Chantry Library Bibliographies:
No. 3: Woven Fabrics in Book Conservation by Celia Bockmuehl and Nikki Tomkins, OCC

From 2017 to 2019, Celia Bockmuehl and Nikki Tomkins of the Oxford Conservation Consortium, participated in a collaborative research project to test material properties of cotton and linen used in book conservation. Their research in this area required an extensive literature search and was guided by materials scientists at Cranfield University. The project findings on strength and durability of cotton and linen woven fabrics were published in IIC's peer-reviewed *Studies in Conservation*, available here.

Celia Bockmuehl gained an MA in paper conservation from the University of Northumbria after graduating with a BA in Chinese Studies from Durham University. Her first conservation post was at the British Museum in the department of Eastern Pictorial Art and subsequently she worked at the Fitzwilliam Museum in Cambridge for 13 years.

Nikki Tomkins graduated with an MA in book conservation from Camberwell College of Arts in 2015, before joining the Oxford Conservation Consortium as a conservator in the autumn of that year. She also holds an undergraduate degree in English and History from the University of Leeds.

Introduction

Woven fabrics have a long history in the production and repair of books. Since the 1980s, woven fabrics referred to as 'aerocotton' and 'aerolinen' have been used by conservators for spine linings and board reattachment. Testing repair materials is an imperative in conservation, and during our research project, we identified the following key sources which we hope will be helpful for future research and testing.

Books

Brock, David, 'Split-hinge board reattachment', *Conservation of Leather and Related Materials*. Marion Kite and Roy Thomson, eds. Routledge, 2006.

David Brock's chapter on spine linings directly references the use of 'airplane linen' cut on the bias in board attachment. Brock explains how to use the fabric as both a spine lining and integral part of the board attachment, and includes a useful illustration to demonstrate the placement of the fabric.

May, Eric, and Mark Jones, eds. *Conservation Science: Heritage Materials*. Cambridge: Royal Society of Chemistry, 2006.

This seminal text provides a broad scientific understanding of the materials we use and work with as conservators, examining their composition and modes of degradation. A number of specialists in the field have contributed to the text, reflected in its cross-disciplinary content. This work explains clearly the chemistry behind cotton and linen woven fabrics which is essential for assessing how they will behave when used.

Articles

Bockmuehl, CR, Tomkins, N., Keiding, J., Critchley, R., Peare, A., and D.J. Carr, 'Woven fabrics in book conservation: An investigation into the properties of aerolinen and aerocotton', *Studies in Conservation* 65.7 (2020) 375-387.

An understanding of the strength, composition, and longevity of repair materials is central to conservation practice and this investigation tested two linens and two cottons alongside a discontinued cotton fabric to quantify the relative strengths of the fabrics. Each fabric was tested before and after laundering, and in three directions (warp, weft, and bias). The tests conducted measured mass per unit area, thickness, sett,

tensile strength, folding endurance, and dimensional change. Results and conclusions provide concrete information to guide conservators in the preparation and use of aerocottons and aerolinens in conservation treatments.

Carr, Debra, N. Cruthers, C. Smith and T. Myers, 'Identification of selected vegetable textile fibres IIC Reviews in Conservation Number 9 2008, 75-87
This article provides a useful literature review on the identification of vegetable textile fibres and includes an extensive table with the characteristics and tests for identifying cotton and ramie amongst many other fibres. It is a useful reference tool for anyone wanting to identify vegetable fibres and the best methods for so doing.

Clarkson, Christopher, 'Board Slotting: A New Technique for Re-Attaching Bookboards', IPC Conference Papers Manchester, S. Fairbrass, ed. Leigh, 1992. 158-164.
Clarkson explored the board-slotting technique for board reattachment in book bindings. This technique relies on aerocotton or aerolinen as the primary material, referred to by Clarkson as 'airplane linen', and this paper is one of the earliest publications that refers to the material as such. His technique relies on the strength and durability of the woven fabric, as it is the primary component of the new hinge in the board attachment and will take all the mechanical stress of the opening.

