

**Axminster Carpet: Visual Design Strategies
for Appearance Retention**

by
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Declaration

The material presented in this exegesis is original, except where due acknowledgment is given, and has not been accepted for the award of any other degree or diploma.

Robyn Glade-Wright

Date 17.3.2001

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Abstract

This project demonstrates how the functional life of wall-to-wall carpet can be extended through the visual design process. The judicious selection of visual design strategies and the way they are integrated into the woven surface has the capability of retaining vibrancy and a fresh appearance in Axminster wall-to-wall carpet. In carrying out this research I have studied and then exploited the historical and contemporary languages of design, including: pattern structure, illusion of depth, the psychological and physiological influence of colour and the characteristics of optical colour mixing. The carpet prototypes illustrating the research outcomes have been specifically designed for the high foot-traffic demands of today's hospitality and leisure industries.

In developing the outcomes of my research I have investigated historical precedents which have significantly contributed to present-day wall-to-wall carpet design. This includes the appropriation of central and western Asian cultural motifs by English weavers in the 16th century, the influence of fashion on carpet from the Neo-Classic period, the adoption of flat-coloured woven surfaces in Modernism and the influence of Postmodernism on interior architecture. The project also shows how forgotten design techniques such as those employed in Mamluk carpets can be applied in contemporary wall-to-wall carpet designs.

While the research addresses the specific functional requirements of the hospitality and leisure industries, it also seeks to imbue the carpet prototypes with a sense of time and place by integrating imagery from Australia's natural environment and cultural heritage. In doing this my research demonstrates how the surface of wall-to-wall carpet can be a significant medium in articulating expressions of contemporary cultural relevance.

Acknowledgments

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Introduction

The purpose of this exegesis is to describe the characteristics of Axminster carpet design which can be exploited to extend the performance and appearance retention factors of carpets. Exploitation of these characteristics has been tested in Axminster carpet prototypes which have been specifically designed for the hospitality and leisure industries. In order to capture a sense of time, place and purpose in these prototypes, Australia's natural environment and cultural heritage have been investigated to develop the outcomes for the visual research.

Axminster is high-quality, wall-to-wall carpet with a uniform cut pile surface. It has the capacity for a complex use of colour although due to cost factors, the number of colours employed in a design is usually limited to 18. Axminster carpet design is limited by the need for a pattern repeat and by the number of pile tufts per square centimetre. In most cases Axminster carpets contain 8.5 to 10.9 pile tufts per square centimetre, producing a relatively coarse surface pile structure. This places a severe restriction on the visual design process because fine detail cannot be woven. Hand-woven carpet contains twice to ten times the number of tuft positions as Axminster carpet, permitting a greater level of detail and more complex designs to be woven than is possible in the Axminster process.¹ Axminster carpet is woven in widths ranging from 69 to 366 centimetres. The carpet sections are sewn together to form a wall-to-wall floor covering. This process requires a pattern repeat and in this respect Axminster carpet design differs significantly from that of rugs. Rugs are independent units and therefore are free from the need for a repeat pattern. Rugs are similar in format to painted canvases and, as such, have attracted considerable design interest from visual artists over the past 50 years, as seen in the work of Fernand Leger, Joan Miro and Jean Arp.

On the other hand, wall-to-wall carpet design has demonstrated little innovation because of Modernism's preference for simple, flat-coloured patterned surfaces over the elaborate, decorative use of image. One other factor has also mitigated against a

¹ The terminology used to describe hand-knotted rugs and carpets varies between carpet historians. Some historians describe carpets as a hand-knotted items with a surface area larger than forty square feet and rugs as hand-knotted items with a surface area less than forty square feet. Other carpet historians label all hand-knotted items as carpets regardless of size and, for the sake of uniformity I have chosen to use this particular description throughout this exegesis.

dynamic and purposeful design culture in the wall-to-wall carpet product. I refer here to the position of the traditional designer/maker who has direct and continuous contact with materials preparation and the processes of weaving, compared with that of the modern-day computer designer, who often works in a different city from the carpet factory. The inherent danger is that the computer designer is often removed from an intimate commitment to the full development of the product, particularly within the critical relationship between materials and culturally significant meaning. Furthermore, the small scale industrial textile design culture in Australia has meant that aesthetic innovation and locally inspired content are rarely evident in wall-to-wall carpets. This is largely due to United Kingdom and European parent companies establishing off-shore factories in Australia that repeat home country products. For example, Waverley Woollen Mills, located in Launceston, Tasmania, has relied extensively on designs from the United Kingdom such as traditional tartans and plaids.

In essence, the short history of wall-to-wall carpet manufacture in Australia and the relatively low value placed on the role of the designer has produced a manufacturing culture where aesthetics and design innovation have yet to be fully integrated into the total manufacturing process.

There are several factors which have led to Australia's low regard for industrial design. Historically, Australia has depended on producing raw materials such as wool for export, relying on the manufacturing expertise of England, Europe, India, America and China for down-stream processing. Even as late as the 1950s and early 1960s, when there was unprecedented growth in the building, construction and manufacturing sectors of the economy, the status of the industrial designer's role in Australia failed to crystallise as a major part of industrial culture. Instead, product design was borrowed, heavily influenced by, or purchased from, North America, Europe and Japan.

During this period industrial products were often viewed as bland and unrepresentative of the Australian way of life. By and large, most manufactured goods presented ideals and icons from elsewhere and failed to capture the physical and social conditions that reflected our place in the world. In this period of rapid economic expansion machinery was developed specifically to increase production rates and lower unit costs, often denying the creation of elaborate products that married design innovation with cultural import.

As a result of the ubiquity of these relatively dull, uninspiring industrial products—particularly tableware, silverware, bedding and carpeting—the re-emergence of the hand-made, limited edition object gained acceptance as a personalised product, carrying the so-called ‘makers mark’. These hand-crafted products were utilitarian, presented the ideal of ‘truth to materials’ and, significantly, expressed the time of their making. In this manufacturing strategy the designer was also maker, infusing the product with an array of hand-crafted sensibilities long lost in the 20th century industrial streamlined processes. The international environment and the economic and social settings were right for a flourishing craft revival in the 1970s and 1980s, the kind of which had not existed since the days of William Morris a century ago.

Like all movements, however, this craft revival eventually lost its way by failing to adjust to changing market forces, increased labour costs and the flood of imported, cheap handmade goods from Third World countries. It must be said, though, that some of the endearing qualities of the crafts movement have made their way across and into the manufacturing sectors. This is evident today in the way some worldwide manufacturers of glassware, tableware, bedding and furniture have contracted the skills of craftspeople and artists in the total design process. The Italian company Alessi and the ceramic tableware manufacturers Wedgwood of Great Britain and Arabia in Finland are three notable contemporary examples.

Unlike William Morris who sought to dignify the individual’s work by avoiding industrial production, and who ‘hated the ability of the machine to dehumanise labour and to debase design’², I have engaged the machine and high technology in creating designs for wall-to-wall carpet. My contention is that, despite its rigid practices, industrial manufacture has the potential to widen the radius of conventional artistic practice and therefore contribute to the democratisation of the visual experience.³

² Oliver Fairclough & Emmeline Leary, *Textiles by William Morris and Morris & Co.*, Thames & Hudson, 1981, London, p.14.

³ Ironically, within a decade of the Morris firm’s liquidation in 1940, his printed patterns were being reproduced by industrial machinery and are now more widely recognised than ever before.

1. The Evolution of Knotted-Pile Carpet

The aim of this research is to identify visual design characteristics which extend the appearance retention factor of carpets. Hand-woven, oriental carpets are unique in exhibiting a tireless beauty and the capacity to retain a vital appearance even after decades of use. By examining the development of early hand-knotted carpets it is possible to identify the factors which contribute to their appearance retention and to re-assess our current approach to carpet design. This view is endorsed by the postmodern architect and author Charles Jencks in his comment: "There is no future which does not relate fundamentally to the past."¹

Knotted-pile weaving has a long sequence within the development of textile techniques. Spinning pre-dates the invention of weaving by 13,000 years. Carved bone Venus figurines found in Lespugue, France, dating from 20,000 BC, have skirts made of string (Figure 1).² These figurines indicate that early clothes provided little in the way of warmth or protection and probably functioned as an aid to the process of procreation, indicating reproductive readiness.³ The textile techniques of twining, netting and knotting with a single thread also developed prior to the invention of weaving.

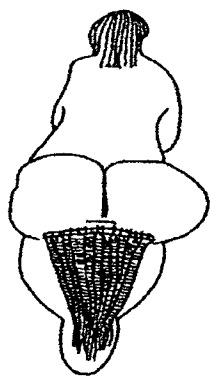


Figure 1. String skirt, 20,000 BC

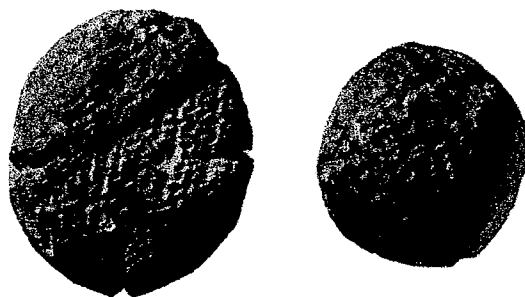


Figure 2. Clay balls, 7000 BC

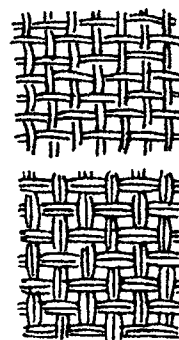


Figure 3. Plain weave (top)
Basket weave (bottom)

¹ Charles Jencks, *What is Post-Modernism?*, Academy Editions, London, 1986, p.70.

² Elizabeth Wayland Barber, *Women's Work: The First 20,000 Years*, Norton, New York, 1995, p.44.

³ Barber, *Women's Work: The First 20,000 Years*, p.59.

The earliest evidence of weaving appears on the surface of two clay balls found in Jarmo, Iraq, dating from around 7,000 BC, at the time when Neolithic people began to settle in permanent dwellings and farm domestic animals (Figure 2). The clay balls bear the impression of plain weave and basket weave (Figure 3).⁴

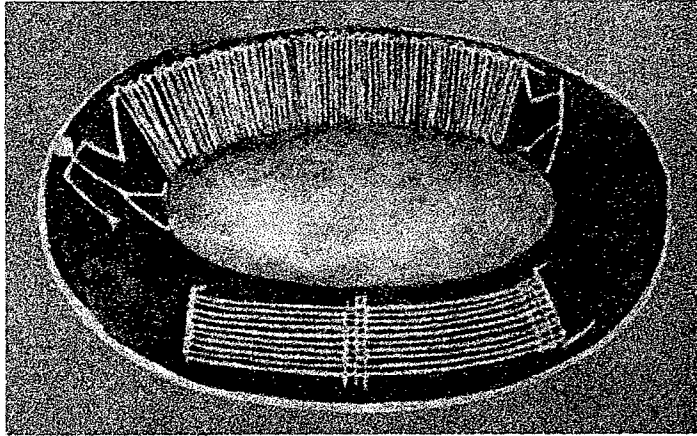


Figure 4. Egyptian pottery dish, 4500 BC

The first depiction of a loom appears on a Pre-Dynastic Egyptian pottery dish dating from around 4500 BC (Figure 4).⁵ The loom is set up in a horizontal configuration in which the warp is stretched out between two beams that are pegged to the ground. Looms of this type remain in current use by nomadic tribes in central Asia.

Ground weave

Weaving requires two separate sets of threads. The warp set is held under tension by the loom. The weft set runs at right angles to the warp passing over and under the warp threads, alternating its passage in each subsequent row. The basic plain or ground weave structure (Figure 5) produces a light-weight fabric suitable for clothing in warm climates. Thicker and warmer fabrics are woven by pulling loops of weft thread out of the ground weave to form a pile (Figure 6). A pile surface can also be produced by sewing extra weft into the ground weave.⁶

⁴ Barber, *Women's Work: The First 20,000 Years*, p.78.

⁵ Peter Collingwood, in Ann Sutton, Peter Collingwood & Geraldine St Aubyn Hubbard, *The Craft of the Weaver*, British Broadcasting Corporation, London, 1982, p.137.

⁶ P.R.J. Ford, *Oriental Carpet Design*, Thames & Hudson, London, 1981, p.33.

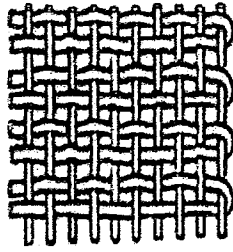


Figure 5. Plain, ground weave

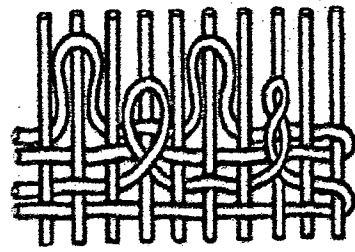


Figure 6. Weft loops pulled out of the ground weave

Articles of pile-woven woollen blankets and clothing were used in Scandinavia from around 3500 BC.⁷ The loop-pile rugs woven in Scandinavia since the Bronze Age are known as rya rugs (Figure 7).⁸ Rya rugs were primarily used for bedding to provide warmth when sleeping, with the pile facing downwards. This differs from the pile-woven textiles produced in central Asia in which the pile faces upwards.

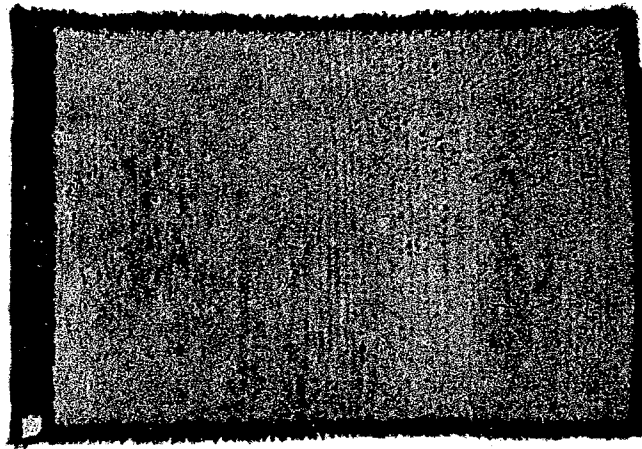


Figure 7. Rya rug from Sakyla

Loop-pile rugs have a shaggy appearance, closely resembling the animal furs which they eventually replaced. The ability to comb wool fibres from sheep and spin and weave a warm fabric eliminated the need to kill the animal for its woollen skin, thereby ensuring a continued source of fibre. Furthermore, animal skins were limited in size, shape and surface condition, whereas woven fabrics could be constructed in a regular shape and woven to larger sizes.

⁷ Riitta Pytkkanen, *The Use and Traditions of Medieval Rugs and Coverlets in Finland*, Archaeological Society of Finland, Helsinki, 1974, p.45.

⁸ Angus Geijer, *A History of Textile Art*, Pasold Research Fund Ltd., London, 1979, p.179.

Sheep were domesticated in the Near East countries, including Iran, Iraq and Anatolia, around 8000 BC where they were initially raised to provide meat. Around 4000 BC selective breeding had culminated in sheep which had a predominantly woollen coat in place of the earlier breeds that had harsh coats composed mainly of kemp fibres.⁹

The domestication of the horse was another important advance in animal husbandry. This occurred around 4000 BC and led to a significant change in the pastoralist's lifestyle, because it was now possible to control a herd of sheep on horseback. This new mobility enabled the pastoralists to inhabit the Great Asian Steppe, a grassland corridor stretching for approximately 8000 kilometres from central Europe to northern China (Figure 8).¹⁰



Figure 8. The Great Asian Steppe

With the migration of the nomadic tribes across the high mountainous regions of the Great Asian Steppe came the need for warmth, protection and comfort from the extremely cold overnight temperatures experienced at these high altitudes. The nomadic lifestyle required possessions that were easy to transport from one camp to the next and which could be manufactured from the resources of the herd. Wool and leather were important raw materials for the tribes. Woollen fibres were felted to form circular tents known as 'yurts'. Pile-woven woollen floor coverings offered protection and comfort from the

⁹ Barber, *The Mummies of Urumchi*, W.W. Norton & Co., London, 1999, p.63.

¹⁰ Barber, *The Mummies of Urumchi*, p.36.

rough, stony ground when sitting and sleeping, and could be easily transported both during the weaving process and as finished products.

Therefore, the cold, harsh climate of the Steppe, the nomad's transitory lifestyle and the advances in animal husbandry, set up conditions which lead to the development of the knotted pile. This is unlike the earlier ancient civilisations of Egypt and Babylon where reed matting was used to cover the floor as the hot climate in these regions did not demand the development of thick, woollen, pile-woven floor-coverings.

The knotted pile

In considering the evolution of the knotted-pile carpet one must ask why this form of carpeting emerged out of the existing shaggy loop-pile rugs which already offered warmth, comfort and protection. Most historians support the view that knotted pile is a result of the desire of nomadic people to inscribe their functional items with decorative qualities that reflected their collective beliefs and recorded aspects of their life. Giovanni Curtola supports this view, noting:

There is every reason to suppose that the first carpets were made with variously coloured wools, joined together at random, and in a subsequent phase, the need was felt to conceive simple decorative motifs.¹¹

The knotted-pile carpet was developed to allow greater flexibility in functional design considerations and to enhance the decorative potential of the pile surface. The development of a knotted pile occurred in the following way: coloured loop-pile weft threads were introduced into the woven piece to enhance the decorative quality. The long, shaggy pile made the colours mix, reducing the effectiveness of the design. The pile was clipped shorter to maximise the effect of the coloured pile threads. As a shorter pile requires a finer ground weave, the warp was set more closely. However, because a short pile can fall out of the ground weave easily a method of securing the pile threads was then developed. This method was the knotting of the pile thread to the warp and with it came the evolution of knotted-pile carpet,¹² as illustrated in Figure 9.

