

On the colours of academic gowns in Spain: Preliminary results

M. Melgosa^{}, R. Huertas^{*}, M. J. Rivas^{*} and M. Suárez^{**},*

^{}Departamento de Óptica, Facultad de Ciencias, Universidad de Granada, 18071-Granada (SPAIN)*

*^{**}Gabinete de Relaciones Institucionales, Universidad de Granada, 18071-Granada (SPAIN)*

Corresponding author: M. Melgosa (mmelgosa@ugr.es)

ABSTRACT

The colours of the academic gowns currently employed in Spain have been analysed with two main goals: to provide a numerical characterization of the colours assigned to the most traditional disciplines, and to suggest new potential colours for the academic gowns of emerging disciplines. This latter problem has been pointed out in protocol studies, and requires new colours which must be clearly distinguishable from the ones used for traditional disciplines. In summary, we look for a rigorous characterization of the colours employed for the academic gowns used in the Spanish universities, in order to preserve and consolidate this beautiful and old tradition, which could also be adopted by universities in other countries.

1. INTRODUCTION

Preservation of cultural heritage and historical tradition is increasingly important in most developed countries. Historically, the university as well as the church and the army, have been institutions with a rich ceremonial array of symbols, where dress has always played an important role¹. Academic gowns are perhaps one of the most distinctive signs of the universities².

Current academic gown is the last step in a large chain starting from Roman culture, later modified by the church, undoubtedly the most influential institution for the earlier development of the old European universities, these emerging beginning in the last quarter of the XII century. Different colours were used for academic gowns in order to distinguish both personal categories and academic disciplines, as shown by paintings from XV to XVII centuries³. For simplicity, we will restrict our present work to the academic gown currently used in Spain, which was fixed mainly by specific normative laid down in 1850 by the Spanish queen Isabel II. Academic gowns used in universities from other European countries significantly differ from the one described here. In general, the mechanisms by which particular colours become linked with specific goals are not simple, and the selected colours usually change from one country to other.

The main components of the Spanish academic gown have been described in the literature^{1,2} and are shown in Figure 1 (some additional complements such as white gloves, medals, or rings have been omitted from this Figure). The *toga*, analogous to the one worn by lawyers, constitutes the basic element of all academic gowns. It is always a black dress, which is worn under a black suit (with a white shirt, and white tie or bow tie), and is inspired by Roman tunics, as well as clerical and monastic habits. The *toga* is complemented by the *puñetas*, *muceta* and *birrete*, which are three garments with identical specific colours, associated with the different academic disciplines or faculties. Originally, the *puñetas* (also



Figure 1: Main garments constituting the academic gown currently used in Spain (frontal view).

known as *vuelillos*) were practical elements used to protect the wristband of the toga, and later they became a sign of distinction or authority. Currently, they are common elements made of white lace under satin with the specific colour of the faculty. The *muceta* is a short cape or cloak, similar to the ones worn by bishops or prelates, which has the meaning of ‘protection for the development and improvement of the knowledge’. Inside and outside parts of the *muceta* are made of black silk and satin with the colour of the corresponding faculty, respectively. The outer part of the *muceta* of the President of the University is always made of black velvet. The front part of the *muceta* is closed by a set of buttons with the specific colour of the faculty (gold buttons in the case of the President of the University), while the posterior part has a fold, designed as *cogulla*, which was used in the past to protect from rain as well as to carry papers or documents. Finally, the *birrete* is perhaps the most curious or flashy element of the Spanish academic gown. It has particular symbolic relevance as the appropriate garment for the head, like “crown of scientific knowledge and academic merit”. The *birrete* is octagonal, covered with black silk, and with large coloured fringes which fall on the sides of the octagon, culminating in the upper part in a curved element known as *borla*.

2. METHODS AND RESULTS

Currently, the colours related to each discipline are known only by their names, but the numerical colour specifications have not been reported. This could lead to important colour differences between different manufactures, or even for the same manufacturer using materials from different suppliers. In order to have data of the colour related to the different academic disciplines, we have obtained a set of non-used textile samples of the 15 colours currently employed by a very traditional manufacturer of academic gowns (Sastrería Barragán; Espoz y Mina 7, Madrid). Today, Spain has very few manufacturers of academic gowns. These samples were measured using an Oracolor spectrophotometer produced by Corob (Swisslog Group) with a d/0° geometry, specular component included. CIELAB colour coordinates⁴ were computed assuming D65 illuminant and CIE 1964 Supplementary Standard Observer, and the results found are shown in Table 1.

