Micro-fading report

Art&Archival
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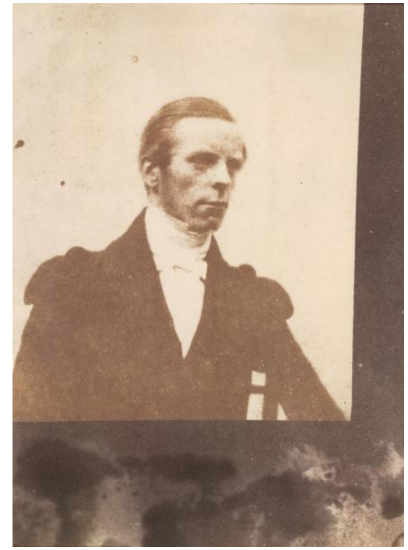


Object:	Photograph, unidentified man
Maker:	Fox Talbot
Accession No:	[redacted]
Materials and media	Salted print
Collection:	Photographic
Collection type:	Permanent collection
Year of production	c.1843
Test Date:	26-3-13
Operator:	Bruce Ford
Requested by:	[redacted]

Summary

The silver image is much more lightfast than BW3 (CIE2000) under the test conditions (Endnotes 1 & 2). This is outside the range of lightfastness (BW1 or worse to BW3) for colourants described in the CIE standard for museum lighting as having “high responsivity to light” for museum purposes (CIE 2004). According to the NGV lighting guideline it is at least within the “medium sensitivity” available for display for 166 days/year at 150 lux (presumably pro-rata at lower lux levels).

While the colour change for paper has been recorded (BW 2.7) it is probably not relevant to setting display restrictions because the long term significance of its response under accelerated light ageing conditions is unclear (Endnote 3).

The current NMA guidelines would normally restrict display of this photograph to 5 years/decade, not because of the lightfastness of image itself, but as a precaution against post-actinic yellowing of the paper and photo-degradation of the paper support.

The light fastness of the silver image – which is at or exceeds the detection limit for the microfade technique – is consistent with that of replica salted prints produced by the National Galleries of Scotland which I microfade tested last October (2012). It is also similar to the un-toned portion of the NGV’s Le Secq print [redacted] microfade tested at the same time as this one.

The above recommendation based on its measured lightfastness is at odds with the AIC PMG recommendations for salted prints (AIC 2004) in which they are assumed to be very light sensitive, presumably because without testing it is not possible to identify poorly fixed examples.

Even though the image itself appears to be completely stable to light, I would recommend careful monitoring on display and after its return to storage, particularly if it were exposed for an extended period.

Figure 1 Test positions

	CIE76			CIE2000							
Colour	BW Range	BW Equivalent	ΔE76	BW Range	BW Equivalent	ΔE2000	ΔL*	Δa*	Δb*	ΔC	Δh
BW1			11.1			4.9	4.3	-3.3	10.2	-9.9	-7.4
BW2			5.5			1.9	1.5	-1.1	5.4	-5.3	-2.4
BW3			1.6			0.4	0.3	-0.8	1.3	-1.5	-0.4
BW4			0.5			0.4	-0.4	0.5	0.3	-0.3	0.8
1 dark	>BW4	>BW4	0.2	>BW3	>BW3	0.1	-0.1	-0.1	-0.1	-0.1	0.2
2 paper	BW4-BW3	3.7	0.8	BW3	2.9	0.5	-0.1	0.1	-0.8	-0.8	-0.8
3 image	>BW4	>BW4	0.2	>BW3	>BW3	0.2	-0.2	-0.1	-0.1	-0.2	0.2

Table 1. Colour change summary. See last page for CIELAB diagram and Endnote 2 for a discussion of CIE76 vs CIE2000 results. Total exposure over the 10 minute fading run is approximately 1mlx hour.