¹¹ Giovanni Curtola, *Oriental Carpets*, Simon & Schuster, New York, 1981, p.24.

¹² Ford, *Oriental Carpet Design*, p.34.

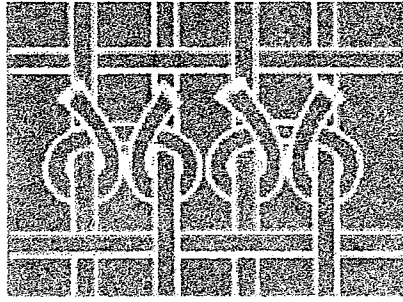


Figure 9. Tying the knot

The most important factor in the development of knotted-pile carpet was the desire to enhance the decorative quality of the product. Anni Albers notes in her book *On Weaving* that the knotted-pile process permits the greatest freedom of any weaving method in producing designs.¹³

Embellishment

The urge to decorate and embellish is present in all ages and cultures from the dawn of human history.¹⁴ Decoration, in the form of abstract patterns has existed alongside realistic representations of animals and humans from the time when the earliest images were created.¹⁵ Figure 10 shows a bracelet found in the Ukraine dating from 22,000 BC, which is carved from mammoth ivory and which indicates a skilful execution of pattern.¹⁶

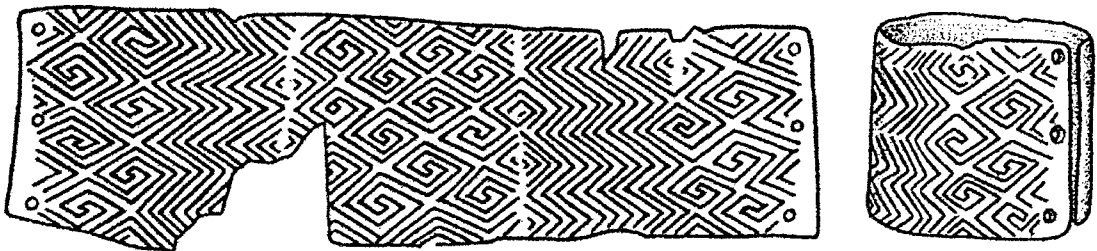


Figure 10. Bracelet from the Ukraine, 22,000 BC

The universal appeal of embellishment and decoration results from its expressive qualities and its freedom from utilitarian constraints. Embellishment rarely performs a functional role such as supporting or holding a structure together.

¹³ Anni Albers, *On Weaving*, Studio Vista, London, 1965, p.56.

¹⁴ Patricia Conway & Robert Jensen, *Ornamentation*, Clarkson N. Potter, New York, 1982, p.3.

¹⁵ Eva Wilson, *8000 Years of Ornament*, British Museum Press, London, 1994, p.27.

¹⁶ Wilson, *8000 Years of Ornament*, p.28.

This freedom from utilitarian constraints sets decoration apart from the numerous mundane tasks associated with day-to-day life.¹⁷ Decoration and ornamentation also play an important role in giving visual form to our imagination. Through the decorative means of colour, pattern and illusion, people have created symbols that give their possessions and environments a sense of identity, memory, beauty, meaning, place and time.

Beyond the utilitarian functions of warmth, comfort and protection, which were already available in the earlier loop-pile rugs, people had a strong inner need to represent their world in visual form, thereby adding meaning to their life. Significantly, knotted-pile carpet weaving has been practised continuously from its early development through to the present day. This simple technique remains pre-eminent in producing a robust, long-wearing, warm product and at the same time offering the weaver the greatest scope in the creation of patterns and images.

Early carpets

Woollen textiles are fragile organic materials which oxidise and crumble with the passage of time. As a result very few carpets or even carpet fragments have survived since the Middle Ages.¹⁸ One notable exception is the Pazyryk carpet which was woven around 500 BC (Figure 11). The Pazyryk carpet is the earliest example of an almost complete knotted-pile carpet.¹⁹ It was preserved in a deep frozen state in the grave of a nomadic Scythian warrior prince until its discovery in 1949.²⁰ The grave is located in the Pazyryk valley, high in the Altai Mountains, 9.5 kilometres inside the Soviet-Mongolia border. The carpet is now held in the Hermitage Museum, St Petersburg. The Pazyryk carpet depicts a procession of horses, riders and Eurasian deer, with a central panel consisting of flowers with eight petals in a geometric pattern. This ancient carpet measures 200 by 183 centimetres, with 240 Turkish Ghiordes knots per square inch. Figure 12 illustrates a Ghiordes knot.

¹⁷ Conway & Jensen, *Ornamentalism*, p.19.

¹⁸ Majid Amimi, *Oriental Rugs*, Van Nostrand Reinhold, New York, 1981, p.12.

¹⁹ P.R.J. Ford, *Oriental Carpet Design*, Thames & Hudson, London, 1981, p.34.

²⁰ Amimi, *Oriental Rugs*, p.12.



Figure 11. Pazyryk carpet, 500 BC

The graves at Pazyryk also contained examples of kilims, felted rugs, loop-pile rugs and a small fragment of another knotted-pile carpet.²¹ This fragment is almost twice as finely knotted as the Pazyryk carpet and employs a different asymmetric knot, as illustrated in Figure 13. The presence of two carpet weaving styles has led historians to conclude that knotted-pile weaving was well established prior to 500 BC and was practised in more than one weaving centre.²²

²¹ Ford, *Oriental Carpet Design*, p.34.

²² David Black, *Rugs and Carpets*, Tiger Books International, London, 1994, p.46.

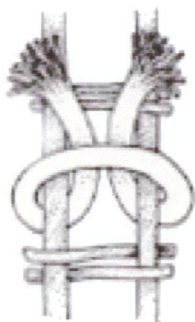


Figure 12. Ghiordes knot

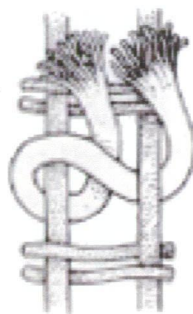


Figure 13. Asymmetric knot

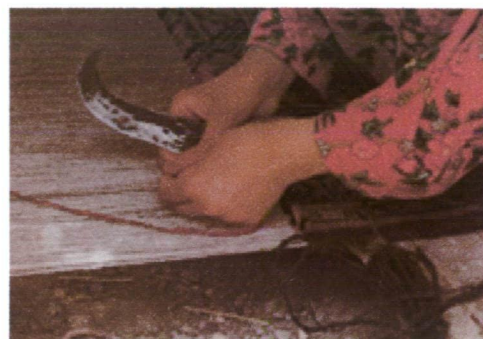


Figure 14. Curved cutting blade

Elizabeth Wayland Barber ‘expects to see traces’ of the earliest knotted-pile carpets to be as early as the 3rd millennium BC.²³ Barber has based her theory on comparative studies of ceramic decoration which emulate early carpet designs, as well as on the discovery of curved pile-cutting blades (similar to the cutting blade shown in Figure 14) in women’s graves in Soviet Turkoman and northern Iran. These cutting blades were used to cut the weft pile thread after a knot was tied and their discovery in the graves indicates that knotted-pile weaving was practised at this time.²⁴

Historians have been able to establish that knotted-pile carpets were used as floor coverings, by observing the similarity between the design of the carved stone doorway panels in the North Palace of Ashurbanipal 668-627 BC (Figure 15) and the central panel of the Pazyryk carpet (Figure 16). Carpets would have worn out quickly if they had been laid in the doorway thresholds and in their place, therefore, carved stone panels imitating the carpet designs were installed. The outdoor courtyards of the palace were paved with bricks, while the interior floors, except for the doorway panels, were compacted mud. As the outdoor courtyards were paved, it is reasonable to conclude that the interior floors surfaces may have been covered with carpets.²⁵ The presence of carpets in royal burial mounds and the use of carpets in palaces infers that carpets were valued items which may have carried expressions of cultural meaning and symbolised material wealth.

²³ Elizabeth Wayland Barber, *Prehistoric Textiles*, Princeton University Press, Princeton, 1992, p.171.

²⁴ Barber, *Prehistoric Textiles*, p.171.

²⁵ Ford, *Oriental Carpet Design*, p.34.



Figure 15. Stone paving slab, 668–627 BC



Figure 16. Detail, Pazyryk carpet, 500 BC

The Asian Steppe was inhabited by numerous unrelated ethnic groups sharing a common nomadic lifestyle. Jon Thompson suggests that the common lifestyle led at times to the adoption of a shared religion and homogenous artistic conventions.²⁶ The common lifestyle may have led to a homogenous culture; however, the diversity of ethnic groups probably strengthened the desire for individuals to identify with their clan and record aspects of their clan's history and life through their art.

Symbolic language in carpet weaving

A language of symbols developed in carpet weaving from early nomadic times. Motifs such as the gul have had a remarkable history which continues to the present day. The word 'gul' is an ancient Turkish word meaning 'clan' or 'family'. The gul motif functioned as a coat-of-arms and each tribe owned a gul symbol. The tribe's gul remained in existence unless the tribe was defeated in battle. In this event the tribe was obliged to adopt the gul of the victors.²⁷

The gul motif emerged from the form of the octagon star, which has a long tradition and an important spiritual association for the people of western and central Asia, as it is understood to mark the centre of creation.²⁸ The nomad's understanding of the universe was based on observations of nature, such as the transit of the stars and the planets. The nomadic people imagined the earth to be flat and the sky to be a dome, like an inverted

²⁶ Jon Thompson, *Carpets From the Tents, Cottages and Workshops of Asia*, Barrie & Jenkins, London, 1983, p.7.

²⁷ Ford, *Oriental Carpet Design*, p.176.

²⁸ David Black, *The Atlas of Rugs and Carpets*, Tiger Books International, London, 1994, p.60.

bowl covering the earth.²⁹ The four primary directions were important points, indicated by the sun rising in the east and setting in the west. When facing the morning sun, the position of the nomad's shoulders apparently made them aware of north and south. The four primary directions were depicted with a cross.

The intermediate directions were marked as an 'x' on top of the initial cross. This symbol gradually evolved into the image of an eight petal flower, the octagon star and the gul.

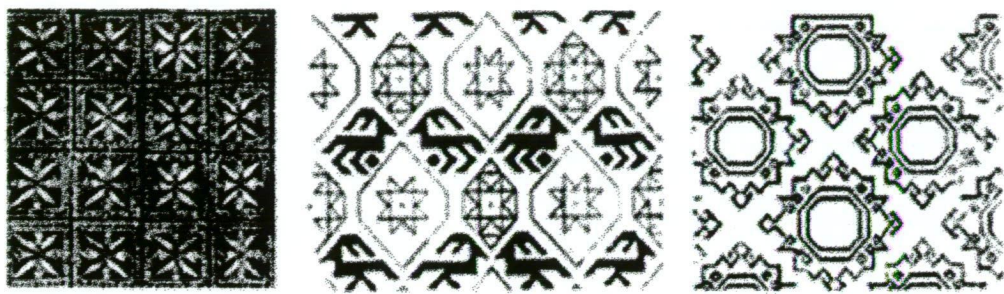


Figure 17. Pazyryk carpet Figure 18. Eight point star Figure 19. Framed octagon or gul

The development of the gul is illustrated in the carpet designs shown in Figures 17 to 19. The central panel of the Pazyryk carpet shows a cross overlaid with an 'x', forming an eight petal flower (Figure 17). The designs presented in Figures 18 and 19 are drawings of carpet fragments from the 13th to 15th centuries, found in Fostat, Cairo. In Figure 18 the central point of the cross overlaid with an 'x', expands to become a star. The central area of the star is even larger in the design shown in Figure 19, where it becomes a framed region or gul.

The idea that this design represented a 'centre of creation' is supported by the charts drawn by the ancient sages tracing the movements of the stars. The charts describe the circular path of all the stars and other heavenly bodies around the bright North Star. The sages did not realise that the circular path of the stars was caused by the earth's rotation, believing instead that the earth was stationary and flat. The movement of the heavenly bodies around the North star suggested to the sages that this was the centre of the universe from which streamed celestial light.

²⁹ Black, *The Atlas of Rugs and Carpets*, p.36.

To the people of the great Asian steppe, the octagon star or gul symbol represented a portal or sky door through which one could gain entry to another infinite or Heavenly world beyond the world they knew. David Black affirms the universality of this concept:

This idea of a sky door leading to Heaven was not confined to Western Asia. The pierced dome of the Pantheon in Rome and the hole through the ceiling in Gothic cathedrals, like the symbolic 'hole' in mosque ceilings and the circular reserve guarded by a dragon in the ceiling of certain Chinese temples, all represent this universal concept; so it should not surprise us to find it featured on carpets that were intended to show an earthly reflection of the World Above.³⁰

The framed region of the gul was to become the province of an exhaustive array of motifs embodying the aspirations of the weavers, including tribal identity, good fortune, fertility, protection from evil spirits and religious beliefs.³¹ Carpets therefore, became a powerful medium for expressing the nomads' world view. Carpets provided spiritual and physical comfort to the people of the Steppe and offered visual relief from the monotonous and, at times, desolate landscape.

Thirteen hundred years separate the knotted-pile textiles found in the graves at Pazyryk from the next extant carpet fragments which were found in the rubbish dumps in Fostat, Cairo. However, written sources confirm that carpets have always played a significant role in the economies and cultures of communities of western and central Asia.³² Carpet manufacture was well established along the silk road from Persia to China, from the time of Christ. It is known to have flourished under court patronage in city centres, and carpets were produced at home by nomadic pastoralists for domestic use and for sale in the local trading towns. Unfortunately, there are no remains of a large and elaborately bejewelled garden carpet in a Sassanian palace woven around 600 AD, which was recorded in early Arabic chronicles, or the 22,000 carpets seen by Byzantine envoys in 917 AD at the Abbasid palace in Baghdad.³³ The latter example highlights the prevalence of knotted carpets in the daily lives of people during these times.

³⁰ Black, *The Atlas of Rugs and Carpets*, p.36.

³¹ Thompson, *Carpets From the Tents, Cottages and Workshops of Asia*, p.6.

³² Patricia L. Barker, 'Carpets of the Middle and Far East', in Jennifer Harris (ed), *5000 Years of Textiles*, British Museum Press, London, 1993, p.119.

³³ Barker, 'Carpets of the Middle and Far East', Jennifer Harris (ed), *5000 Years of Textiles*, p.119.

Hand knotted-pile carpet weaving has a history of production covering 5000 years. Even today, in countries such as Egypt, India and Romania, similar technology to that employed in the earliest carpets is still practised in a thriving cottage industry. Interestingly, the highly industrialised countries use power looms to produce broad loom and Axminster carpets which owe their characteristics of pile and density to the ancient hand-knotted models.

Investigating the lineage and tradition of knotted-pile weaving allows a fuller, more critical, appraisal of current carpet design. This background study widens and deepens the speculative space for imagining new prototypes that will complement the built environment and contribute to the cultural milieu. To this end, the next chapter examines the seminal historical period where the convergence of beauty, technical virtuosity and cultural significance was a hallmark in carpet production.

2. Mamluk Carpets

In this chapter I will discuss the technical and aesthetic characteristics of Mamluk carpets. The Mamluk approach to colour and meaning are important strategies which can be applied to contemporary carpet manufacture and to the design of my carpet prototypes for the hospitality and leisure industry.

Although the variety of extant carpets produced after the 13th century is extensive, I have chosen to examine one group of carpets in detail. These are the Mamluk carpets which were produced in Egypt from 1460 to 1674. They are notable for their rich and distinctive exploitation of colour and the complex use of motif.¹

The Mamluks ruled over Egypt and the Levant from 1250 to 1517. They were a pagan-born society who enthusiastically embraced the Egyptian, Islamic, artistic vocabulary.² The Mamluk people were of Turkish origin, and they brought an appreciation of hand-knotted carpets to Egypt and an understanding of their value in the trade of luxury goods. By the 15th century, carpets were the recognised accoutrements of the royal courts and the ruling classes throughout the Islamic and Mediterranean world.³

Prior to the Mamluk period, carpet production was limited in Egypt because the hot climate of the region made thick woollen or silk floor coverings unnecessary. The Mamluk rulers established carpet workshops in Cairo around 1460, with State support, utilising the skilled labour of Turkomin weavers.⁴ Carpet production continued in Cairo until 1674, well after the Ottoman conquest of Mamluk territory in 1517.⁵



Figure 20. S-twist yarn



Figure 21. Z-twist yarn

¹ Patricia Barker, 'Carpets of the Middle and Far East', in Harris, Jennifer (ed.), *5000 Years of Textiles*, British Museum Press, London, 1993, p.119.

² Carlo Suriano Marri, 'Mamluk Blazon Carpets', *Hali*, vol. 97, 1998, p.76.

³ David Black, *The Atlas of Rugs and Carpets*, Tiger Books International, London, 1994, p.60.

