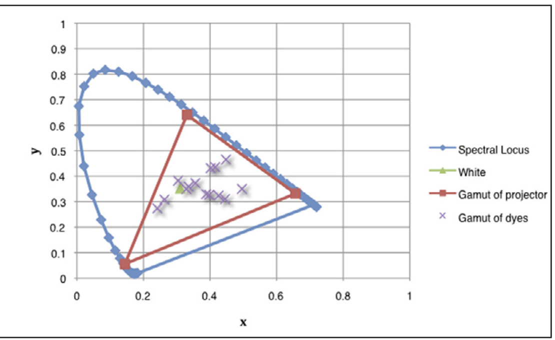
30.6	31.1			31.8	31.0	30.4			29.1	27.3
		33.5	32.5	33.3	32.5	32.2	32.0	30.1		
31.1	31.9	33.8	34.5	36.4	34.7	33.8	33.0	30.6	29.5	27.7
		33.3	37.8	39.9	40.8	36.2	35.8	31.3		
31.9	33.0			41.1	42.1	36.8			32.5	30.0

COLOURIMETRIC PERFORMANCE OF THE PROJECTOR

In order to determine the gamut of the projector, a set of colour ramps were produced. Ten coloured patches were created in each of the red, green and blue channels. These coloured patches were displayed full field and projected onto a white screen. Ten neutral patches were also created and displayed for radiometric measurement with the PR-655. The patches were measured in a darkened room from a distance of 0.5 metres and the chromaticities of the maximum red, green and blue (RGB) channels were calculated. The chromaticity coordinates of the model tapestries and the projected RGB channels are presented (Figure 7) and it can be seen that the chromaticities of the model tapestries fall inside the gamut of the projector.

This process was repeated and the colour ramps were projected over the tapestry. The PR655 was used to capture radiometric measurements at specified points relating to particular dyed areas of the tapestry. Linear transformations were calculated based on these data and applied to the projected image. Dyes exhibiting poor light fastness had almost completely faded. The projection of a target colour onto a neutral background required minimal colourimetric correction, but for mixtures of dyes where one component had completely faded the prediction of the overlay was less colourimetrically accurate.

Henry VIII and Kathryn Parr (actors) view the virtually restored tapestry as part of HCPs costumed interpretation (Figure 8).



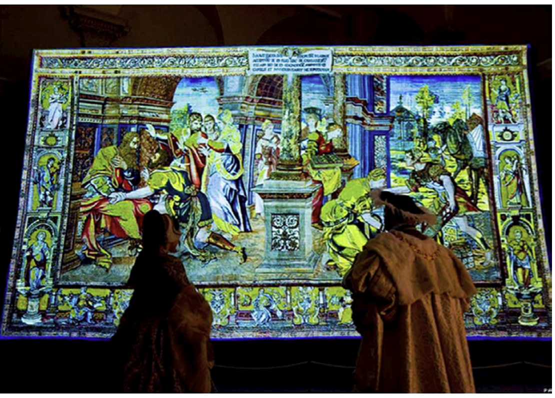


Figure 7
CIE Diagram of the Gamut of the PT-DW10000 projector and model dyed fabric samples

Figure 8
An image of the recoloured tapestry during the *Henry VIII's Tapestries Revealed* show

LIGHT BUDGETS

The conservators at HCP have set an acceptable annual light dose for the tapestry of 150,000 lux hours and calculations ensured the annual light dose the tapestry would receive during the exhibition was within acceptable limits. The ambient light and the use of the Queen's Guard Chamber for evening functions and events were also taken into consideration. The show was scheduled five times per day, which amounted to no more than a few minutes of projector light exposure each day. Light monitoring showed that the total light dose was only 100,000 lux hours for the period of April 2009 to January 2010, 50,000 less than the budgeted light level. The show's popularity, associated high visitor numbers and excellent feedback coupled to this lower-than-predicted light exposure led to the exhibition being extended until the end of October 2010 (Historic Royal Palaces 2010).

CONCLUSIONS

The project research has successfully focused on the digital conservation and virtual restoration of the *The Oath and Departure of Eliezer* tapestry. The innovative integration of multispectral imaging, materials characterisation and projector characterisation and optimisation has provided the scientific basis for a ground-breaking exhibition at Hampton Court Palace that has reawakened the public perception and awareness of the vibrant imagery and impact of medieval tapestries.

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