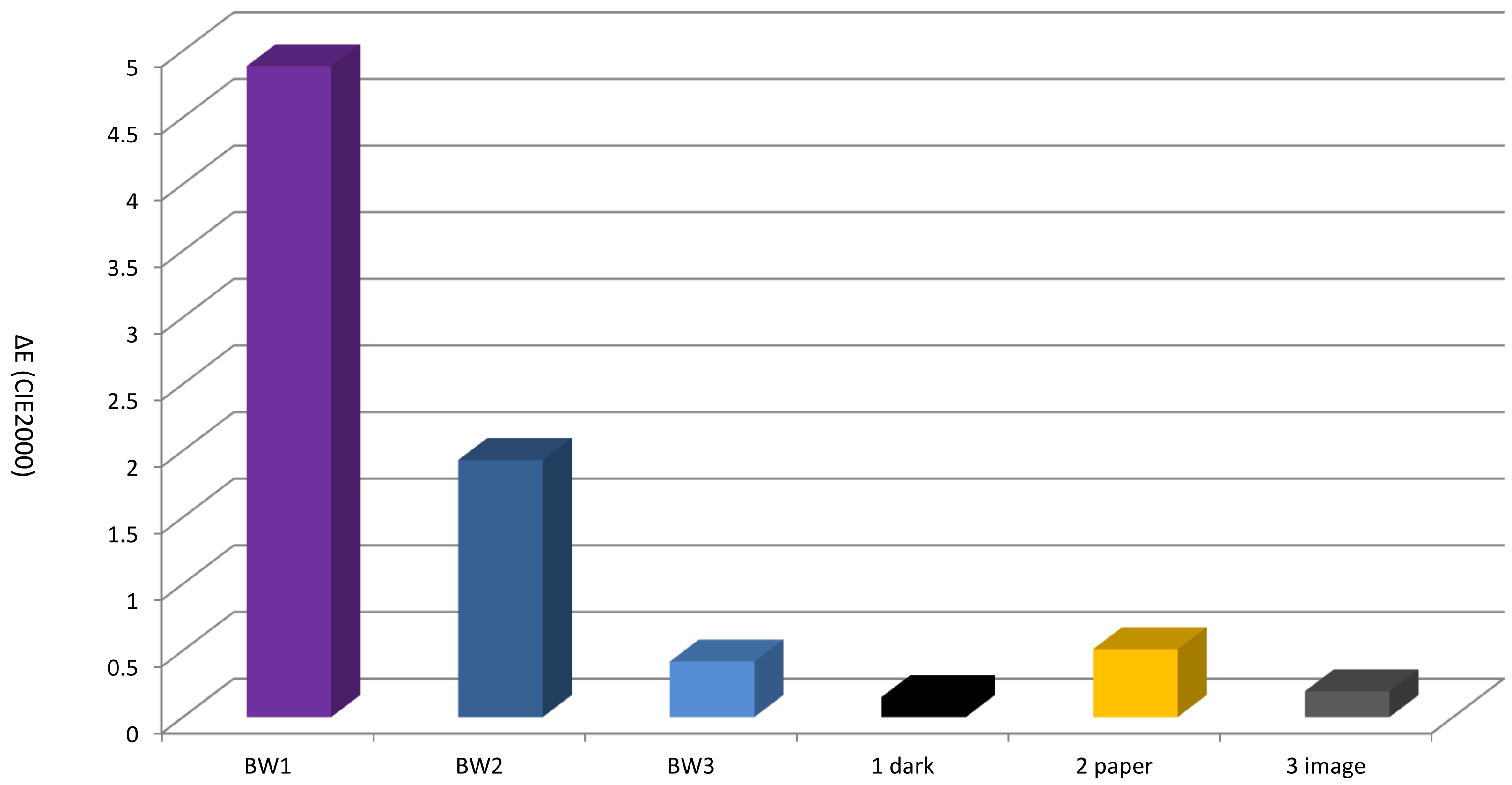


Figure 2. Relative colour change rates , CIE2000

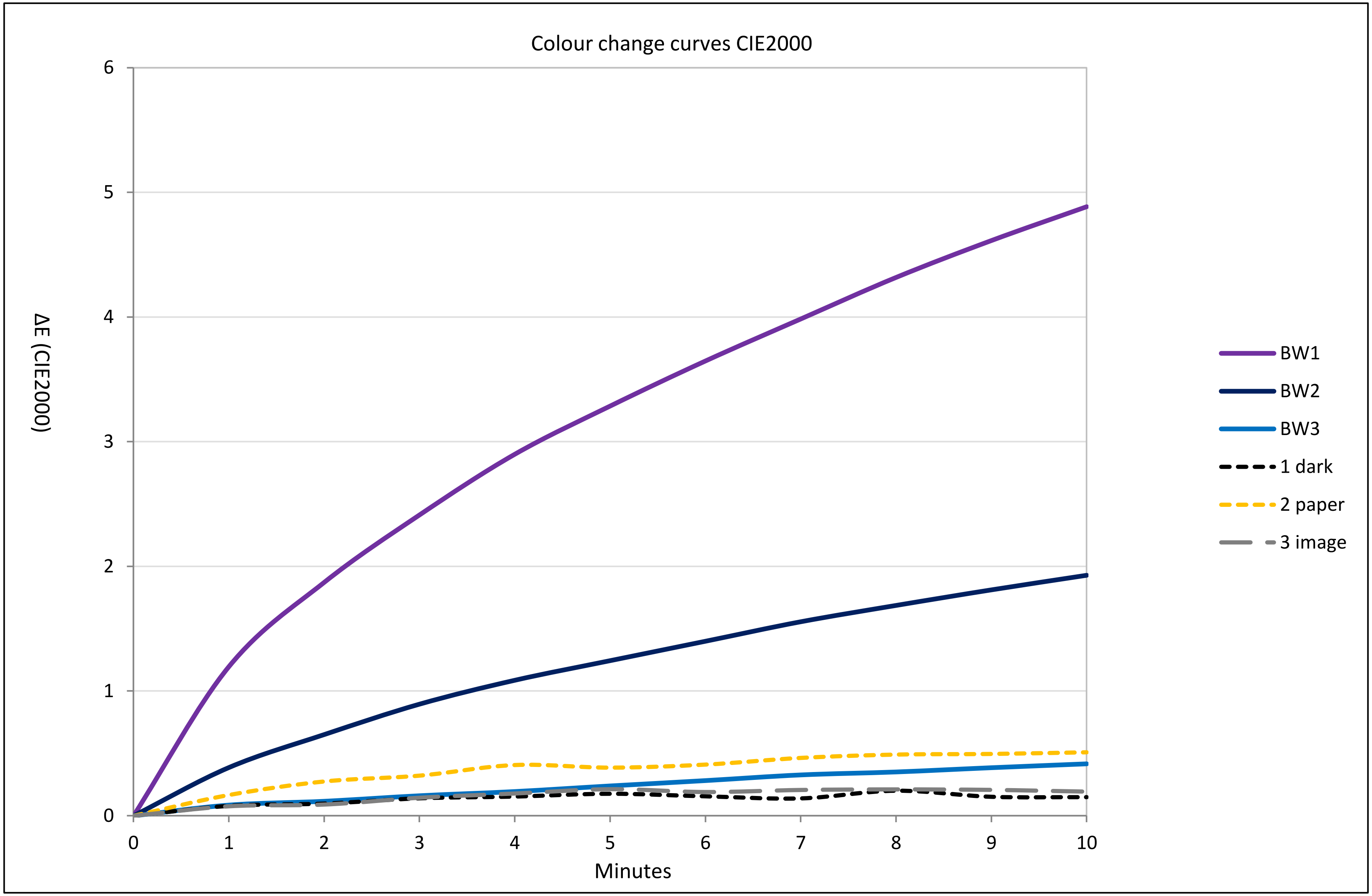