Dorning, David, 'The Development of a Testing Method for Assessing Book Joint Repair', *The Paper Conservator* 29 (2005): 25–38.
David Dorning took a different approach to testing the folding endurance of woven fabrics in the context of a book joint. In this article he outlines the construction of a bespoke machine that imitates the action of a folding book joint, in order to test precisely the durability of different materials. It is an interesting approach but non standardised and as far as we know, a unique piece of equipment available only at West Dean.

Minter, William, 'The Use of Linen as a Book Covering Material', *The Book and Paper Group Annual* 4 (1985) 4-7.
Although woven fabrics have a long history in the production and repair of books, their application in contemporary conservation treatments and the search for the strongest, most durable material, has been relatively recent. Minter's text outlines the discussions and material choices taking place in the 1980s, providing a broader context of the use of linen in book conservation.

Neville, Elizabeth, 'Aero Cotton and Aero Linen', *The Bookbinder* 30 (2016) 59-68.
Literature that specifically focuses on fabrics referred to as 'aerolinen' or 'aerocotton' is limited, and Neville's research in 2016 sought to bring together a range of reflections and research on the subject. Neville takes an empirical approach, describing the handle and characteristics of the materials alongside reflections on their performance.

Zimmern, Friederike, 'Board Slotting: A Machine-Supported Book Conservation Method', *The Book and Paper Group Annual* 19 (2000) 19–25.
Zimmern's work has for a long time been the point of reference for assessing the folding endurance of aerolinen and aerocotton. The results show some clear differences in durability between the two materials. This paper shaped the direction of our subsequent research, and acted as a preliminary study with which to compare our folding endurance results.

Sawicki, Rachel, 'To What Extent Are the Mechanical Properties of Aerocotton and Aerolinen Affected by Warp Orientation, Washing and Use of Acrylic Paint for Colouring in the Context of Board Reattachment?', unpublished MA dissertation, West Dean College, 2009.
A well-presented, extensive MA thesis from Sawicki which builds on Zimmern's results and takes them further. The testing methods made use of the bespoke Dorning machine at West Dean, and the scope of her research also sought to look at the effect of dyeing techniques with acrylic. Sawicki has placed a copy of her dissertation in the Chantry Library.

British Standards
Reference was made to the standards below in order to ensure that the research undertaken complied as far as possible with the criteria used in independent testing and to ensure that the tests could be repeated and the results compared.

British Standards Institute. 1977. *BS 5523:1977 Glossary of Terms for Textiles - Weaves - Definitions of General Terms and Basic Weaves*.

British Standards Institute. 1992a. *BS 7F 8 Specification for 140 g/M2 Mercerized Cotton Fabrics and Serrated Edge Strip for Aerospace Purposes*.

British Standards Institute. 1992b. *BS 9F 1:1992 Specification for 140 g/m Linen (Flax) Fabric and Serrated Edge Strip for Aerospace Purposes*.

British Standards Institute. 1994. *BS EN 1049-2 Textiles. Woven Fabrics. Construction. Methods of Analysis. Determination of Number of Threads per Unit Length*.

British Standards Institute. 1997. *BS EN ISO 5084 Textiles. Determination of Thickness of Textiles and Textile Products*.

British Standards Institute. 1998. *BS EN 12127 Textiles. Fabrics. Determination of Mass per Unit Area Using Small Samples*.

British Standards Institute. 2008. *BS EN ISO 5077 Textiles -- Determination of Dimensional Change in Washing and Drying*.

British Standards Institute. 2011a. *BS EN ISO 139:2005/Amd 1:2011 Textiles -- Standard Atmospheres for Conditioning and Testing*.

British Standards Institute. 2011b. *BS EN ISO 3759 Textiles -- Preparation, Marking and Measuring of Fabric Specimens and Garments in Tests for Determination of Dimensional Change*.

British Standards Institute. 2012. *BS EN ISO 6330 Textiles -- Domestic Washing and Drying Procedures for Textile Testing*.

British Standards Institute. 2013. *BS EN ISO 13934-1 Textiles. Tensile Properties of Fabrics. Determination of Maximum Force and Elongation at Maximum Force Using the Strip Method*.