Table 1: CIELAB coordinates (D65/CIE 1964 Supplementary Standard Observer) of the 15 colours supplied by a traditional manufacturer of academic gowns in Spain (Sastrería Barragán, Espoz y Mina 7, Madrid, Spain), together with the usual name used for each colour, and the related academic discipline/s.

Colour Names	L^*_{10}	a^*_{10}	b^*_{10}	Academic Discipline/s
Black	21.05	0.495	-1.615	President of the University
Purple	27.335	22.845	-30.455	Pharmacy
Green	27.475	-16.64	1.64	Veterinary, Commerce, Canon Law
Cobalt Blue	32.965	4.375	-36.07	Physics, Chemistry, Biology, Mathematics and Geology
Dark Red	36.755	34.505	12.11	Food Science
Red	39.42	55.395	28.56	Law
Brown	40.53	16.12	25.545	Engineering and Architecture
Fuchsia	47.11	63.935	-8.255	Odontology
Sky Blue	57.315	-6.8	-15.985	Philosophy, Geography and Philology
Violet	63.815	15.29	-12.6	Psychology
Orange	64.215	23.95	42.705	Sociology, Economics and Business
Lead Grey	64.565	-2.57	-6.64	Nursing and Information Science
Light Green	68.93	-12.285	10.93	Sport Science and Tourism
Yellow	71.28	4.435	68.185	Medicine
White	86.95	0.015	-1.92	Fine Arts and Theology

These colour samples were also scanned⁵, in such a way that enough different textures were perceived for the different samples, although this aspect will not be considered here. In our opinion, these measured samples could not be adopted as absolute standards for the academic disciplines, because they only represent the colours of the textile materials employed at a specific moment for a

given manufacturer. Anyway, the results shown in Table 1 have been plotted in CIELAB space (Figure 2), because it is interesting to note that there are no colours in the region with high negative values of a^* . Obviously, this region should provide us new colours for the academic gowns of new emerging disciplines, a problem which has been previously reported by protocol experts. For example, it has been suggested to employ a very dark blue colour (navy blue) for the academic gowns of Ph.D.'s in Naval Engineering, but this proposal has not been accepted, mainly because of the similarity between this colour and the black one, which must be a special distinctive for the President of the University. The possibility of using two or more different colours for the academic gowns of new disciplines must also be discarded, because this option is the traditional one in Spanish universities for people who have earned more than one Ph.D.

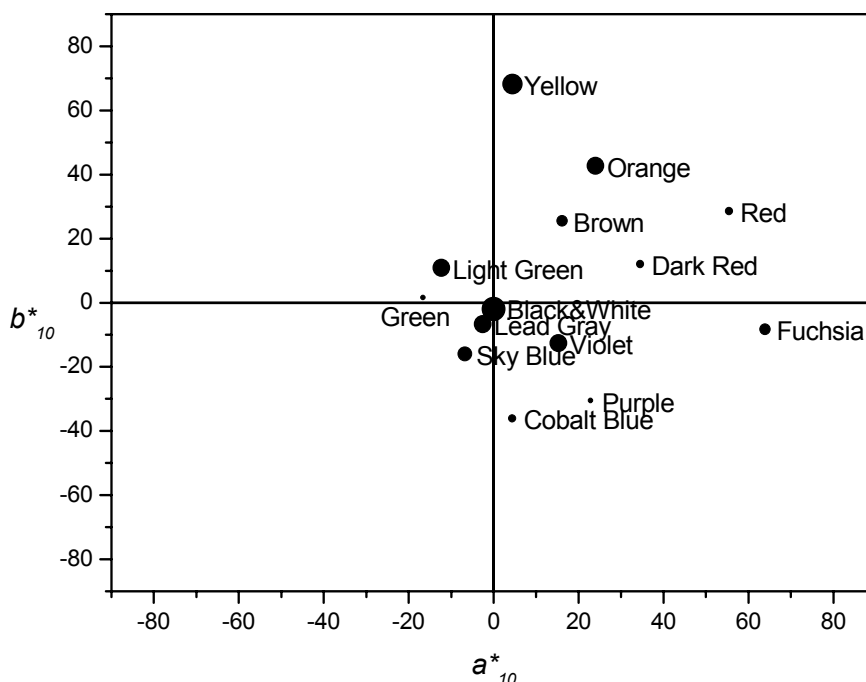


Figure 2: CIELAB coordinates (D65/CIE 1964 Supplementary Standard Observer) of the 15 colours of the academic gowns shown in Table 1. The size of the dots is indicative of the L^*_{10} values: higher lightness is shown by bigger points.