Figure 3. Colour change curves, CIE2000

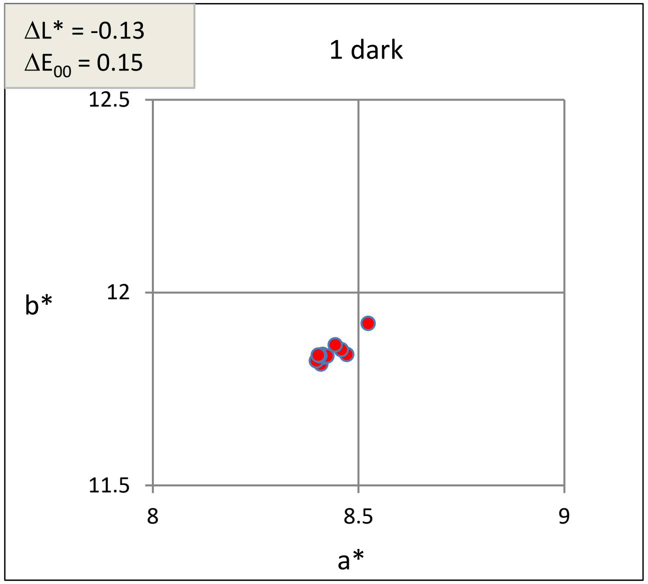
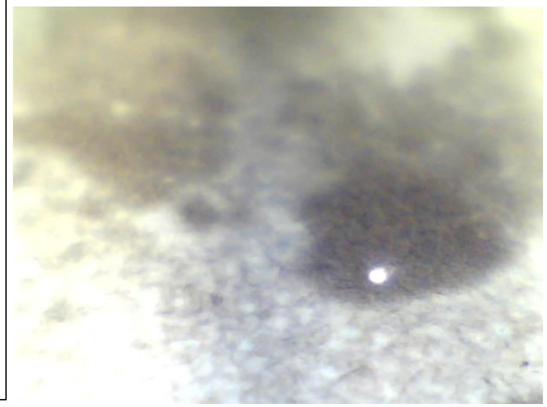
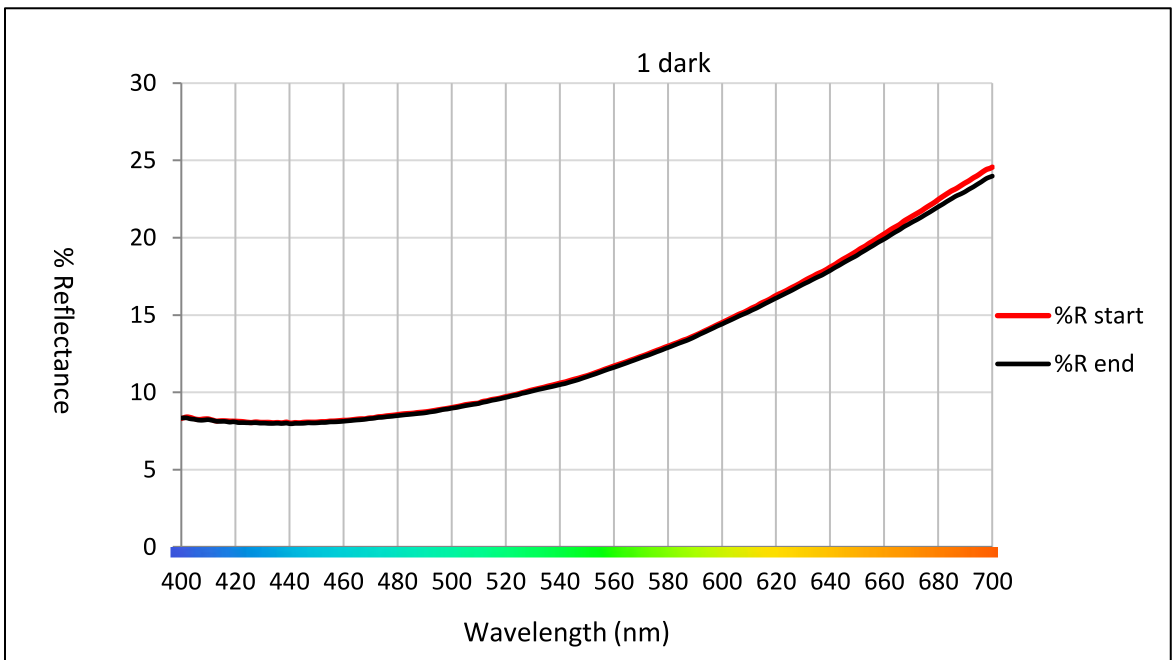