⁴ Black, *The Atlas of Rugs and Carpets*, p.60.

⁵ Barker, 'Carpets of the Middle and Far East', in Harris (ed), *5000 Years of Textiles*, p.119.

Carpets produced in this multi-cultural arena resulted in work which was distinctive in pattern and construction. The wool imported into Egypt from Turkey and Anatolia for weaving Mamluk carpets was spun with an S-twist in accordance with the local tradition of linen spinning (Figure 20). The natural spiral structure of linen fibres makes the yarn less likely to unravel when it is spun in the S-twist direction.⁶ Most carpet weaving centres throughout central and western Asia use Z-twist yarns (Figure 21); however, the Mamluk carpets were woven from wool spun with an S-twist, as this method had been established for centuries in Egypt for spinning linen.



Figure 22. Mamluk carpet woven with a silk pile, 16th century

Optical colour

Mamluk carpets appear to shimmer because of the numerous small points of different colour in the plush pile, as illustrated in Figure 22. The points of colour are too small to be resolved by the eye as independent colours and are therefore seen as one optically mixed colour, or ‘area-averaged’.⁷ It is evident that the Mamluk weavers were conversant with the optical system of colour mixing. The fine knot count of 240 knots per square inch used in the Mamluk carpets enables optically mixed colours to be

⁶ Geijer Angus, *A History of Textile Art*, Pasold Research Fund Ltd., London, 1979, p.17.

⁷ Robyn Glade-Wright, *Colour Mixing For Textiles*, self published, Hobart, 1989, p.13.

produced when the carpet is viewed from a minimum distance, equal to a normal standing position.⁸

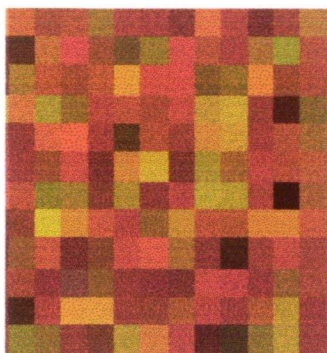


Figure 23. Enlarged detail of the silk Mamluk carpet.

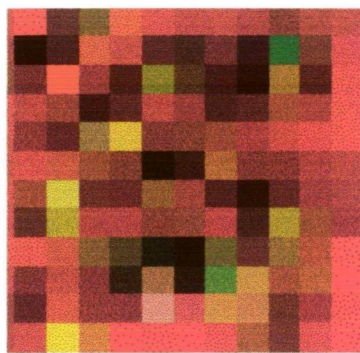


Figure 24. Enlarged detail of the silk Mamluk carpet.

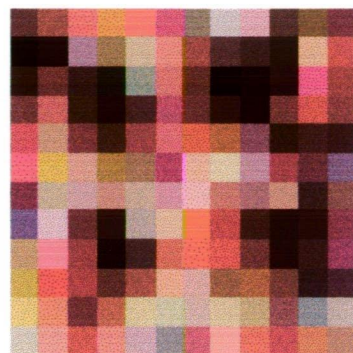


Figure 25. Pile threads from the bluish area surrounding the central medallion.

The main colours employed in the Mamluk carpets are red, green and blue; white and yellow hues were added to carpets woven at a later date.⁹ The juxtaposition of red, green and yellow pile threads creates an 'intense jewel-like shimmer'¹⁰, visible in the silk carpet shown in Figure 22. Two enlarged sections of this silk carpet (Figures 23 and 24) illustrate the red, green and yellow threads that mix optically to form a golden-ochre. These sections are approximately eight times larger than the original carpet and each coloured square is an enlargement of one individual coloured thread.

The silk Mamluk carpet shown in Figure 22, is a complex web of optically mixed colours. The colours in the perimeter surrounding the central medallion in the silk Mamluk carpet mix to a shimmering grey. This is achieved by an optical mixture of blue, yellow, pink and red pile threads, illustrated in the enlarged section in Figure 25.

Motif and meaning in Mamluk carpets

Another important quality of Mamluk carpets is the way in which decoration and the articulation of space, function in the designs. Mamluk carpet designs were strongly influenced by the established traditions of Islamic geometric decoration. These abstract

⁸ This information is drawn from printed reproductions and text. I have also woven fabrics that support these conclusions.

⁹ Black, *The Atlas of Rugs and Carpets*, p.60.

¹⁰ Barker, 'Carpets of the Middle and Far East', in Harris (ed), *5000 Years of Textiles*, p.119.

geometric design modes flourished in the medieval Islamic world in response to the religious restrictions placed on figurative representation.¹¹

The Girikh was a popular design mode in the Medieval Islamic world. It consists of algebraically definable elements in two-and-three dimensional formulations. Girikh designs produced almost emblematic star-and-polygon compositions that were generated by a diffuse grid system.¹² The Girikh designs were recorded on paper scrolls by artisans when selecting patterns for architectural decoration and other forms of embellishment, including carpet design.¹³

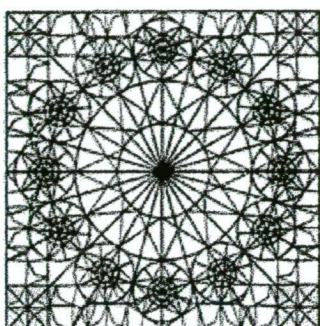


Figure 26. Radial grid

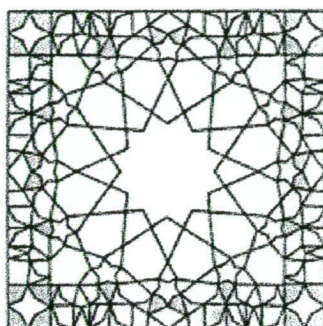


Figure 27. Formation of a medallion from a radial grid

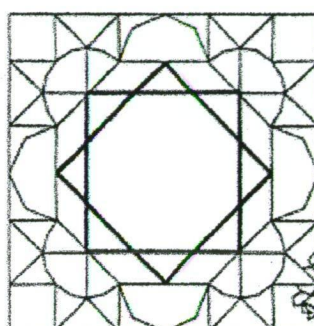


Figure 28. Octagon star

The designs illustrated in Figures 26 to 28 are from a late 15th or early 16th century pattern scroll in the library of the Topkapı Palace Museum, Istanbul. The drawing in Figure 26 shows a radial grid which underpins the design shown in Figure 27. This unseen radial grid creates a dynamic expansion of the medallion form.¹⁴ The octagon star illustrated in Figure 28 is typical of the central medallions found in Mamluk carpets, including the example in Figure 29.

¹¹ Carlo, 'Mamluk Blazon Carpets', *Hali*, p.75.

¹² Carlo, 'Mamluk Blazon Carpets', *Hali*, p.80.

¹³ Carlo, 'Mamluk Blazon Carpets', *Hali*, p.76.

¹⁴ Carlo, 'Mamluk Blazon Carpets', *Hali*, p.81.



Figure 29. Early sixteenth century Mamluk carpet.



Figure 30. Detail of a large-pattern Holbein carpet, Anatolia, 14th century

The complexity of the octagon motifs used in the Mamluk carpets reflects the combination of two design traditions. One is the age-old beliefs and **gul** motifs of the nomads, brought to Egypt by the Turkish and Anatolian weavers. Examples of **gul** motifs woven by Turkoman tribes living in Anatolia are pictured in Figure 30. The second is the Islamic abstract design vocabulary.¹⁵ The unique use of colour and the combination of design traditions apparent in Mamluk carpets are **significant** factors which contributed to their fresh new appearance, even after 500 years. These attributes will be discussed in relation to contemporary carpet design in **future** chapters.

In the next chapter I examine the production of wall-to-wall carpet in the western world and assess the influence of industrial manufacture on carpet as an **object** of cultural significance.

¹⁵ Black, *The Atlas of Rugs and Carpets*, p.51.

3. Wall-to-Wall Carpet

In this chapter I will examine the development of wall-to-wall carpet and the influence of hand-knotted carpets from western and central Asia on contemporary carpet design. I will also show how the design practices established in England during the 18th century have continued to influence contemporary carpet design. In undertaking this investigation it has been necessary to study the way floors were adorned in England prior to the 15th century.

Rush matting

During the 15th and 16th centuries, floors in England were covered with rushes, straw, fragrant herbs and flowers. These materials were used underfoot to make the interiors smell 'fayed and sweet'¹ and to ensure the area was cleared of dust when the floors were swept.² Rushes and straw were replaced by rush matting around 1600, as shown in the Great Chamber of Hardwick House, illustrated in Figure 31. The walls in this chamber are adorned with elaborate woven tapestries, indicating that at this time, quality textile work was reserved for walls and not the floors. In an untitled painting produced in 1584, rush matting is also depicted as a floor covering (Figure 32).



Figure 31. Rush matting in the Great Chamber, Hardwick House, c.1591

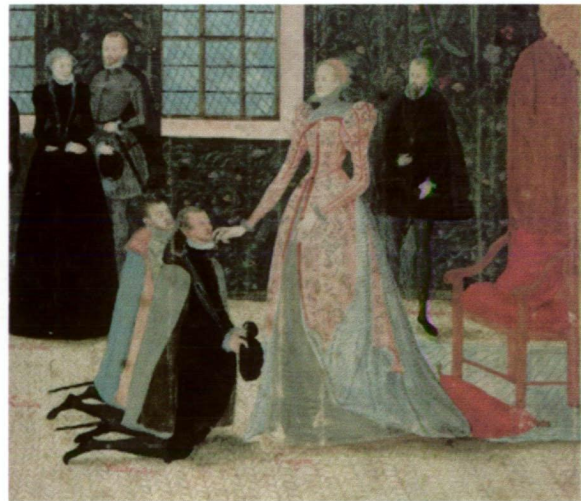


Figure 32. Queen Elizabeth receiving the Dutch ambassadors on rush matting, untitled painting, c.1585

¹ Treve Rosoman, 'Wall-to-wall weaves', *Traditional Homes*, February, 1991, p.60.

² Pamela Clabburn, *Furnishing Textiles*, Penguin Books, London, 1988, p.192.

The rush matting was made by plaiting reeds into stripes 60 centimetres wide and 74 metres long.³ Room-length sections were cut from the roll of matting and sewn together to form a floor covering, thereby establishing the format for the woven wall-to-wall carpets which developed later.

Imported carpets

From the 13th century, woven carpets imported into Britain from Persia and Turkey were mainly used as table and cupboard covers. Only the richest households could afford to use imported carpets as 'foot carpets'. Table and cupboard covers were considered to be important decorative elements in English interiors at this time and people from the rich to the poor always had some form of table and cupboard covering.⁴ A Turkoman carpet woven in Anatolia is used as a table cover in the painting shown in Figure 33. This style appeared so frequently in paintings by Holbein that it became known as a Holbein carpet. A house inventory of the Earl of Rutland in 1543, lists five long table carpets, one foot carpet and thirteen cupboard carpets, all of 'Turkey making'.⁵



Figure 33. Holbein carpet of Turkoman origin, woven in Anatolia, 1604



Figure 34. Carpets in Karapinar Mosque, Central Turkey

In the carpet-weaving countries of western and central Asia, buildings with large floor areas, such as mosques, were covered by laying numerous small carpets next to and on top of each other (Figure 34). Carpets were expensive items; however, the mosque

³ Treve, 'Wall-To-Wall Weaves', *Traditional Homes*, p.60.

⁴ Clabburn, *Furnishing Textiles*, p.189.

⁵ Clabburn, *Furnishing Textiles*, p.190.

could be carpeted with many precious pieces because it was customary for the people living in these countries to donate a carpet to a mosque. In this way, the weavers and their family could honour their god.



Figure 35. Persian carpet, 400 squ. m. Figure 36. Persian carpet made in Goa, early 17th century

Wall-to-wall carpets were not produced in western or central Asia. Large hand-knotted carpets were woven for the adornment of palaces, from the 1st century AD. The large carpet shown in Figure 35 was woven in Persia in the 1980s, with a surface area of 400 square metres. The largest oriental carpet on record has a surface area of over 1000 square metres.⁶ Both large and small Persian carpets are independent units, designed to be placed in the centre of a room with a central motif, or a series of motifs and defined border patterns.

The prohibitive cost of imported carpets in England, during the 16th century precluded the use of numerous carpets to form a floor covering. Robert Dudley, one of England's richest men in 1583, owned several Turkish carpets. A significant aspect of the Dudley carpet collection is the inclusion of carpets woven in Turkey with Turkish and English motifs. One of the carpets in the collection is worked with an English rose in the centre and the Stafford knot at both ends.⁷ The English rose and the Stafford knot were signs of heraldry, signifying ownership of place and success in battle. They had no relationship with the Turkish motifs in the remainder of the carpet.

⁶ Jon Thompson, *Carpets From the Tents, Cottages and Workshops of Asia*, Barrie & Jenkins, London, 1983, p.144.

⁷ Clabburn, *Furnishing Textiles*, p.190.

The separation of design from weaving.

In the early years of the 18th century, designs for carpets were sent to China and India for weaving.⁸ The carpet illustrated in Figure 36 is derived from a Persian design, commissioned in England and woven in Goa, India. The practice of sending designs to weavers in other countries, for production at a lower cost or with higher technical skill continues to the present day. This practice separates the task of designing from that of making. While this has been successfully undertaken in the hand-knotted carpet producing countries of the world, such as Anatolia and Persia, where artists are sometimes employed to produce designs for others to weave, the artist works in the same region as the weavers and importantly, shares the same spiritual aspirations for the work. By contrast, the English designers did not hold the same beliefs as the producers. The English were eclectic in their use of design, taking designs from one source, adding their own territorial emblems and commissioning weavers in an unrelated country, to produce the work.

Turkey work

'Turkey work' is a further example of the English practice of privileging decorative motif over meaning.⁹ Turkey work developed in England in the 16th century in order to emulate Turkish carpets; wool was worked in patterns that imitated Turkish carpet designs. Turkey work was used for foot and table carpets, cushions and upholstery, until the first half of the 18th century.¹⁰ The example of Turkey work shown in Figure 37, combines Turkish carpet weaving patterns with thistles and roses. The two styles are not integrated stylistically or in relation to their respective meanings: the Turkoman gul described in earlier chapters represents a portal to the heavenly world, whereas the thistle and the rose are emblems marking a territory, a sign of place, situated in the earthly realm.

⁸ Clabburn, *Furnishing Textiles*, p.190.

⁹ Turkey work is a woollen pile fabric produced in imitation of expensive Turkish and Persian carpets which was used for table, upholstery and floor coverings during the 16th and 17th century. Turkey work was woven on a loom with a linen warp. The pile row of woollen knots was tied after one to three rows of linen weft.

¹⁰ Natalie Rothstein, in Lubell, Cecil (ed.), *A History of British Textile Design: Textile Collections of the World*, Cassell & Collier Macmillan, London, 1976, p.64.



Figure 37. Detail, English 16th century 'Turkey work', combining Turkish carpet weaving patterns with thistles and roses

Borrowing designs

The borrowing of designs from a different culture and using them without the same beliefs and commitment ultimately discredits the integrity of the re-worked design. When work is appropriated without a spiritual or conceptual understanding, the integrity of the original is lost and the designs become empty elaborations of once-meaningful signs and patterns. The English use of Turkoman patterns can be contrasted with the blending of styles, apparent in the Mamluk carpets. The integration of the Turkoman and Islamic design motifs in the Mamluk carpets succeeded because the aims of both cultures were similar: to communicate on a spiritual level in preparation for an after-life.



Figure 38. Embroidered carpet, c.1710



Figure 39. Embroidered carpet, early 18th century

Embroidered carpets

Carpets were also hand-embroidered on canvas during the early 18th century, using floral designs reminiscent of oriental carpets, both in terms of the distribution of the flowers and the use of border patterns (Figures 38 and 39). Alternating bands of light and dark patterns were used in the Turkoman carpets to indicate the passage of time from day to night. These border designs formed another symbolic window through which one could reach the heavens above. The variation from light to dark has been carried forward into the rose border in the embroidered carpet shown in Figure 39. The border fulfils the English requirement for decoration, but loses the original meanings developed by the nomadic people. The task of embroidering a carpet is considerable, and indicates the level of interest in carpets which were soon to be produced on hand- operated cloth weaving looms.

Cloth looms

Hand-operated cloth looms were used to produced fabrics such as canvas during the 17th century. The rate of fabric production was higher on a cloth loom than was possible with hand-knotting or embroidery techniques, although the fabric construction was different. Strong canvas fabric woven on a cloth loom was used as a cloth floor covering. Floor cloths were made by cutting lengths of the canvas to fit the size of the room and sewing them together in the same manner as the earlier rush matting. The

canvas was sized, painted with oil paint and, following a drying period of several months, could be walked on and cleaned without damage.

The first carpets woven on cloth looms were produced during the early years of the 18th century. They were woven from heavy, cheap wool, using striped or checked patterns, and were known as Ingrain and Scotch carpets. Kidderminster carpets were woven in a double-weave structure, whereby two layers of fabric were woven together with the pattern on one side reversed on the other side. These types of woven carpets did not have a pile surface.¹¹

Pile carpets

Pile carpets were woven by hand on cloth looms in England around 1740 under the trade names of Wilton and Brussels. The looms had previously been used for producing velvet.¹² Brussels carpet has a loop pile. These loops are cut in Wilton carpet producing a velvety texture.¹³ The characteristics of Wilton and Brussels carpets were similar in pile density to hand-knotted carpets; however, the method of construction was different. The adaptation of the velvet looms to carpet weaving became the forerunner to current methods of carpet production. By the 1760s it was fashionable in England to have fitted carpets made by either the Wilton or Brussels technique.¹⁴ The main disadvantages of the early fitted wall-to-wall carpets were the limited colour range and design options.