The data shown in Table 1 have been used as the starting point for the design of a lattice in colour space, which provides a set of colours, all of them clearly distinguishable for observers with normal colour vision. This lattice provides colours which are acceptably close to each of the ones shown in Table 1, as well as additional colours which could be used for academic gowns of new academic disciplines.

For the design of this lattice, we preferred to employ the DIN99d colour space⁶ because of its improved perceptual uniformity with respect to CIELAB. The geometry of our lattice was the rhombohedral chosen by the Optical Society of America for its Uniform Color Scales^{7,8}. The rhombohedral lattice is a type of “closest packing” where each point of the lattice is surrounded by 12 nearest neighbours, all equidistant. This minimal constant distance represents an important characteristic of the lattice, which must be carefully chosen: a short distance leads to a great number of samples, while a large distance leads to few samples which are not sufficiently close to the colours given in Table 1. The polyhedron formed by the 12 points is also called a cubo-octahedron because it can be formed by cutting off the eight corners of a cube to the middle of its 12 edges. According to Fox⁹, this method is the basis on which to assemble a collection of colour chips of fixed total number that shall have the greatest possibility of including a near match for any colour chosen at random.

The final lattice we have designed has 54 standard colours, the average colour difference between nearest neighbours being 17.9 CIELAB units (with a standard deviation of 6.9 CIELAB

units). Bearing in mind that a suprathreshold colour-difference for surface colours is about 1.75 CIELAB units¹⁰, these 54 colours can be considered clearly discernible for observers with normal colour vision. In addition, some variations between the colours of the different materials available to manufacturers are allowed. The average colour difference between the 15 colours given in Table 1 and 15 colours included in our lattice is 5.4 CIELAB units (with a standard deviation of 2.0 CIELAB units). Thus, we propose 15 colours which are relatively close to the traditional ones (Table 1), and 39 additional colours clearly distinguishable among them, which should be useful for assignation to the academic gowns of new academic disciplines in Spanish universities. For the sake of brevity, the CIELAB coordinates of these 54 proposed colours are not given here, and will be reported in a forthcoming paper.

Acknowledgments

To Dr. Claudio Oleari, Dr. Fernando Fermi, and Remo Reverberi (Dipartimento di Fisica, Università degli Studi di Parma, Italy), for helpful assistance with experimental measurements and interesting comments. To Sastrería Barragán (Espoz y Mina 7, Madrid, Spain) for kind assistance for the development of this work, and free supply of textiles samples. Azioni Integrate Italia-Spagna IT928, MIUR 2003 (Italy); Acción Integrada HI2002-0076, Ministerio de Ciencia y Tecnología (Spain). Research Project FIS2004-05537, Ministerio de Educación y Ciencia (Spain).

References

1. E. Hernández, "De universitatis splendour," *Revista Electrónica de Estudios Filológicos*, Num. 4, November (2002), <http://www.tonosdigital.com>.
2. A. Martín, "Ritual y uso del traje académico," presented at El Protocolo en la Universidad. I Encuentro de Responsables de Protocolo y Relaciones Institucionales de las Universidades Españolas, Granada (Spain), 1997.
3. A. Darías, "Los colores en la indumentaria académica: pasado y futuro," presented at II Encuentro de Responsables de Protocolo y Relaciones Institucionales de las Universidades Españolas, La Rioja (Spain), 1997.
4. CIE Publication 15.2, *Colorimetry 2nd Edition* (CIE Central Bureau, Vienna, 1986).
5. G. Antonioli, F. Fermi, C. Oleari, R. Reverberi, "Spectrophotometric scanner for imaging of paintings and other works of art," in *Proceeding of the Second European Conference on Colour in Graphics, Imaging and Vision* (Society for Imaging Science and Technology, Springfield, Va., 2004), p. 219.
6. G. Cui, M. R. Luo, B. Rigg, G. Roesler, K. Witt, "Uniform colour spaces based on the DIN99 colour-difference formula," *Color Res. Appl.*, 27, 282-290 (2002).
7. G. Wyszecki, "A regular rhombohedral lattice sampling of Munsell renotation space," *J. Opt. Soc. Am.*, 44, 725-734 (1954).
8. J. T. Luke, "OSA instrumental in development of the uniform color scales," *Optics & Photonics News*, September, 29-33 (1999).
9. D. L. MacAdam, "Uniform color scales," *J. Opt. Soc. Am.*, 64, 1691-1702 (1974).
10. M. Melgosa, E. Hita, A. J. Poza, D. H. Alman, R. S. Berns, "Suprathreshold color-difference ellipsoids for surface colors," *Color Res Appl.*, 22:148-155 (1997).