Figure 4. Dark silver image (1): little if any response.





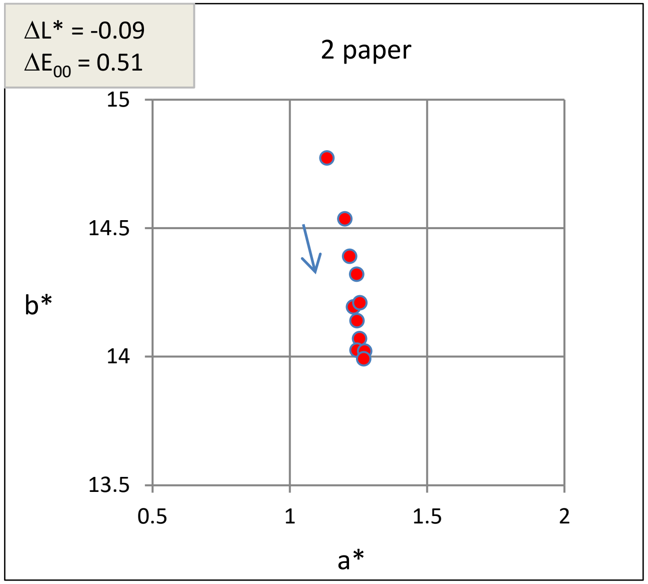
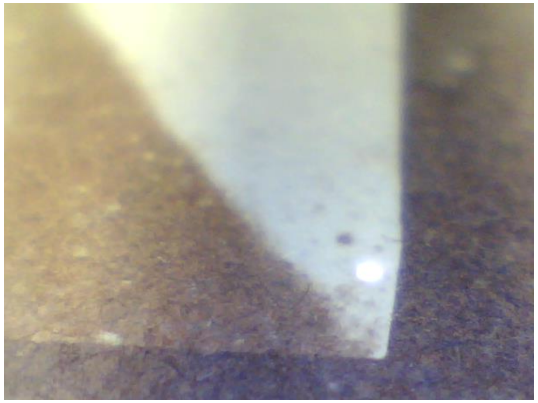
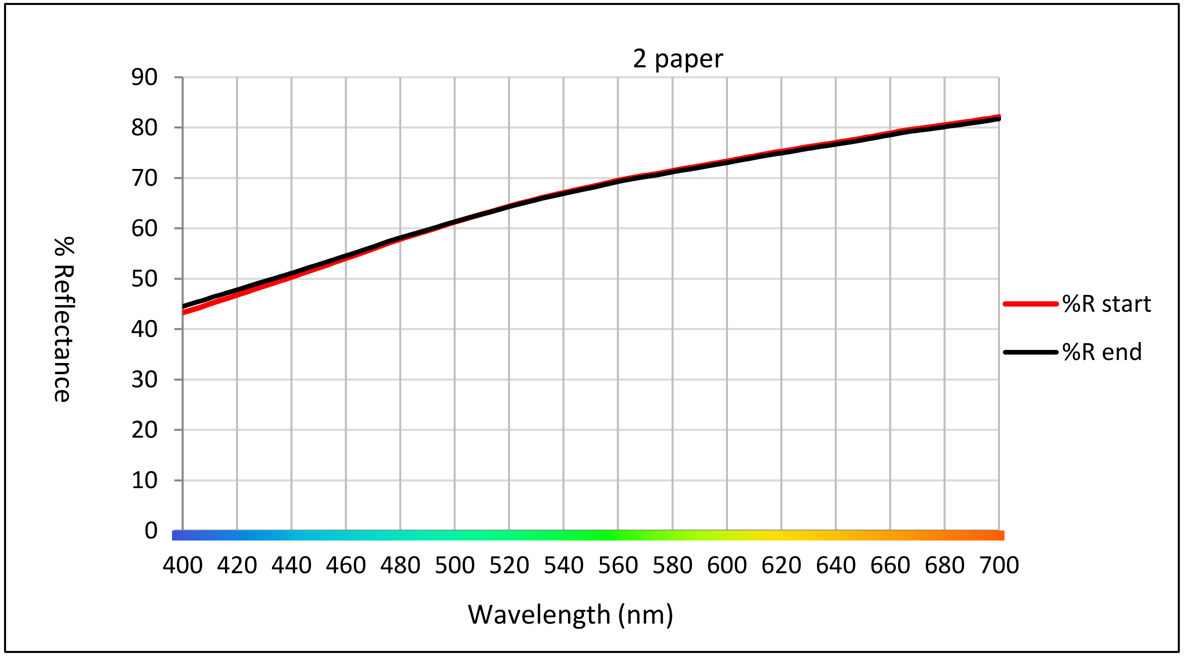