In 1754 Thomas Whitty, a cloth weaver from Axminster in Devon, copied the Turkish knot and produced seamless hand-knotted carpets which became well-known in England¹⁵ (Figure 40). The term 'axminster' originates from the name of the town of in which Whitty operated his first carpet-weaving business. In the 18th century 'axminster' was used to describe the hand-knotted carpets which could be woven with more complex designs and with a greater variety of colours than was possible in either Brussels or Wilton carpet. The use of the name 'Axminster' has been carried forward from the hand-knotted carpets to those woven on power looms in the 19th century and

¹¹ Clabburn, *Furnishing Textiles*, p.195.

¹² Rothstein, *A History of British Textile Design*, Lubell Cecil (ed), p.64

¹³ Rosoman, 'Wall-to-wall weaves', *Traditional Homes*, p.62

¹⁴ Ann Gore & Alan Gore, *The History of English Interiors*, Phadian Press, Oxford, 1991, p.93.

¹⁵ Clabburn, *Furnishing Textiles*, p.195.

it continues to be used to the current day. The term 'Axminster' is associated with high quality, luxury carpeting with an elaborate use of pattern and colour.

Whitty used an upright loom that was similar to a tapestry loom. This technique was introduced to his factory following contact with French weavers who had worked at the Savonnerie factory in France. Thomas Moore and Claude Passavant also wove hand-knotted carpets in England during this period, using the same style of upright loom as Whitty (Figures 41 and 42).¹⁶ All three weavers competed for market share in England.



Figure 40. Carpet woven by John Whitty at Axminster, 1770



Figure 41. Axminster carpet, 1757

The size and shape of floor coverings varied after the 1760s, from leaving a border of exposed flooring around the edge of the carpet, in the French style, or covering the floor completely.¹⁷ Axminster carpets designed for a single room were known as 'bespoke' carpets. They were woven in the form of an oriental carpet with a central motif and decorative border. Wall-to-wall Axminster carpet was woven in narrow 69 centimetre strips with a repeat pattern. They were cheaper than the 'bespoke' carpets

¹⁶ Clabburn, *Furnishing Textiles*, p.195.

¹⁷ Clabburn, *Furnishing Textiles*, p.201.

and the carpet could be cut to fit around hearths. A decorative border strip, which was woven separately, could be laid around the perimeter of a room, as illustrated in Figure 43.¹⁸ The pattern in this carpet is derived from Roman tessellated pavements in keeping with the Neoclassical style which was fashionable at this time.¹⁹



Figure 42. Exeter carpet, 1758



Figure 43. Fitted carpet with a woven border, c. 1780

Neoclassicism and the influence of fashion

Neoclassicism was a revival of classical antiquity, experienced in England from about 1750 to 1850.²⁰ This interest was stimulated by the archaeological excavations at Herculaneum and Pompeii and the rediscovery of Greek art as the source of classic style.²¹ It gave rise to a new style of interior decoration in England, where architects designed complete schemes for the building interiors.²²

Robert Adams, an architect of the Neoclassical style, designed an Axminster carpet specifically for the saloon room at Saltram (Figure 40). The carpet was woven by John Whitty in 1770. The carpet design corresponds to the plasterwork ceiling decoration. The room reflects the 'noble simplicity and calm grandeur' of classical Greece, with an emphasis on symmetry and geometric precision.²³

¹⁸ Hermann Muthesius, *The English House*, Rizzoli International, New York, 1979, p.178.

¹⁹ Gore, *The History of English Interiors*, p.93.

²⁰ H.W. Janson, *A History of Art*, Thames & Hudson, London, 1962, p.453.

²¹ Janson, *A History of Art*, p.460.

²² Gore Ann and Alan, *The History of English Interiors*, Phadian Press, Oxford, 1991, p.92.

²³ Janson, *A History of Art*, p.460.

The carpet shown in Figure 41 is embellished with acanthus leaves, referring to classical times. Simultaneously, the Romantic return to nature is referenced by the baskets of flowers and the spaniel which sits on a tasselled cushion in the carpet centre. The table covers are embroidered with Medieval heraldic designs. Although the format draws on traditional hand-knotted carpets, the design is an eclectic composition of styles and ideas.

The long traditions of hand-knotted carpet weaving in western and central Asia have had a strong influence in the 18th century on the development of wall-to-wall carpets in regard to pile density, the creation of pattern and the design of borders. The English use of rush matting and floor cloths in the Middle Ages established the format for the later wall-to-wall carpets.

The meaning of decoration in English carpets in the 18th century was different from that of the ancient hand-knotted carpet-producing regions of the world. For the English, carpet was a functional product, reflecting the fashion of the day. Carpets formed one element in a complex interior environment and were not called upon to express spiritual relationships.

From this time, Western interiors became subject to the concept of fashion in which decoration was required to be in step with the prevailing style, for example; 'in the style of the orient', Neoclassical or Romantic. This development privileged fashion trends over the individual's expressive role and it was in this cultural milieu that Axminster carpets were initially manufactured. The new culture of interior fashion was to have ramifications in the colonies such as Australia.

Re-colouring and current carpet design

The design practices established during the early years of English carpet manufacture continue to influence carpet design today. For example, taking designs from other cultures without respect for their original meaning is a well-entrenched practice in the carpet industry. The term 're-colouring' describes the widely applied practice of taking established designs from other cultures and periods in history and re-formatting them in colour accents that are fashionable. The contemporary practice of re-colouring designs from different cultures is not related to the postmodern practice of quoting elements from a variety of sources and using them to project multiple readings or a

double coding. Re-colouring is more to do with superficial aspects of fashion than a reinterpretation of the past.

Re-colouring is evident in the carpet design shown in Figure 44, in which the motifs are derived from an oriental carpet. In this design an attempt has been made to emulate the subtle variations in colour which occur in hand-made carpets. These variations are due to the difficulty in reproducing exactly the same shades with natural dyes from different dye lots. The white section in the background behind the central top motif in the photograph is meant to suggest the subtlety of different shades in hand-made carpets. However, the design is weakened by an attempt to reproduce the hand-made appearance and the motifs and the background of the design merge and become chaotic.



Figure 44. Re-coloured carpet design, 1999

A further example of re-colouring is shown in Figures 45 and 46 which illustrate the carpet woven during the mid 1990s and used in the dining room of the Old Parliament House in Canberra. The design emulates traditional Turkish carpets motifs which have been simplified for ease of production, or to conform with the reductive aesthetic of modernism. The simplification in the design erases the 5000 years of history that the motifs represent and renders the design meaningless. The carpet does not reference the

diversity of the people now living in Australia and fails to take up the challenge of reflecting contemporary life.

While the long-term practice of importing imagery offered convenience and appearance value, it retarded the development of a unique, home-grown visual language in carpet design. In many ways re-coloring has degraded meaning and integrity.



Figure 45. Carpet installed in Old Parliament House, Canberra, c. 1990



Figure 46. Detail, carpet installed in Old Parliament House Canberra, c. 1990

Current industrial textile design in Australia

One of the features of contemporary industrial textile design is the removal of the designer from an intimate dialogue with the materials and the process of weaving. The weavers of hand-knotted carpets consider the placement of each coloured thread and have ample opportunity to modify and develop the design during the weaving process. The nature of industrial carpet design is not conducive to this slow and interactive process of design development during weaving because design work is carried out on a computer. Sample-sized carpet trials are often made in the design studio by a mechanical process which assists designers to gain an impression of the finished appearance of the woven product; however, the designer is still removed from an interactive dialogue with the materials. For example, the way in which a coloured

pile thread in a carpet appears to change hue or value, depending on the colour of the thread it is placed next to, cannot be recognised when designing carpets on a computer screen.

In the traditional hand-knotted carpet-producing regions of the world, weavers benefited from designs passing from one generation to the next. Carpet weaving was common in the domestic setting and there was a large stock of design material to draw from. Community buildings such as mosques contained an extensive range of carpets which functioned as a 'library' of carpet designs. These designs could be studied and extended by the weavers of new carpets.

By contrast, wall-to-wall carpet has not had a rich history of design innovation and the culture of industrial textile design in Australia is not highly regarded. The small number of Australian carpet designers (approximately 20) means that design development is restrained. Carpet manufacturers operate in a competitive market-place and therefore designers do not discuss new design developments with rival companies. Furthermore designers often have short lead times in which to develop prototypes and the work is often in response to a client request for a particular design (often from a magazine or photograph) in colours to co-ordinate with an established colour scheme. In developing designs for these client-driven orders, the designer has little time or opportunity to invest the product with ideas beyond the specifications provided. The culture of industrial textile design and to a large extent the fabric of our society in Australia, does not require a commitment to innovative carpet designs dealing with identity, place or context.

A closer partnership between the two fields of art and industry has the potential to create more original and Australian products with possible benefits for increased export revenue. To this end, I will detail the construction of Axminster carpet in the next chapter and discuss design considerations for extending the appearance retention factor of carpets for the hospitality and leisure industry in the following chapters.

4. Axminster Carpet Construction and Design Considerations

In this chapter, I will detail the construction of Axminster carpet, the influence of tuft density on the design process, the constraints of a pattern repeat and the influence of an illusion of depth on the appearance retention factor of carpet.

The Axminster process enables the design and production of high quality wall-to-wall carpet. A good deal of this capability rests with the way the Axminster process can accommodate flexibility in design and incorporate an elaborate use of colour. Axminster wall-to-wall carpet has a uniform cut pile surface in contrast to loop pile, tufted carpet, which can be woven with a sculptured surface. It is woven in widths ranging from 69 to 366 centimetres which are sewn together to form a wall-to-wall carpet format.¹

Power looms were introduced to the carpet trade in 1851 and the spool Axminster system was developed and in 1878. This system replaced earlier methods of weaving because it could produce more elaborate designs.²

Axminster construction

In Axminster carpets, horizontal rows of coloured weft pile yarn are inserted into the ground weave. The ground weave forms a secure base to hold the weft pile in place. It consists of a stuffer end, the three double weft picks, and two chain ends, as illustrated in Figure 47. The coloured weft pile threads pass around one set of the double weft picks and the chain ends interweave over and under the double weft picks. During the finishing processes, the weft pile surface is trimmed and brushed slightly to one side. The sloping pile has the effect of pushing the design towards the woven edge (Figure 47).



Figure 47. Detail, Axminster carpet construction

¹ It is possible to make loop pile Axminster carpet where the pile is not cut.

² J.J. Vincent, *Shuttleless Looms*, Redwood Burn, Great Britain, 1980, p.41.

There are two systems of Axminster weaving: the gripper system and the spool system. The spool system, used by Tascot Templeton in Tasmania, allows an unlimited number of colours to be woven into a design. Designs are painted or printed onto squared paper, with each square corresponding to one pile tuft. The coloured pile yarns are wound onto spools. Each spool carries the pile yarn for one row in the design. The spools are placed in a pre-determined order in a frame for weaving.³

Tascot Templeton uses yarns composed of 80 per cent wool and 20 per cent nylon in its Axminster carpet. This fibre blend contributes an attractive low sheen and comfort underfoot to the finish product. The desirable fleece characteristics for carpet yarns specified by R.H. Sides include:

harsh handling wool with a mean fibre diameter of 40+ microns, minimum crimp; a staple length of (100-150); 30 per cent or more of the fibres should be medullated and the average extent of medullation should be 30 per cent or more of the fibre diameter. The fleece should be a dull chalky white in colour and kemp should be minimal as it takes up dye poorly and is brittle leading to loss in manufacturing.⁴

Axminster carpets are woven with yarns spun in the woollen or semi-worsted systems. Woollen spun yarns have good bulk, a matt appearance and a slightly fuzzy surface. Semi-worsted yarns are more dense, smooth and lustrous than yarns spun in the woollen system.



Figure 48. Navy two-ply yarn and mauve three-ply yarn

³ Z.J. Grosicki, *Watson's Advanced Textile Design*, Butterworth & Co, London, 1977, p.352.

⁴ R.H. Sides, *Carpet Wool Production*, Department of Agriculture, Tasmania, 1988, p.28.

The wool fibres are cleaned in a scouring process and dyed prior to, or after spinning. Axminster carpets can be woven from either a two- or three-ply yarn (Figure 48). A two-ply yarn consists of two single strands which are twisted together, whereas three single strands are twisted together to make a three-ply yarn. The quality of the carpet can be varied by the use of a two or three-ply yarn.

Power looms for the Axminster process are constructed to weave carpet with a pre-set number of columns in the warp direction. Most Axminster carpet looms are pre-set to weave in a pitch of 7 columns per inch or 28 per 10 centimetre. (It is still a common practice in the textile industry to use imperial measurements as much of the weaving equipment was built for this configuration.)

As the looms are constructed to a pre-determined pitch, the quality of the carpet is varied by adjusting the density of the pile rows and by the selection of a two- or three-ply pile yarn. High quality carpets woven by Tascot Templeton contain 9 pile rows per inch while the lower quality carpet contains 6.5 pile rows. The weight of the carpet varies from 800 to 2500 grams per square metre. The additional weft in the high quality carpet increases the thickness of the pile making it fuller and more sumptuous than the lower grade product, but at greater cost.

The carpet quality influences the degree of definition possible in a design. In carpets woven with 6.5 rows per inch there are 45.5 pile tufts per square inch. ($6.5 \text{ rows} \times 7 \text{ columns} = 45.5$) With carpets woven with 9 rows per inch, there are 63 pile tufts per square inch. ($9 \text{ rows} \times 7 \text{ columns} = 63$) Finer detail is possible in carpets with 9 rows per inch, although the outline of shapes tends to be jagged and lacking definition. Marks such as fine lines are not possible in this grid structure. To illustrate the appearance of an image in different carpet qualities, a design is shown with 6.5 rows per inch in Figure 49. The same design is shown with 9 rows per inch in Figure 50. The angles are not as jagged in Figure 50; however, both structures are relatively coarse, particularly when compared with oriental carpets.

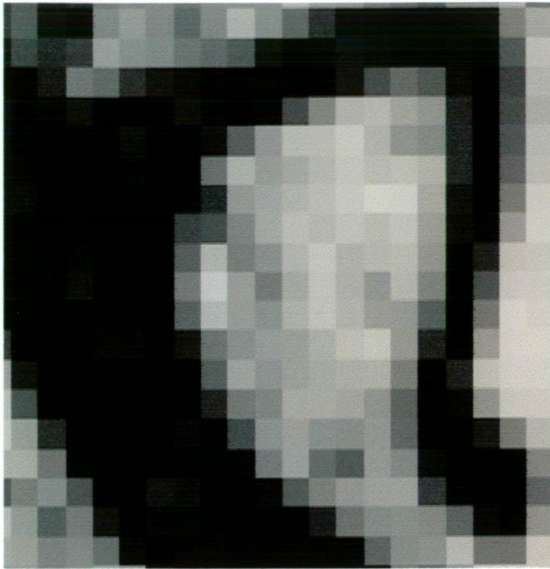


Figure 49. Design rendered with 7 columns and 6.5 rows per inch

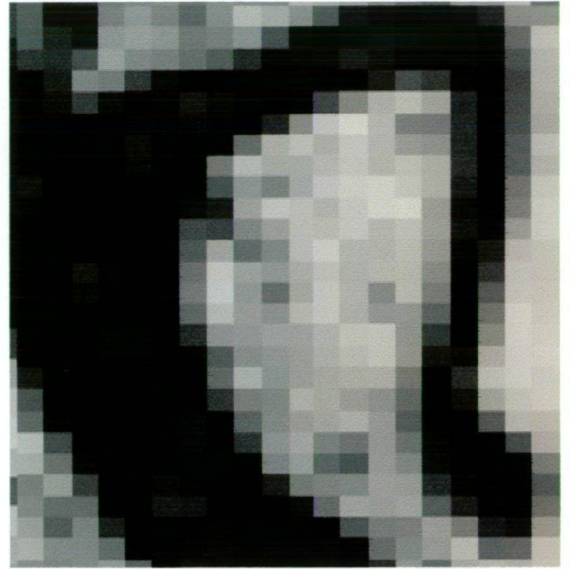


Figure 50. Design rendered with 7 columns and 9 rows per inch

One of the challenges of Axminster carpet design is establishing at what scale images need to be in order to produce a visible image in the woven structure. The crab shown in Figure 51 is 3 inches square. When this image is translated into the 7 x 7 grid structure of Axminster carpet, the crab is not visible, as shown in Figure 52.



Figure 51. Crab image, 3 in. sq.

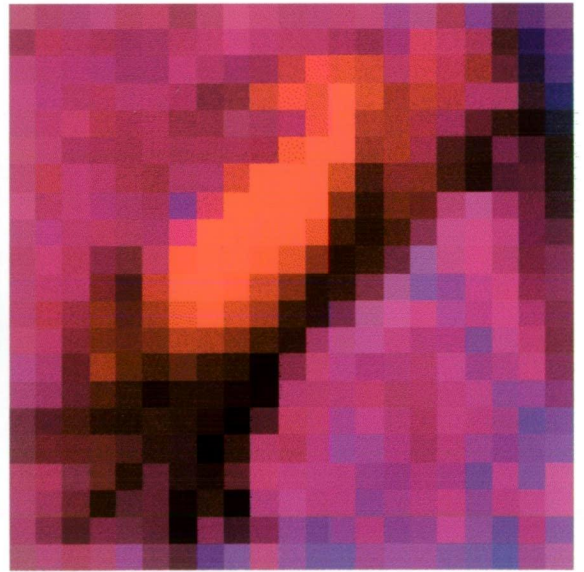


Figure 52. Crab image, 3 in. sq.,
7 x 7= 49 tufts/sq. in.

In the diagram shown in Figure 53, the crab is pictured 6 inches square in the 7 x 7 grid structure. The crab becomes visible when this image is 6 inches square.

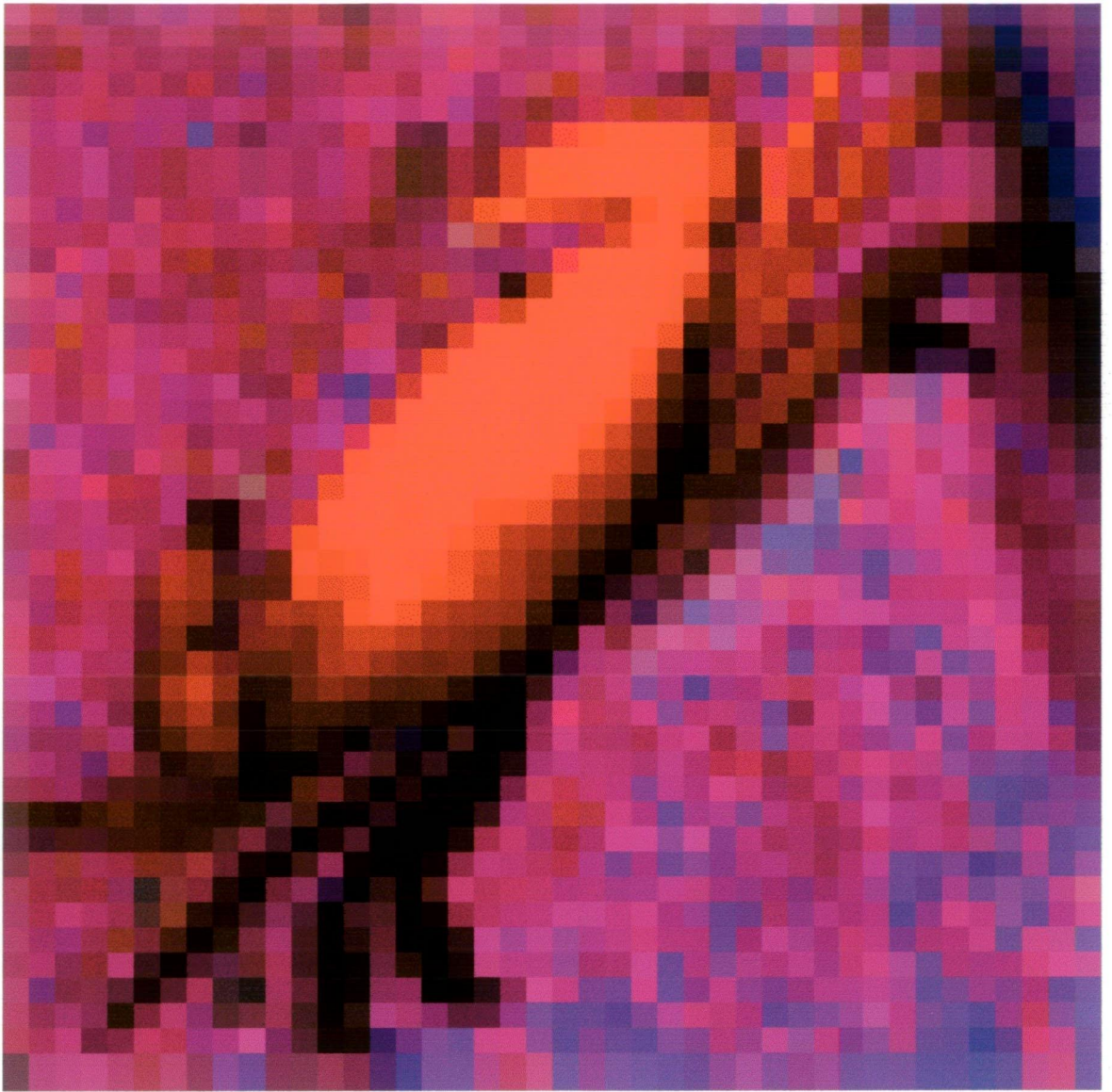


Figure 53. Crab image, 6 in. sq., 7 x 7= 49 pile tufts per sq. in.

Designs for Axminster carpet require relatively large images so that they can be recognised visually in the woven structure. The tuft count in Axminster carpet is 45 to 63 tufts per square inch. This is a low count when compared with the hand-knotted carpets from central and western Asia which contain 150 to 600 knots per square inch. Therefore hand-knotted carpets contain between two and ten times the number of knots as Axminster carpet, enabling more detailed and intricate images to be woven. One of the great challenges in designing Axminster carpet is the extent to which the coarse grid structure can be disguised by the characteristics of the design.

Repeat patterns

Axminster carpet requires repeat patterns in which identical elements occur at regular intervals. This enables carpet strips to be joined together and installed wall-to-wall.

Repeat patterns may be constructed from simple forms such as the square, diamond, ogee, brick and half drop, as illustrated in Figure 54.⁵ History also shows that repeat patterns have developed in complexity over successive generations with one design suggesting another.⁶ Elaborate design modes such as the Girikh apparent in the Mamluk carpets (discussed previously in Chapter 2) evolved in this way (Figure 55).

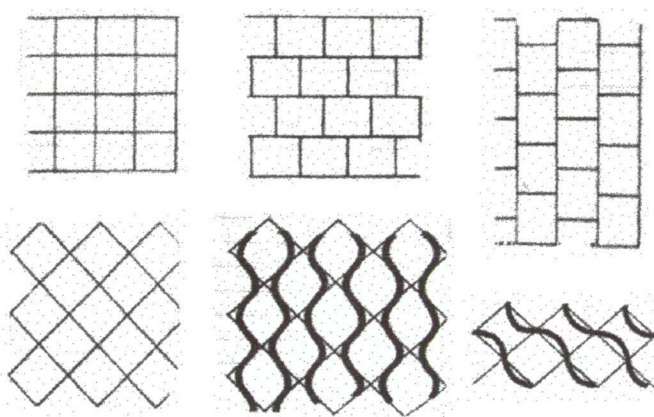


Figure 54. Square, brick, diamond and ogee pattern forms

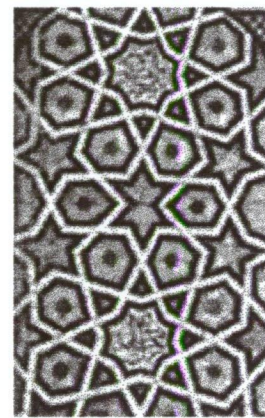


Figure 55. Girikh design

Illusion of depth

Illusion of depth in repeat patterns for wallpaper and floor coverings has been the focus of debate since the 19th century. August Pugin, a design reformist during the 1840s, objected to the use of three-dimensional representation in wallpaper and in carpet, arguing that the notion of illusion came into conflict with the function. Pugin claimed that ancient craftsmen knew better because their paving tiles were decorated with patterns that were devoid of an illusion of depth. He commends Turkish rugs because 'they have no shadow in their pattern, but merely an intricate combination of coloured intersections'.⁷

⁵ For a comprehensive description of repeat pattern construction see Andrea McNamara & Patrick Snelling. *Design and Practice for Printed Textiles*, Oxford University Press, Melbourne, 1995.

⁶ E.H. Gombrich, *The Sense of Order: A Study in the Psychology of Decorative Art*, Cornell University Press, Oxford, 1979, p.87.

⁷ Gombrich, *The Sense of Order. A Study in the Psychology of Decorative Art*, p.34.

The view that there is no need for perspective in decoration was reiterated by fellow design reformers such as Semper, Ruskin and Jones, who, in the 1850s, attempted to drive home the rule that:

nature must not be imitated but should be conventionalised in order not to offend against the law that decoration must be essentially flat.⁸



Figure 56. The unswept room,
Roman mosaic, c. 220 AD



Figure 57. Old rose carpet design, c. 1960

Having said this, the illusion of depth has been used extensively in the decoration of floor surfaces from antiquity. The Roman mosaic floor depicting an 'unswept room', shown in Figure 56, is an example of a floor surface design which utilised a three-dimensional format and is remarkable for its contemporary appearance.

Appearance retention and the illusion of depth

The use of colour and image to suggest an illusion of depth is a key element in extending the appearance retention of carpets. Examples of the old rose carpet styles prevalent from the 1960s have a powerful illusion of depth, as shown in Figure 57. These carpets have been recognised by the industry for their longevity; however, their 'old-fashioned' appearance results from their imagery and the illusion of depth.

⁸ Gombrich, *The Sense of Order. A Study in the Psychology of Decorative Art*, p.56.



Figure 58. Alex Von Jawlensky,
Still Life, 1909



Figure 59. Paul Klee,
Park of Idols, 1939

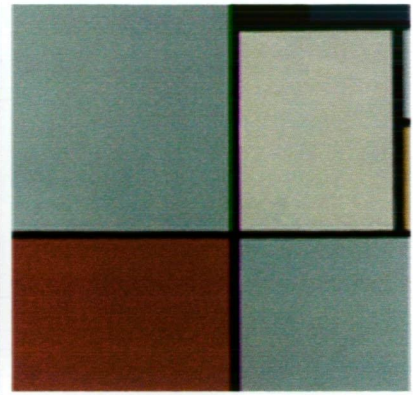


Figure 60. Piet Mondrian,
Composition, 1928

Modernism favoured a flat picture plane and colour was pursued for its expressive qualities, as shown in the paintings of Jawlensky, Klee and Mondrian (Figures 58, 59 and 60). This era of painting was to have a profound and lasting effect on carpet design with numerous carpets being woven in the second half of the 1900s that reflected the exploration in modern painting which had occurred during the first decades of the 20th century.

The success of carpets with an illusion of depth

The use of flat areas of colour in the carpets shown in Figures 61, 62 and 64 creates a background from which stains and wear marks are readily noticed.



Figure 61. Flat areas of colour

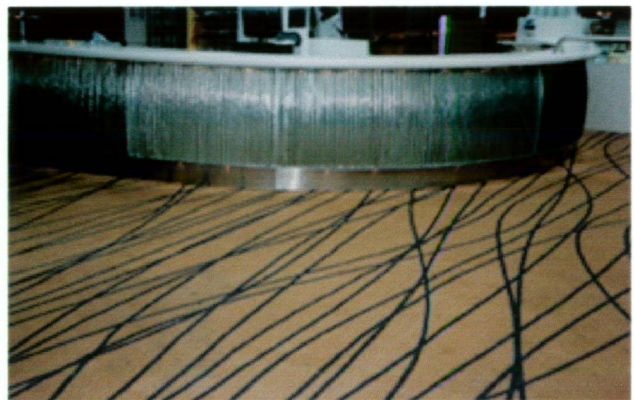


Figure 62. Flat areas of colour

Soiling is more obvious on flat areas of colour than on areas composed of the numerous values required to create an illusion of depth. To illustrate this point the stain marks from the carpet shown in Figure 64 have been transported onto a simulated carpet with an illusion of depth (Figure 63). The stain marks are disguised to a significant degree in the simulated carpet.

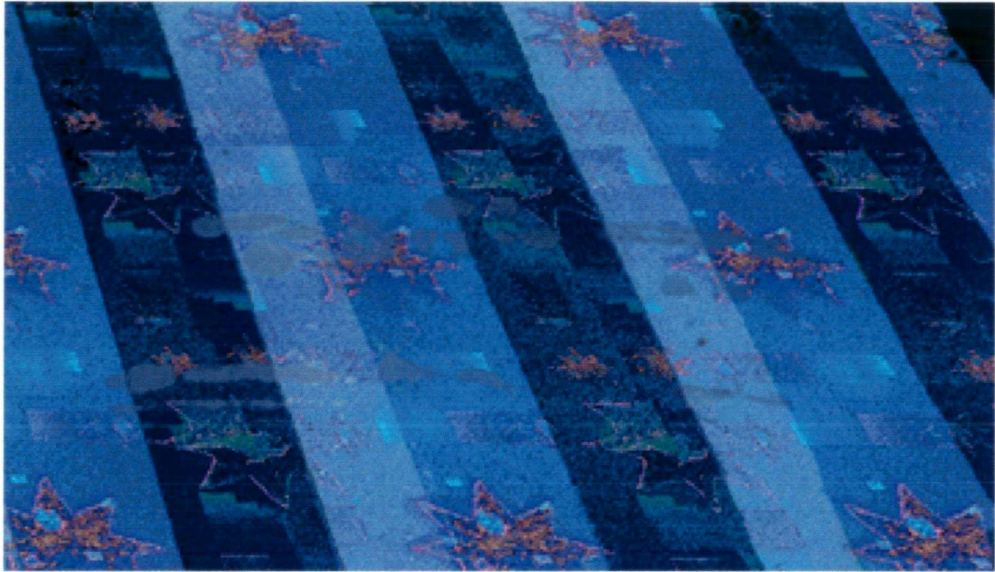


Figure 63. Simulated carpet design overlaid with spoilage marks

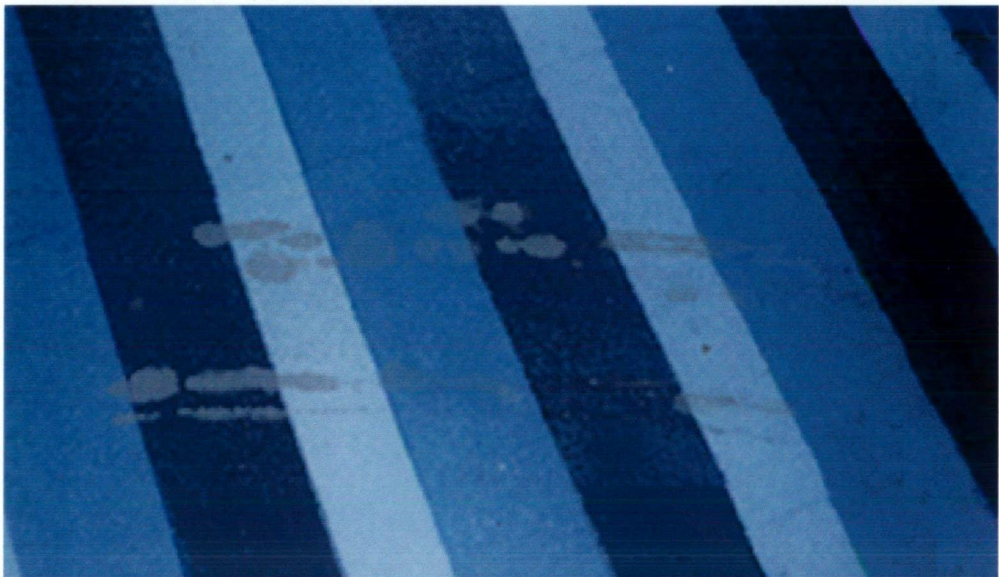


Figure 64. Flat-coloured carpet with visible spoilage marks

Disguising wear for the hospitality and leisure industry

The apparent success of carpets with an illusion of depth to disguise wear marks has important benefits for commercial interiors, as soiled carpets produce negative visual images and feelings which are uncomfortable and off-putting. These are not the welcoming messages the hospitality and leisure industry wishes to project. The spoilage marks illustrated in Figure 64 are more visible in the light and dark blue sections than they are in the medium blue section. The strong influence of the value of colours on the appearance retention factor of carpet will be discussed in Chapter 6.

When a carpet is worn, the presence of an illusion of depth continues to contribute vitality or 'life' to the design.⁹ By contrast, carpets composed of flat Modernist areas of colour, appear tired and lifeless when subjected to a similar amount of foot traffic. The two-dimensional surface quality of carpet design needs to be re-evaluated in respect to functional attributes of carpet. From my investigations, it is clear that an illusion of depth is an important device in extending the appearance retention factor in carpet. Patterns also create illusions which affect our ability to perceive stains and wear marks, as discussed in the next chapter.

⁹ Roger Emery, the Tasmanian State Manager of Tascot Templeton, noted during an interview in September 1999 that an illusion of depth in a design is an advantage, as it assists a carpet to retain its fresh new appearance. Mr Emery lamented the fact that the market rarely requires designs with the degree of depth evident in the old rose carpets.

5. Seeing Pattern

The way we interpret visual information affects the way we see carpet. Our perception of patterns has a significant effect on whether wear marks and stains in carpet are masked or highlighted. In this chapter, I will identify the ways in which pattern can be exploited to assist in extending the appearance retention factor in carpet.

Vision and pattern

In his book, *The Sense of Order: A Study in the Psychology of Decorative Art*, E.H. Gombrich details a number of theories which describe the visual process. By applying these theories to the way we see carpet, the reasons why stained and threadbare sections appear to be disguised in some carpets and highlighted in others, can be explained.