Figure 5. Paper (2): less yellow(ed). Typical bleaching of yellowed paper under accelerated conditions. See Endnote 3 about post-actinic thermal colour changes.





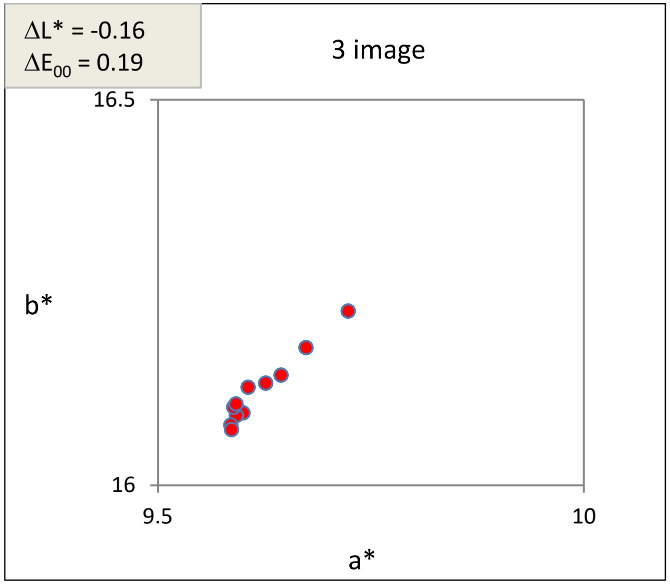
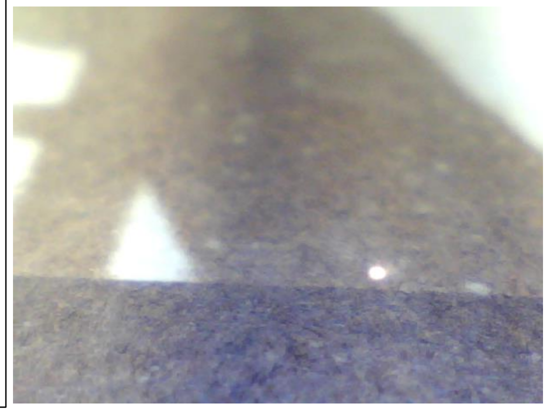
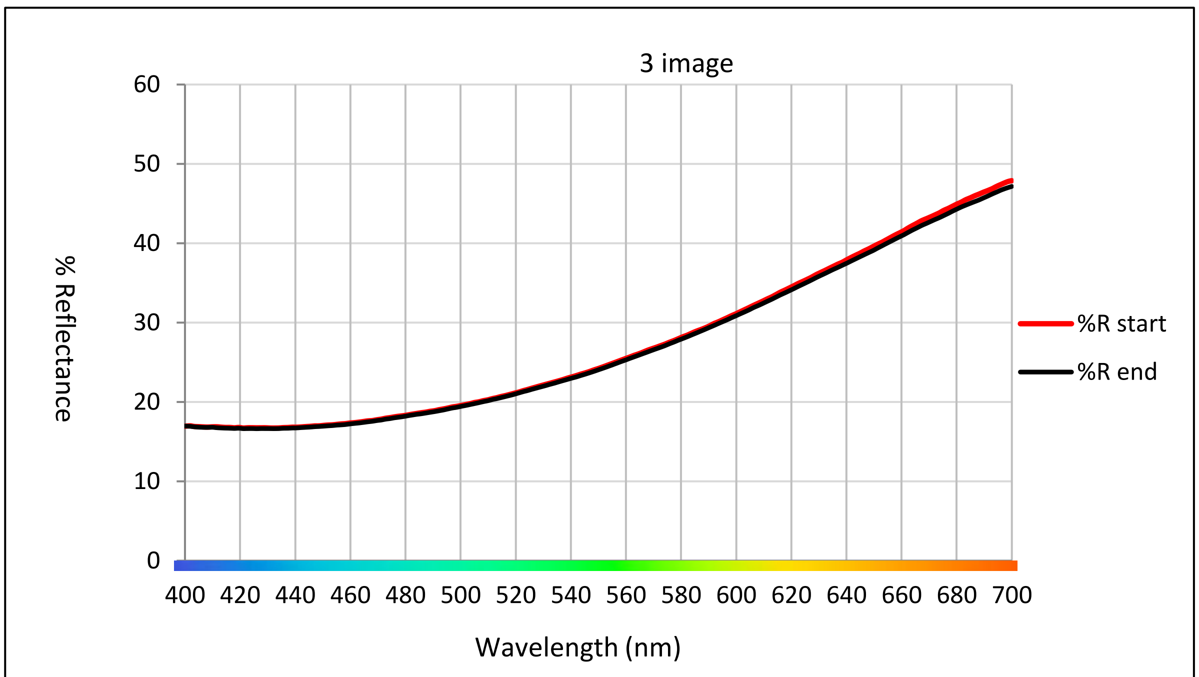