Vision is an active process where people test what they see against a set of cognitive maps stored in the brain.¹ Visual knowledge is developed from infancy and is updated when new information does not fit with what we already know.² For example, a child learns from experience that the floor is flat and that steps are on different levels. As this knowledge increases the 'cognitive maps' form a system of co-ordinates on which meaningful objects can be plotted.³ In this way, our visual understanding of a table top enables us to recognise that it is flat and rectangular in shape, regardless of whether it is viewed from a sitting or standing position.

The stored information allows us to efficiently navigate our way through the mass of visual stimuli. We compare what we see with our visual map in order to identify which information conforms to our expectation and which information requires further visual investigation.

We have developed two systems to sort incoming visual stimuli into hierarchies of relevance.⁴ One is a system of cognitive maps which has a capacity for the expectation

¹ E.H. Gombrich, *The Sense of Order: A Study in the Psychology of Decorative Art*, Cornell University Press, Oxford, 1979, p.1.

² Gombrich, *The Sense of Order: A Study in the Psychology of Decorative Art*, p.1.

³ Gombrich, *The Sense of Order: A Study in the Psychology of Decorative Art*, p.5.

⁴ Gombrich, *The Sense of Order: A Study in the Psychology of Decorative Art*, p.14.

of regularity and the other is a 'searchlight' facility to probe the environment and plot the messages that conflict with our expectation of regularity.⁵

The expectation of regularity is developed by coding visual information such as simple geometric patterns. Once they are coded, these patterns enable us to recognise the underlying rule that all the elements in a pattern are identical. This occurs when we see a standard brick wall: on recognising the underlying rule that all the bricks in the pattern are identical, the wall meets our expectation of regularity and the arrangement sinks below the level of our awareness⁶ (Figure 65). The ease of perception accounts for the boredom and monotony that these 'easy to understand' structures create.⁷

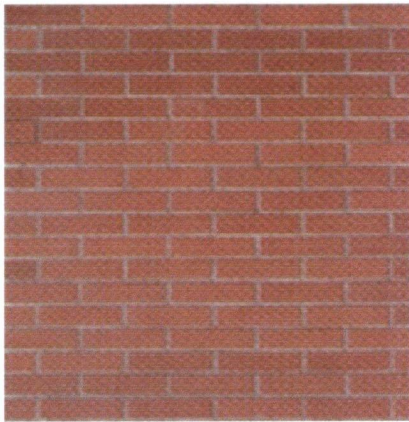


Figure 65. Brick wall



Figure 66. Rose-patterned carpet

Expectation of regularity in carpet

When we view patterned carpets we search for a recognisable pattern. If we readily identify the underlying rule—the repetition of identical elements—the carpet is 'easy to understand' and becomes monotonous and redundant, as with the example of the brick wall. In these carpets we cease to attend to the fine detail and overlook variations such as stains and worn areas.

Carpets such as the rose designs that adorned many houses in the 1950s succeed to a remarkable degree in disguising stains and wear marks (Figure 66). We quickly understand the underlying rule that the groups of roses in the pattern are identical. The

⁵ Gombrich, *The Sense of Order. A Study in the Psychology of Decorative Art*, p.3.

⁶ Gombrich, *The Sense of Order. A Study in the Psychology of Decorative Art*, p.9.

⁷ Gombrich, *The Sense of Order. A Study in the Psychology of Decorative Art*, p.9.

carpet is ‘taken for granted’ and it is not until closer examination, such as during cleaning, that the threadbare and stained regions are apparent. A threadbare and stained section is situated above the cross in Figure 66. A close-up detail of this section of carpet is illustrated in Figure 67. A corresponding area of carpet in good condition is shown in Figure 68.

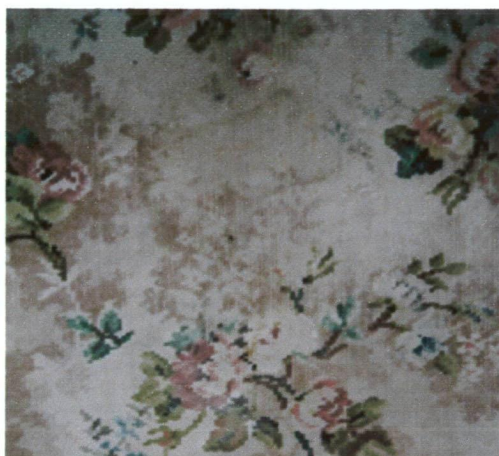


Figure 67. Rose carpet, threadbare section

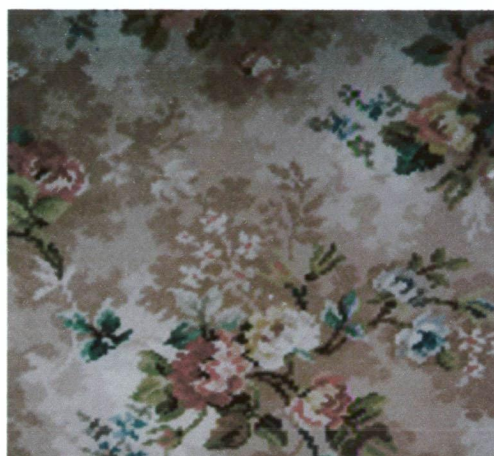


Figure 68. Rose carpet, section in good condition

When an image is consistent with what we have come to expect in our cognitive map, we have a tendency to ‘fill in’ the gaps from our imagination. We ‘extrapolate’ or ‘see’ things when the information to indicate them is scant. In an attempt to preserve our attention for novelty, we have developed a capacity to ‘fill in’ or gamble on the pre-wired expectation of continuity, wherever the monitor receives no message to the contrary.⁸ This ability to extrapolate can be illustrated by our recognition of the downwards-pointing triangle in Figure 69 and the gondolier, buildings and bridge in Guardi’s short-hand sketch in Figure 70. We see a gondolier because we know gondoliers are a part of a Venetian waterway, and we see a triangular shape pointing downwards, because it is hinted at by the surrounding shapes.

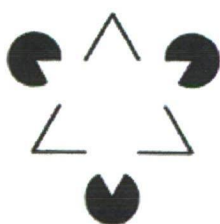


Figure 69. Absent triangle



Figure 70. Guardi’s sketch of a Venetian waterway

⁸ Gombrich, *The Sense of Order: A Study in the Psychology of Decorative Art*, p.108.

When we view the rose-patterned carpet, we fail to notice the worn areas because the pattern sinks to a redundant level in our vision awareness and we project our provisional expectation of continuity and imagine the worn roses are visible, saving our attention for the appearance of novelty.

Carpet patterns which highlight worn areas

While some patterns are effective in appearing to disguise wear marks, other styles of pattern appear to highlight the worn areas. The design of the mottled carpet in Figure 71 is not constructed with easy-to-identify images and the ‘restless’ and abstract nature of the design makes it difficult to identify the pattern repeat. As we continue to scrutinise the carpet, the worn areas are readily noticed.



Figure 71. Mottled carpet

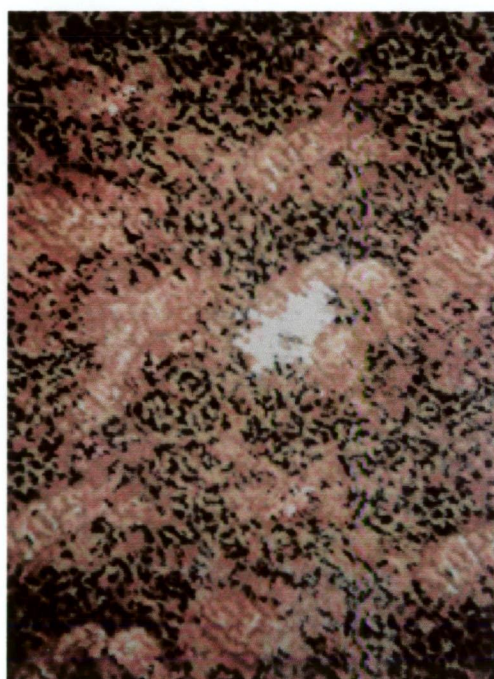


Figure 72. Detail, mottled carpet

We do not extrapolate when we view ‘restless’ patterns. Instead, another feature of our visual system comes into play, which Gombrich calls the ‘break stopper’. Our eyes scan a scene, starting with the ‘big picture’—the perimeter of an object or picture—then focus on those internal elements which disrupt a pattern or scene.⁹

⁹ Gombrich, *The Sense of Order. A Study in the Psychology of Decorative Art*, p.121.

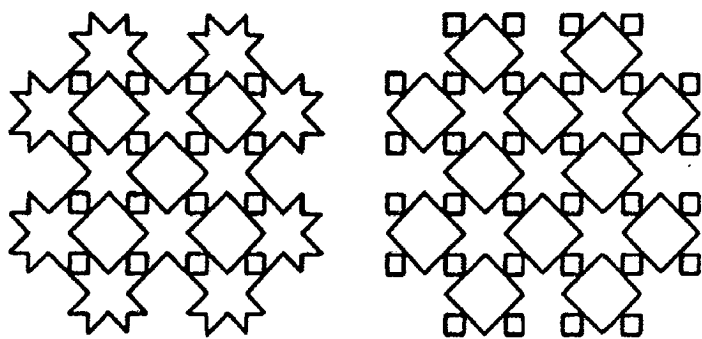


Figure 73. Two identical patterns with different perimeters

The way our eyes first examine the exterior of an object or picture is illustrated in the two patterns shown above in Figure 73. Our eyes initially investigate the perimeter of the two samples but, as the perimeters are different, we imagine the patterns are not the same. Our eyes do not scrutinise the interior patterns as they appear to repeat the external elements in a regular order. In fact, the patterns are identical.

Once our eyes have scanned the perimeter of an object or the bigger picture, we focus our attention on internal points of maximum information which do not fit into our expectation of regularity. For example, if we gaze at a vista, we initially scan the scene and inevitably, our eyes settle on a moving object such as a bird flying, a travelling vehicle or the branches of a tree being blown by the wind. These items attract the attention of our 'break stopper' because they are restless and do not conform to our expectation or regularity. The function of the 'break stopper' is also evident when we look at stationary figures such as the diagram in Figure 74. At first we take in the whole image and then our eyes investigate the central area where two steps are the same size. As the image does not conform to our exception of regularity, our 'break stopper' focuses attention on the area where two steps are identical.

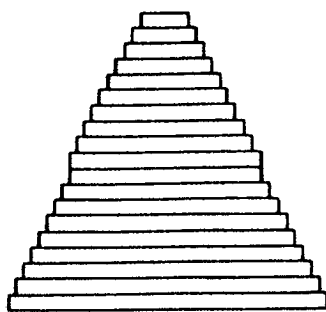


Figure 74. Pyramid

In the mottled carpet shown in Figure 71, our visual attention is sustained due to the restless nature of the design. The 'break stopper' searches out the breaks in the pattern which are the worn sections of the carpet, highlighting the poor condition of the floor covering.

Patterns can be described as lying in the continuum between restlessness and confusion on one hand—attracting the attention of the 'break stopper', and monotony or redundancy on the other—effectively turning off our visual attention. Patterns which are perceived as restless and confusing, attract our attention and highlight stains and wear marks. Patterns which are readily identified become monotonous and fall below the threshold of our awareness.

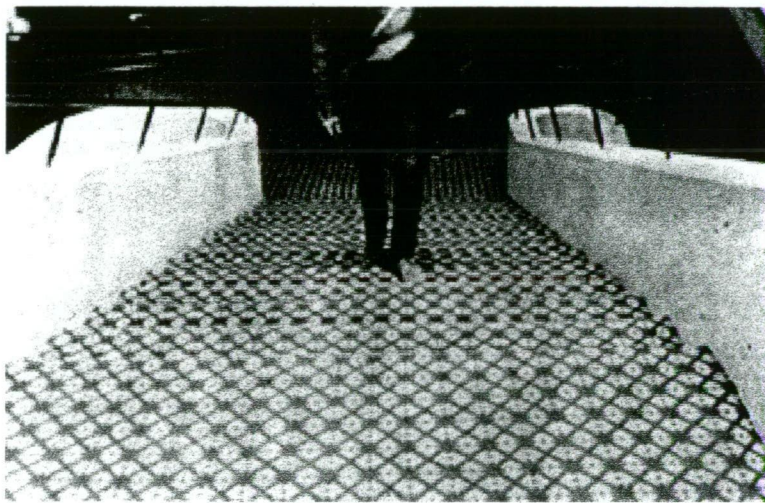


Figure 75. Dangerous carpet for a stair

Strident patterns

While predictable patterns are effective in disguising wear marks, they can also disguise important visual information such as the position of stairs treads and various levels in split levels floor plans. Strident, regular patterns can have unwanted outcomes when they over-ride fine detail in the floor surface.¹⁰ The loud pattern in the carpet shown in Figure 75 masks the edge of each step, making this a difficult and dangerous staircase to negotiate. In his book *Visual Explanations*, Tufte makes the point that:

¹⁰ Gombrich, *The Sense of Order. A Study in the Psychology of Decorative Art*, p.108.

Shrill and strident visual activities tend to dominate the information space, scrambling finely detailed but relevant content.¹¹

In another example of a distracting design, the stair treads in a New York city railway station were covered in a material decorated with design elements running parallel to the tread edge. Over a period of six weeks, until the material was removed, more than 1400 people fell on the flight of stairs.¹² In this case, the easily understood pattern allowed the flooring to sink below the level of conscious awareness and the visual information required to negotiate each step was confused. The gamble we take on expected regularity is useful in masking wear marks but needs to be modulated in relation to carpeting for stairs and split level surfaces.



Figure. 76. Carpet with a 'directional pull'

Directional pull

The nature of 'directional pull' is a critical consideration in carpet design. A directional pull is a visual impression created by the design of the carpet which makes one feel like moving in the direction set by the pattern track. For example, the carpet shown in Figure 76 creates a forceful directional pull from the bottom right to the top left. This design has the effect of making one feel the need to walk towards the top left hand corner of the passage. In addition, the positioning of the carpet tends to draw in the

¹¹ Edward Rolf Tufte, *Visual Explanations*, Graphics Press, Connecticut, 1997, p.65.

¹² Tufte, *Visual Explanations*, p.65.

vertical elements of the architecture making a small entrance lobby seem even smaller than it really is.

More than one directional pull can occur in a design. For example, the pattern shown in Figure 77 creates the impression of two imaginary lines running through the design from bottom right to top left at angles of approximately 40 and 150 degrees. If this pattern was used in a carpet it would have a similar effect to the carpet in Figure 76 of making one feel the need to walk towards the top left-hand corner of the area.

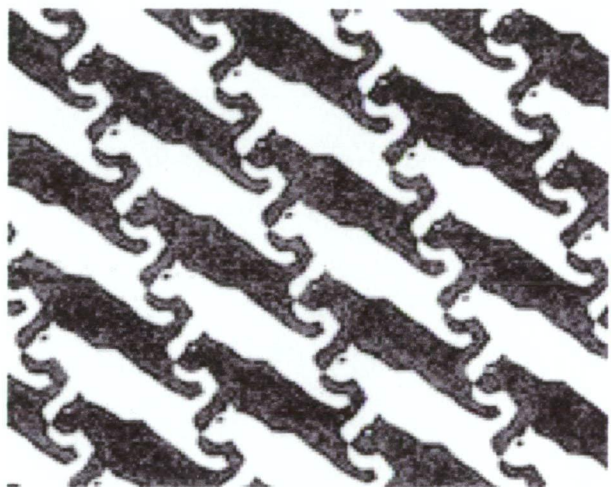


Figure 77. Design with a 'directional pull'



Figure 78. Vertical lining

Lining is the term used to describe a directional pull which occurs in the vertical or horizontal direction. An imaginary vertical line is apparent in the design shown in Figure 78. Vertical lining make spaces appear thinner and longer and horizontal lining makes spaces appear shorter and wider. Balanced patterns, free of design lines and directional pulls are required for carpeting as they avoid the uncomfortable impression of having to walk in a direction suggested by the carpet.

A further consideration in the design of carpet pattern is the use of geometric patterns and thin straight lines such as those found in tartan patterns or diagonal lines and grids, as they tend to move slightly due to foot traffic when they are installed. This has the effect of making the straight lines and grids waver and curve creating an untidy and unattractive patterned surface. Carpets designs composed of straight lines and grids appear out of place when they are installed in rooms which are not exactly square in shape or have angular or curved walls. These carpet patterns highlight any oblique

walls in the room. The lines, shapes and grids in the carpet pattern seem out of place and incongruent in these settings, as shown in Figure 79.



Figure 79. Carpet with strong geometric forms against curved walls

The perception of pattern affects the extent to which our eyes recognise the presence of stains and wear marks, therefore selective pattern configuration in the visual design process can be exploited to extend the functional life of the carpet.

While pattern formation is an important design tool for influencing appearance retention, the application of colour within the woven surface also performs a significant role, as described in the next chapter.

6. Colour: Psychology and Application

In this research, visual design strategies which are effective in extending the appearance retention factor in wall-to-wall carpets have been identified so that they can be applied to the carpet designs for the leisure and hospitality industries. Colour is a significant factor in this process, as it has a strong influence on the appearance retention factor of carpet. I will now examine this influence along with; the psychological effects of colours, colour harmonies, the visual system's capacity for adaptation, the suitability of colours to particular room functions, and the potential for colours to contribute to a mood or a theme in venues of the hospitality and leisure industries.