Figure 6. Medium image density (3): little response, probably consisting entirely of underlying paper bleaching.





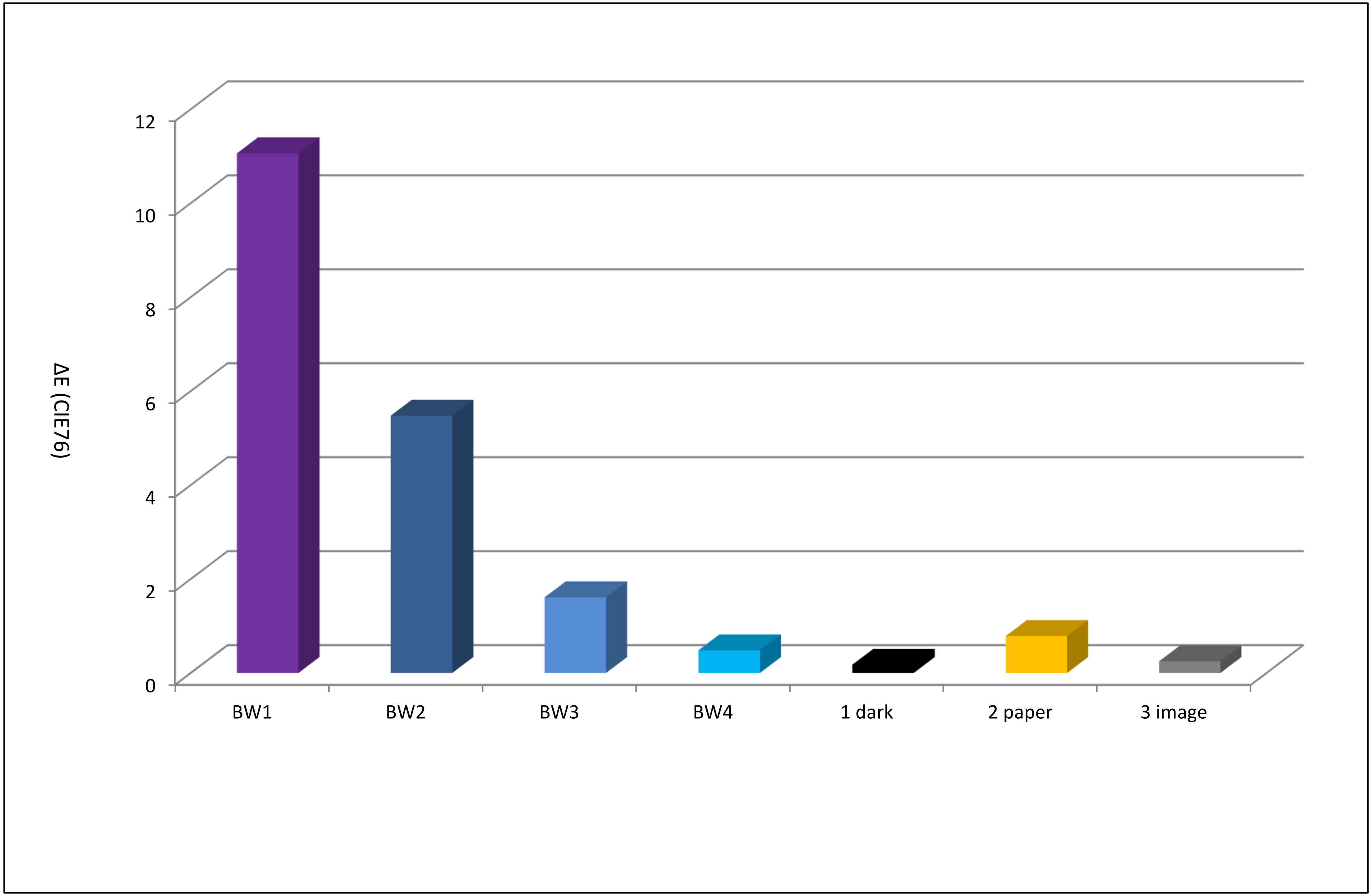


Figure 7. Relative colour change rates , CIE76

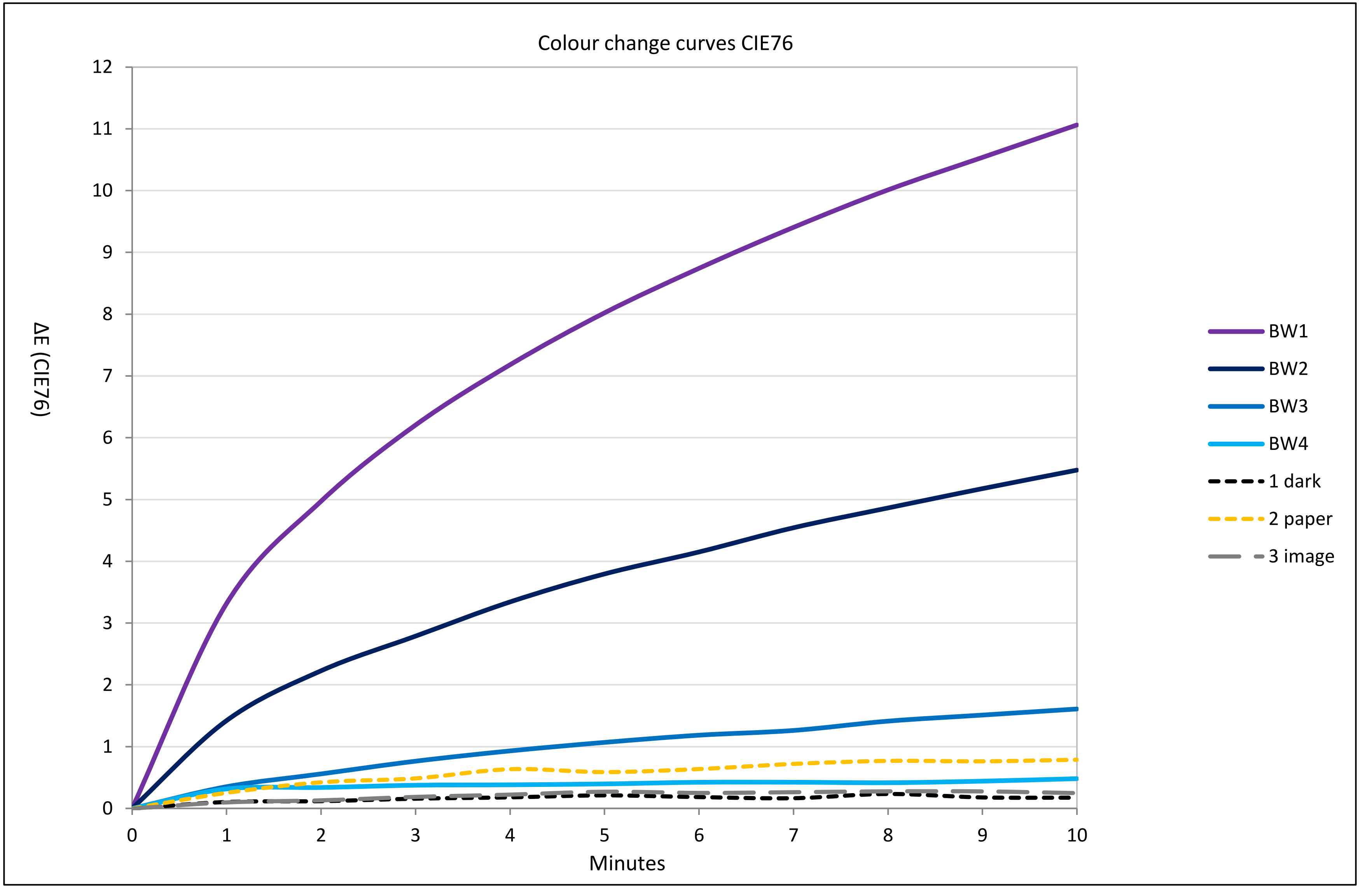


Figure 8. Colour change curves, CIE76

Notes & References

Endnote 1

Microfade testing is a highly accelerated form of light exposure (millions of lux) and as with any accelerated ageing technique there are uncertainties surrounding the correlation between what is observed at very high test intensities and is likely to occur on display and during subsequent storage (Whitmore et al 2000). It is a semi-quantitative risk assessment tool rather than predictive. The results in this case apply only to UV-free light and because the colour temperature of the test illuminant is higher (in excess of 5000^{0}K) than most gallery light sources except UV-filtered daylight, and other fundamental assumptions are conservative, the microfading results are likely to be overestimates.

Endnote 2

The conclusions in this summary have been discussed in terms of the CIE2000 perceptual model for colour change, however the CIE76 (CIELAB)results are also provided in Table 1 and Figures 7 & 8. Much of the instrumental colourimetric fading data in the conservation literature is in the CIE76 (CIELAB) colour space, however because CIE2000 is the most perceptually uniform space , relative lightfastness is likely to be more accurate using this metric.

The ISO Blue Wools are assessed as more lightfast by approximately 1BW step for the same light exposure in the CIE2000 perceptual model, and because some other colours are not so greatly affected by the revision of the perceptual model, they appear less lightfast by comparison - that is according to their BW ratings. The data for Blue Wool fading rates in CIE157 (CIE2004) are themselves approximations with a probable error of ± 1 BW step (Michalski 2010), therefore absolute predictions of the response of a colourant to a particular exposure (mlx-h) are uncertain to a similar extent. Research into this issue is ongoing.

Endnote 3

The significance of microfading results for paper is unclear because of the complexity of the reactions involved in its ageing both as a result of light exposure and other mechanisms. Microfading usually reflects only the photo-bleaching of paper and parchment under UV-free conditions however concurrent thermal reactions lead to yellowing as well as reactions initiated by light but which continue during subsequent dark storage (post-actinic processes).

Endnote 4

Effective display lifetimes are based on a Just Noticeable Difference (JND) = 1.6ΔE; 10 JND's are taken to constitute unacceptable colour loss for exhibition purposes (Ashley-Smith et. al 2002). This is only 1/3rd the 30 JND suggested by Michalski (2012).

The NMA further makes a judgement based on a significance test as to whether the object/collection is likely to be in strong demand for exhibition and/or whether the colour is an important attribute of the object and adjusts recommended exposures accordingly.

References

AIC 2004, PMG Section 1.4.1 Standards, Guidelines, and Recommendations for Light Levels During Exhibition, http://www.conservation-wiki.com/wiki/PMG_Section_1.4.1_Standards,_Guidelines,_and_Recommendations_for_Light_Levels_During_Exhibition

Ashley-Smith, J, Derbyshire, A & Pretzel, B 2002, 'The continuing development of a practical lighting policy for works of art on paper and other object types at the Victoria and Albert Museum', *Preprints of the 13th triennial meeting of the ICOM Committee for Conservation in Rio de Janeiro*, vol.1, pp. 3-8.

CIE 2004, *CIE 157-2004, control of damage to museum objects by optical radiation*, 20. Vienna: Bureau Central de la Commission Internationale de l'Éclairage

Ford, B & N Smith, N, 2009, 'The development of a significance and risk based lighting framework at the National Museum of Australia', AICCM Bulletin vol. 32 pp. 80-86.

Michalski, S. 2010. Personal communication, October 10. Canadian Conservation Institute.

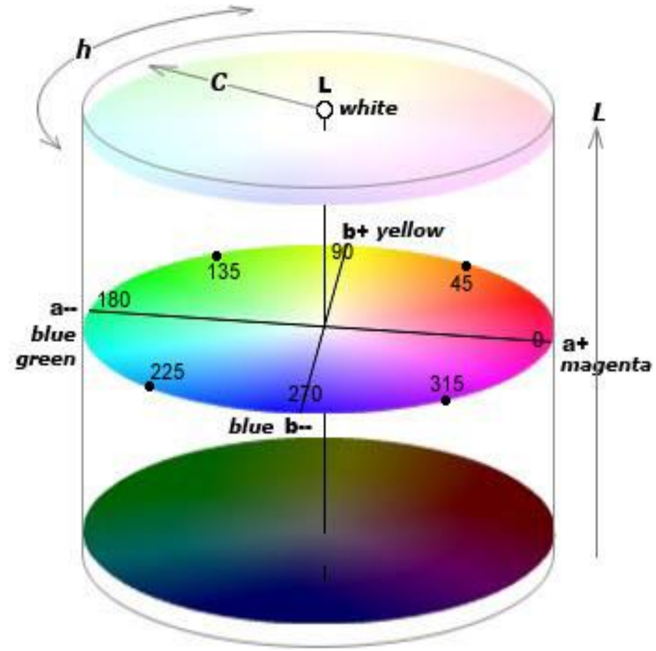
Michalski, S. 2012. 'Light, ultraviolet and infrared'. Footnote to Table 3. http://www.cci-icc.gc.ca/caringfor-prendresoindes/articles/10agents/chap08-eng.aspx (8/12/12)

Whitmore, PM, Bailie, C & S. Connors, 2000, 'Micro-fading to predict the result of exhibition: progress and prospects', in *Tradition and Innovation: Advances in Conservation*, ed. A. Roy and P. Smith, pp. 200-205. London: IIC

For a more complete list of references to microfading and its applications see http://www.microfading.com/resources.html

Instrument Settings

Spot power (mW)	~ 3.5
Luminous flux (mlm)	~700
Spot lux (megalux)	~ 6-8
Spot size (mm)	0.3
Colour difference equations	∆E CIE 2000, 1976



L* a* b* and L C h are different ways of describing the same shift in CIELAB space

L* = Lightness
a* = red-green axis
b* = yellow-blue axis

C = vividness (chroma)
h = hue angle anticlockwise from red (0)