Colour is a critical component of carpet design. It is an evocative phenomenon, capable of provoking immediate, marked and continuing responses in the viewer's perception of a scene. Carpet is one of the main components of an interior space and occupies approximately 33 per cent of the visible surface area.¹

The physical make up of our visual system influences the psychological responses we experience when we view coloured areas. Our eyes contain three types of colour sensitive cells, called cones. The cones are sensitive to either red-orange, green or blue-purple wave lengths.² By combining different levels of these three colour-sensitive cells we can see all the colours in the visible spectrum.³ Our eyes are equipped with twice as many red-orange sensitive cones as blue-purple sensitive cones. The number of green sensitive cones are mid-way between those of red-orange and blue-purple.⁴ This feature of our visual system means that people are more sensitive to red-orange than to green or blue-purple hues.⁵ The heightened sensitivity to red hues is an evolutionary feature which has assisted human survival by alerting us to danger. Red is the colour of blood, which stands out clearly in the natural environment where green and blue hues predominate.

Our physiology and emotions are also affected by the colours we see. Different coloured light entering the eye affects the hypothalamus, which in turn affects the

¹ Yvonne Rees, *Floor Style*, Van Nostrand Reinhold, New York, 1989, p.70.

² Helen Vardley, *Colour*, Mitchell Beazley Artists House, London, 1980, p.32.

³ Paul Zelanski, & Pat Fisher, *Colour*, The Herbert Press, London, 1989, p.19.

⁴ Glade-Wright Robyn, *Colour Mixing For Textiles*, self-published, Hobart, 1989, p.16.

pituitary gland. The pituitary gland controls the entire endocrine system, including the thyroid and the sex glands, which control hormone levels and the moods that they create. The physiological effects of red include a quickened heart rate, raised blood pressure, increased respiration rates, a trigger for the release of adrenalin into the bloodstream and a sense of warmth.⁶ Orange shares these effects to a lesser extent and so does yellow to a slightly lower level again. Those colours which decrease these physiological measures are green (which has a minimum effect - the lens of the eye focuses green light almost exactly on to the retina)⁷ and blue (which has a medium effect). Black generates the maximum effect in these measures.⁸

The physiological effects of colour have been utilised in interiors to create specific emotional responses. This was illustrated by a French football coach who painted his team's locker room red to excite his players. The coach painted the visiting teams' locker rooms green to relax and sedate the visitors before the game and during the half-time break.⁹

Experiments have established that people feel five to seven degrees warmer in rooms painted in warm red-oranges hues than they do in rooms painted blue-green, even though the temperature is the same in both areas.¹⁰ An example of the influence of colour on temperature is evident in a factory with blue-green walls in which the employees complained of feeling cold. The walls were repainted in a coral hue and the employees no longer felt cold even though there had been no change in the room temperature.¹¹

Colour in the built environment

The physiological and psychological effects of each colour need to be considered when designing carpets in order to recognise and utilise the evocative nature of colour in the built environment.

⁵ 'Hue' describes the general colour groups. The terms 'red' and 'blue' describe different hues.

⁶ Vardley, *Colour*, p.186.

⁷ Vardley, *Colour*, p.206

⁸ Zelanski & Fisher, *Colour*, p.30.

⁹ Zelanski & Fisher, *Colour*, p.31.

¹⁰ Johannes Itten, *The Art of Colour*, Van Nostrand Reinhold, New York, 1973, p.64.

¹¹ John F. Pile, *Interior Design*, Harry N Abrahams, New York, 1988, p.267.

The aggressive, energetic, warm and exciting physiological impact of large areas of saturated red hues can result in people feeling over-stimulated and uncomfortable.¹² Carpets composed primarily of red hues are most suitable for spaces which are not occupied for long periods of time, such as hotel foyers. Warm reds are also suitable for multilevel spaces where staircases and open levels subdue the red's stimulating influence. In these spaces red hues are experienced as rich, exciting, warm, luxurious and welcoming. A saturated, active, red carpet would create a dynamic feeling in a fast food establishment; however, it may not be suitable for creating the relaxed ambience required in an exclusive restaurant. David Hick's carpet (Figure 79) combines an active red hue with black squares and produces a highly stimulating environment typical of the 1970s design values. Deeper tones of red, including maroon and magenta, create a feeling of warmth, richness and opulence.¹³



Figure 80. David Hick's stimulating 1970s carpet



Figure 81. Orange carpet in a Chicago office

Orange hues share the physiological qualities of red, albeit on a reduced scale. Orange hues are experienced as warm, expansive, rich and extroverted.¹⁴ Orange is associated with tenderness and commercial success.¹⁵ It shares the cheerful associations of yellow. Orange stimulates our senses and contributes warmth to carpet designs, as illustrated in the Chicago office shown in Figure 81.

¹² Itten, *The Art of Colour*, p.134.

¹³ A tone is a colour which is made darker by the addition of black or another dark colour.

¹⁴ Vardley, *Colour*, p.194.

¹⁵ John F. Pile, *Colour in Interior Design*, McGraw Hill, New York, 1997, p.144.

Yellow is a warm expansive colour and is experienced as less aggressive than red or orange.¹⁶ Yellow is the brightest colour in our visual system, as both red-orange and green cones are activated by yellow light.¹⁷ For this reason yellow is used as the warning colour for heavy machinery and raincoats. Yellow has symbolic associations with the sun and has cheerful and active connotations.

The light value¹⁸ of yellow is problematic for use in carpet, however, as stains and wear marks become readily visible. This is evident in a yellow carpet installed in a bar in the Crown Casino, Melbourne, which was severely spoiled by numerous cigarette burn marks (Figure 82).

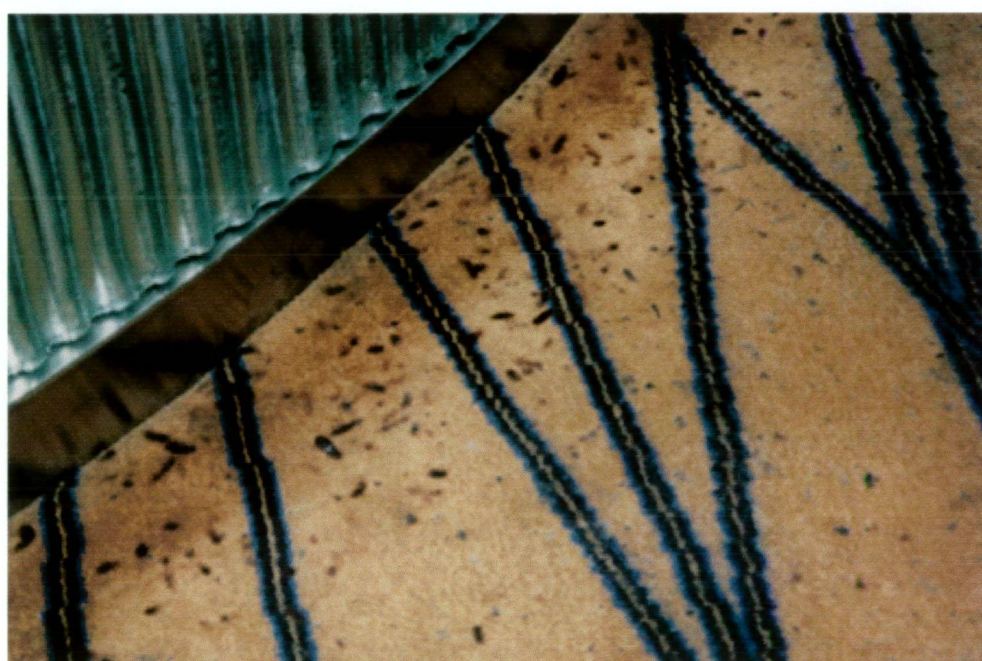


Figure 82. Yellow carpet with burn marks, Melbourne Crown Casino

A second carpet in blue tones was installed around the perimeter of the yellow carpet (Figure 83). The blue carpet was also covered with unsightly cigarette burn marks; however, they were only visible on close inspection, as the value of the blue hue was similar to that of the burn marks, thus effectively camouflaging their presence (Figure 84).

¹⁶ Pile, *Colour in Interior Design*, p.144.

¹⁷ Vardley, *Colour*, p.200.

¹⁸ 'Value' describes the lightness or darkness of a colour. White has the highest value and black has the lowest value. Pink is lighter in value than maroon.



Figure 83. Yellow and blue carpet,
Melbourne Crown Casino

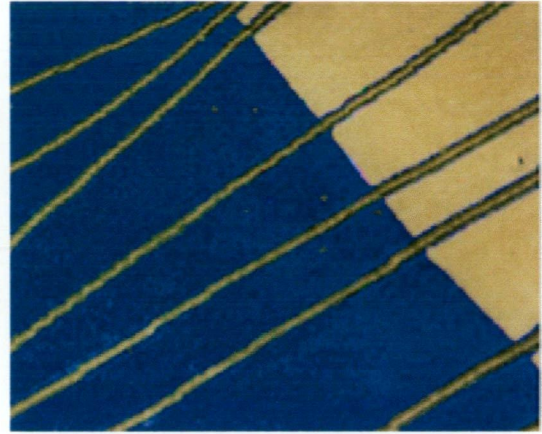


Figure 84., Blue carpet with cigarette burn marks,
Melbourne Crown Casino

The problem with using yellow carpet in the hospitality industry is not one of psychological concern, but rather, a practical issue, as it is difficult to disguise wear marks in carpets of light value such as yellow.

Yellows containing a high percentage of green/grey induce associations with illness.¹⁹ A carpet composed of yellow hues on the green/grey side of the scale and red hues was replaced only after six months use in a restaurant in the Crown Casino due to the persistently negative reactions from the patrons. The negative responses resulted from the psychological mismatch between the carpet's colour and the desire to eat.

Green hues are the most restful for the eye as the lens focuses green light almost exactly on the retina.²⁰ Green is associated with fruitfulness, contentment, emotional balance, tranquillity and the interpretation of knowledge and faith.²¹ The non-denominational Rothko Chapel in Houston, Texas, is hung with Mark Rothko's large colour field paintings in shades of green and creates a meditative environment for visitors (Figure 85).²² Green has been regarded as an ideal choice for interiors and its consequently over-use in government buildings has led to the term 'institutional green'. However, green remains a popular choice for interiors and there are no adverse psychological concerns with using green hues in carpet design.

¹⁹ Itten, *The Art of Colour*, p.132.

²⁰ Vardley, *Colour*, p.206

²¹ Itten, *The Art of Colour*, p.136.

²² Zelanski & Fisher, *Colour*, p.35.

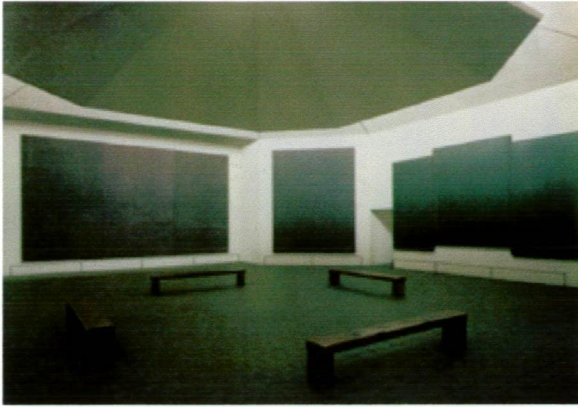


Figure 85. Rothko Chapel, Houston, Texas

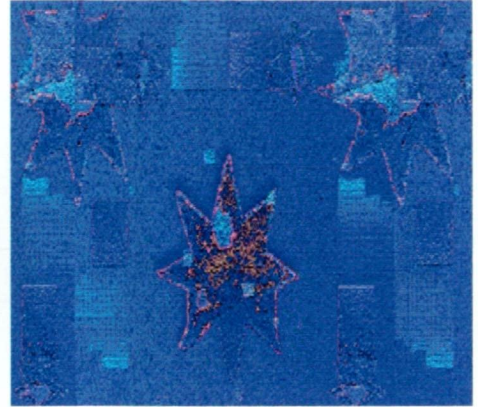


Figure 86. 'Eureka' carpet design

Blue surroundings have the effect of lowering the body's temperature, blood pressure and pulse rate, creating a physical and emotional sense of coolness.²³ Blue can be associated with depression, as indicated by the phrase 'to have the blues'. Blue is also an expansive colour suggesting the openness and spaciousness of the sea and the sky and is associated with tranquillity, peace and eternity.²⁴ The cooling aspect of blue hues can be countered to some extent in carpet design by the addition of warm highlights, as shown in Figure 86. Representatives from the carpet industry report that blue hues are not used as frequently in carpet installations as greens, warm red shades and browns.²⁵ The cooling aspect of blue hues is in contrast to the warm, comforting feelings associated with wall-to-wall carpet and the desire to create a warm, welcoming interior space in the venues of the hospitality and leisure industry.

Violet hues are warm when they are inclined towards red, and cool when they are closer to blue. The psychological associations of violet include sensitivity, subtlety, self-identity, mystery and artistic expression. Tints of violet represent the brighter aspects of life, and violet shades represent the darker negative forces.²⁶ Violet was once considered a troublesome colour for interiors due to its wide range of associations. It is now readily applied in the built environment, as shown in the San Antonio Library, Texas (Figures 87 and 88).²⁷

²³ Pile, *Colour in Interior Design*, p.148.

²⁴ Vardley, *Colour*, p.212.

²⁵ Advice from Roger Emery. Tasmanian State Manager. Tascot Templeton.

²⁶ Itten, *The Art of Colour*, p.137.

²⁷ Pile, *Colour in Interior Design*, p.148.



Figure 87. Exterior use of violet,
San Antonio Library, Texas



Figure 88. Interior use of violet,
San Antonio Library, Texas

Browns share the psychological warmth of red, orange and yellow without the energetic implications. Hues such as tan, honey and terracotta are associated with the fertile earth, wood, clay and bricks. Browns are effective in expressing a combination of dignity, homeliness and subdued comfort.²⁸ Brown hues are suitable for carpets if the application is one in which traditional comfort and homely dignity is required.

White is symbolic of purity, cleanliness, simplicity, clarity and peace. An arctic white carpet would have a psychologically cold, empty and uninviting association which is at odds with the warm, comforting and luxurious associations of carpet. White Axminster carpet would present the same challenges as other light hues such as yellow in terms of its low ability to disguise wear marks and stains.



Figure 89. Cream carpet



Figure 90. Black carpet

²⁸ Pile, *Colour in Interior Design*, p.149.

Off-white and cream tones in carpet provide a sense of warmth and luxury, as shown in Figure 89. In the commercial environment light cream hues readily show wear marks and stains. A plain, cream-coloured carpet with a sculptured surface was installed in a large gambling amenity in the Crown Casino. The light cream hue was initially selected to help create an environment of opulence and luxury. The cream shade became greyish within six months even though the carpet was steam-cleaned weekly, making the room appear tired, shabby and worn.

Grey is associated with secrets, seclusion and non-involvement. Dark greys can engender a depressive and ominous psychological response. Light greys in the warm range serve as an effective foil for more chromatic tones in carpet designs.

Black has the greatest effect of any colour in stimulating the heart rate, increasing blood pressure and respiration rates, and prompting the release of adrenalin into the bloodstream.²⁹ Black is a powerful colour suggesting dignity, formality and solemnity, as shown in Figure 90. Black carpets can be overpowering if they are used in large areas.

The deep tone of dark carpets such as black, navy, dark grey and deep maroon create a strong contrast in value to light-coloured wear marks such as food spills and litter. Because of the high contrast in value, it is easy to identify lighter coloured spoilage marks and litter on dark coloured carpets. Figure 91 illustrates how the food spillage marks are more readily apparent on the dark and light sections of the carpet than they are on the mid-blue section. Therefore, both dark and light coloured carpets present problems in the hospitality and leisure industries as it is difficult to maintain a fresh appearance in carpet when spoilage materials are readily apparent.

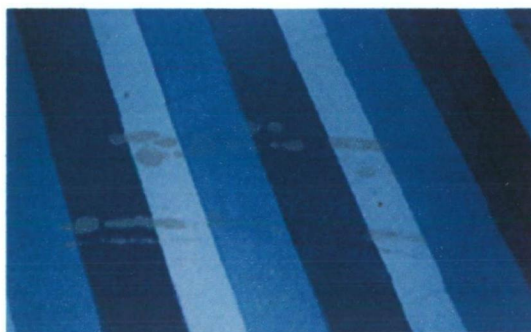


Figure 91. Soiled carpet, Melbourne Airport

²⁹ Vardley, *Colour*, p.186.

Adaptation

One of the features of the visual system which needs to be considered when specifying carpet colours is our capacity for adaptation. Colour adaptation serves to protect the individual from an excess of sensory reaction to a given situation.³⁰

Adaptation is evident when one moves from a brightly lit environment into one that is dim. At first it is difficult to see in the dim light but after several minutes the visual system adapts and vision becomes easier. Adaptation is also evident when one puts on tinted sunglasses. Brown tinted sunglasses initially make the scene appear to be tinged with brown until the visual system brings about an adaptive correction and the colours are seen as normal. When the glasses are removed the world then appears to be tinged with blue-green until re-adaptation takes place.³¹

Adaptation is also experienced when a red area is viewed for a period of time and our vision then shifts to a white surface where a complementary green tone will be seen briefly. Similarly a small red dot on a black background will appear as a green dot on a white background when our vision shifts to a white surface.

When a large area of colour is present the adaptive mechanism seeks the complementary colour to reduce the impact of the predominant colour. By providing the complementary accents in the colour scheme of a carpet design the viewer is relieved of excess sensory input; and the need for maintaining an adaptive, defensive colour shift through mental adjustment, is reduced.

Monochromatic colour schemes composed of tints and tones of one hue create a sense of monotony.³² The negative reactions to monochromatic colour schemes are caused by the mental strain required for adaptive relief from the overload of a particular colour sensation.

Neutral colour schemes can create negative reactions from the lack of colour stimulation. White can appear blank, and greys and black can be experienced as monotonous and depressing. Computer screens are predominantly white and black

³⁰ Pile, *Colour in Interior Design*, p.104.

³¹ Pile, *Colour in Interior Design*, p.105.

³² A tint is a colour which is made lighter by the addition of white or another light colour

during word processing functions. To relieve the mental strain of adaptation to these neutral tones, a lively Axminster carpet composed of red, green, blue and orange hues was laid in the computer laboratory of the School of Architecture in the University of Tasmania (Figures 92 and 93). The carpet provides chromatic relief from the neutral tones of the computer screen.³³

Carpet can be effective in providing colour stimulation and relieving the mental strain of adaptation to neutral tones, frequently used on wall and ceiling surfaces.³⁴



Figure 92. Computer laboratory,
University of Tasmania, 1999



Figure 93. Detail, Computer laboratory,
University of Tasmania, 1999

Colour combinations

Combinations of colours in carpets contribute to the tone of an interior. This can range from energetic and lively to calming and relaxed. Multi-coloured carpets are effective in reducing the strain of the adaptive process.

³³ The colourful carpet was selected by Ian Clayton to reduce the fatigue caused by adaptation.

³⁴ Pile, *Colour in Interior Design*, p.105.

Analogous colour schemes are derived from colours positioned next to each other on the colour wheel. The close relationship of analogous colours virtually ensures harmony and produces relaxed colour schemes. Analogous colours provide more variety than monochromatic schemes; however, some adaptive strain will occur as the complementary colours are absent. The carpet design shown in Figure 94 is an example of an analogous colour scheme that consists of green, blue and mauve hues. In a room with carpet in this design, the warm red, orange and yellow hues would be formed in the process of adaptation as these colours are not present in the carpet.

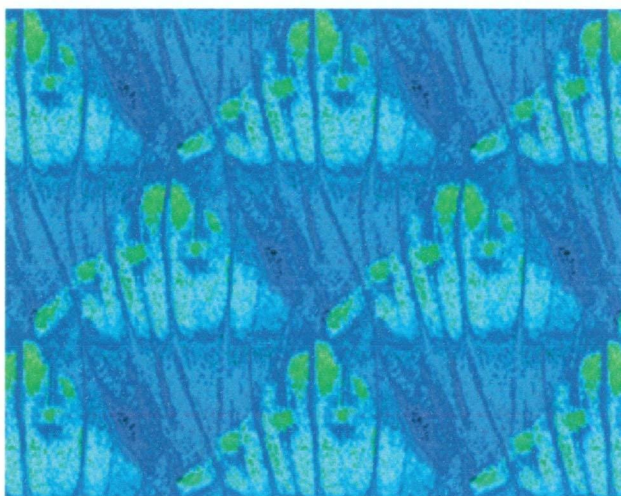


Figure 94. Carpet design in analogous colours

Complementary colour schemes utilise pairs of colours which are positioned opposite to each other on the colour wheel. The complementary colour combinations of yellow/purple, red/green and blue/orange create liveliness and variety in a colour scheme. Used in appropriate proportions, complementary colour schemes establish a visual equilibrium and create a balance that avoids the need for adaptation.³⁵ The colour theorist and author Johannes Itten writes that: 'The stabilising power of complementary colour is important in mural painting'.³⁶ The carpet surface, like the mural, benefits from the balance derived from one or more sets of complementary colours because of the visual equilibrium.

When the saturation of the hue is high in both colours present in a complementary scheme the image tends to become excessively active. These schemes are frequently

³⁵ Itten, *The Art of Colour*, p.79.

³⁶ Itten, *The Art of Colour*, p.79.

used in sporting uniforms and advertising material. In the Eureka design shown in Figure 86, the complementary colours blue and orange are present. The orange hues are low in saturation and in smaller proportions, forming a more subdued scheme for the carpet.

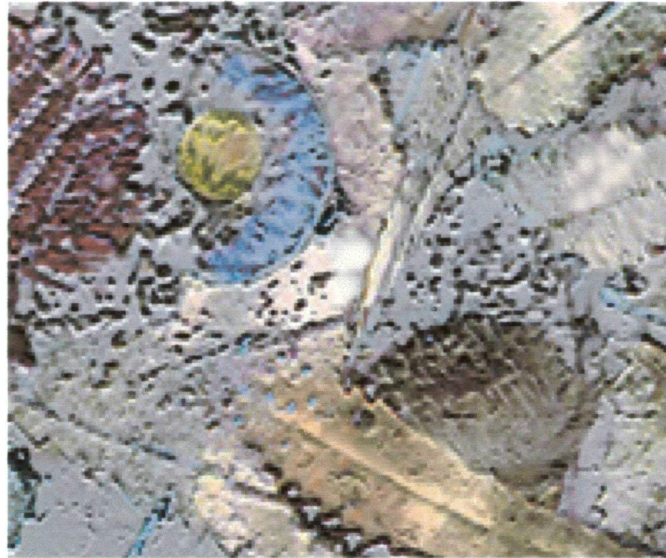


Figure 95. Carpet design using triadic colour scheme

Triadic colour combinations comprise any three colours equally spaced around the colour wheel, such as red, blue and yellow, or orange, green and purple. These colour schemes produce rich colour harmonies, the distribution of colours ensuring that both warm and cool elements are present in the design. A triadic combination of red, blue and yellow tints is utilised in the Banksia design shown in Figure 95.

In the harmonies discussed above, areas of different coloured hues are positioned next to each other in the carpet design. Significantly, carpet surface has the advantage of being woven from yarns that can be spun from a combination of different coloured fibres. This permits the incorporation of optical colour mixing, as described in the following chapter.

7. Optical Colour Mixtures

In this chapter I will examine the potential for producing optical colour mixtures in Axminster carpet and detail the way in which colours mix in the optical system. The rich shimmering quality of optically-mixed colours contributes a vitality to the carpet surface. This is an effective strategy in extending the appearance retention factor of the carpet.

Optical colour mixing occurs when areas of different colours are too small to be resolved by the visual system as independent colours. They are seen as one optically-mixed colour.¹ The French chemist M.E. Chevreul rediscovered optical mixing during his work in the Gobelin Tapestry works in Paris.² Chevreul's work was published in 1839 and was influential in the colour theories of artists such as Seurat, who practised pointillist painting in France during the 1890s.³

The size of coloured areas has a strong influence on optical mixing. For example, the green and red eucalypt leaves of the Australian bush mix optically and appear golden when viewed from long distances such as high altitudes in an aeroplane. At ground level the eucalypt leaves are large enough to be perceived individually, as either green or red leaves.



Figure 96. Paisley shawl

¹ Robyn Glade-Wright, *Colour Mixing For Textiles*, self-published, Hobart, 1989, p.13.

² Johannes Itten, *The Art of Colour*, Van Nostrand Reinhold, New York, 1961, p.15.

³ Herbert Read, *A Concise History of Modern Painting*, Thames & Hudson, London, 1974, p.26.

The Paisley shawl shown in Figure 96 illustrates the shimmering jewel-like colours formed by optical mixing, a quality also present in Mamluk carpets (discussed in Chapter 2 and shown in Figure 18). The optically-mixed colours in the shawl are produced by juxtaposing red, yellow and green threads. Two enlarged sections of the Paisley shawl are shown in Figure 97.

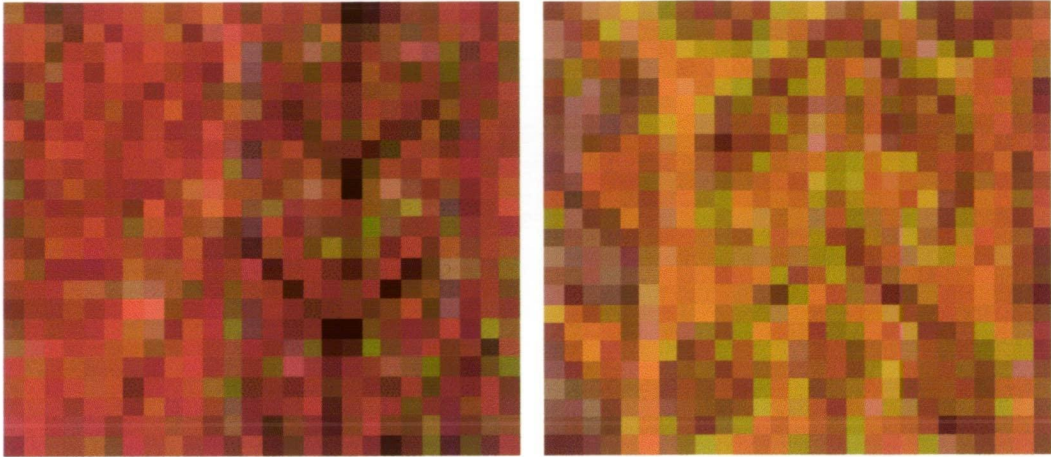


Figure 97. Details, Paisley shawl

Optical colour effects and contemporary carpet

The visual phenomena of optical colour mixing can be utilised in Axminster design where it creates a rich, lively and shimmering quality in a carpet surface. This vitality is effective in retaining the fresh appearance of a carpet.

The use of optical colour mixtures reduces the mental strain of our adaptive colour response because of the numerous colours which can be incorporated. For example, in both Mamluk carpets and the Paisley shawl above, the complementary colours of green and red are combined together with yellow, lime-green and orange hues.

There are several ways of producing optically-mixed colours in Axminster carpet. One option is to create a yarn composed of different coloured strands. The strands are known as ‘singles’ or ‘legs’. A three-leg yarn is formed by twisting a red, a green and a yellow leg together to form a three-ply yarn, as shown in Figure 98.



Figure 98. Three-leg yarn

To examine if it is possible for a three-leg yarn (i.e. composed of three different coloured legs) to create an optically-mixed colour in an Axminster carpet, the following calculations can be undertaken.

The number of coloured points available for optical mixing in the highest quality carpet woven from three-leg yarn can be calculated by multiplying the number of tufts by the number of legs. There are 7 columns and 9 rows in high quality carpets, producing 63 tufts. The tufts have a 'U' shape so each tuft contributes two positions in the carpet surface. Therefore $63 \times 2 = 126$ positions. In the case of a three-leg yarn, 126 positions are multiplied by three, giving a total of 378 points for colour mixing.

For an optical colour mixture to occur, the points of colour must be too small to be resolved as independent colours. We can compare the 378 points of colour formed from the three-leg yarn, with a Mamluk carpet, to establish if this construction will form an optical mixture.

A Mamluk carpet contains 240 knots per square inch. The knots in the Mamluk carpet are 'u-shaped', producing 480 points. This enables optically-mixed colours to be formed when the carpet is viewed from a normal standing position. Therefore a three-leg yarn woven in a high quality carpet would contain 78 per cent of the coloured positions present in a silk Mamluk carpet. The concern in using a three-leg yarn for the purposes of colour mixing is that the colour points may not be small enough to mix optically when viewing the carpet from a close distance.

In lower quality carpet that contain 7 columns and 6.5 rows per inch the number of colour points when using a three-leg yarn would be 273 ($6.5 \times 7 \times 2 \times 3 = 273$). This is approximately 57 per cent of the number of colour points in a silk Mamluk carpet and at this scale optical mixing would only occur from a distance of several metres.

An alternate method for producing optical mixing is to spin a yarn by blending fleece dyed in different colours, as shown in Figure 99. Yarns spun from a blend of different coloured fibres would mix optically because the size of the coloured fibres would be too small to be resolved in the visual system as independent colours.



Figure 99. Yarn spun from a combination of coloured fleece

To establish the potential for optical mixing I spun a yarn from a combination of red, orange, lime-green, green, ochre and yellow fleece. I then wove a carpet sample which emulates the Axminster pile surface, as shown in Figure 100. This sample demonstrates that optically-mixed colours can be achieved in Axminster carpets.

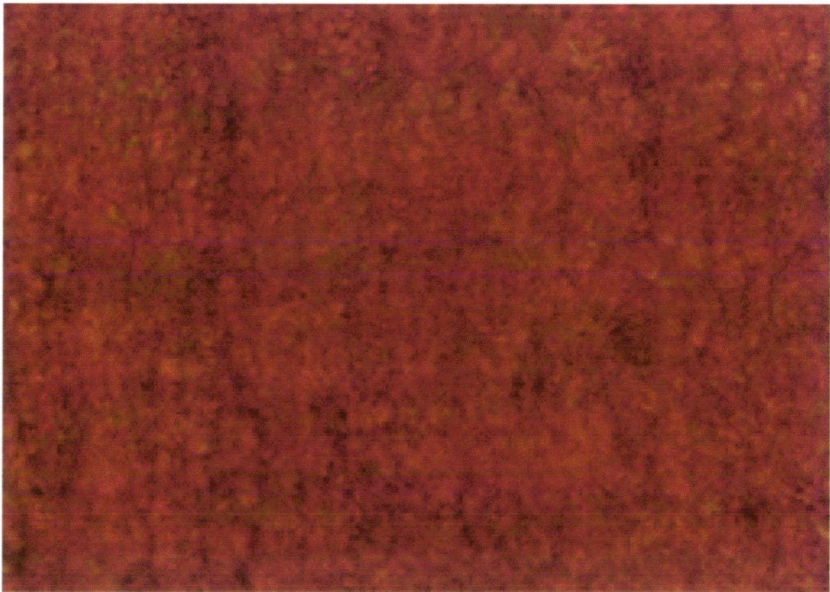


Figure 100. Hand-woven carpet sample

Optical colours

The phenomenon of optical colour mixing works in a different manner from subtractive colour mixing. Subtractive colour mixing occurs when paints and dyes are combined. Optical colour mixing also differs from the additive system of colour mixing that occurs when rays of light are combined. Additive colour mixing typically operates in the colour formation of a television or computer screen.

The appearance of colours in an optical mixture can be identified by the long process of spinning and weaving samples and can be predicted by a process of time-averaging. In this process, the colours to be mixed are placed on a disk and rotated at high speed on the end of a drill or similar rotating device. The speed of the disk rotating results in the colours being time-averaged in the visual process. This has the same effect, as the area-averaging apparent in the blends of coloured fibres and threads. Optical colour mixtures can also be examined by combining colours on the computer screen, repeating them over a large area and then compacting the size of the area. The examples shown in Figures 101 to 111 have been made with the aid of this computer-assisted technique.⁴

Complementary colours in the optical system are positioned opposite each other on the colour wheel, as illustrated in Figure 101. Complementary colours in an optical mixture produce neutral greys.⁵ Thus a combination of yellow and blue will create an optically mixed grey unlike the familiar green produced by a mixture of yellow and blue paint. The yellow and blue squares shown in Figure 102 are an enlarged detail of the optically mixed grey in Figure 103.

⁴ I remain sceptical about using combinations of light on the computer screen to emulate materials such as woollen yarns. For this reason I have woven physical carpet samples.

⁵ For further information on the proportions for optical blends see Glade-Wright, *Colour Mixing For Textiles*, p.24.



Figure 101. Optical colour wheel

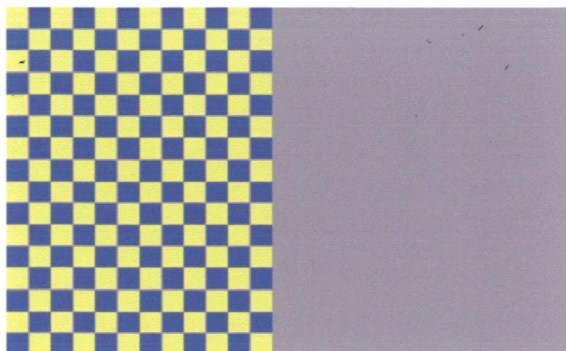


Figure 102. Optical complementaries, yellow and blue

Figure 103. Grey, optically -mixed from yellow and blue

The additive primaries are blue-purple, red-orange and green (Figure 104). An optical mixture of any two of these produces toned hues. Toned hues are colours which deepen with the addition of black. For example, an optical mixture of red-orange and green produces a toned yellow or ochre, as illustrated in Figure 105. An optical mixture of blue-purple and red-orange produces a toned magenta (Figure 106). An optical mixture of blue-purple and green produces a toned turquoise (Figure 107).

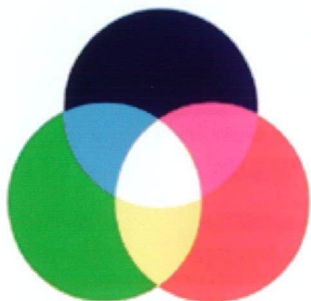


Figure 104. Additive primary and secondary colours

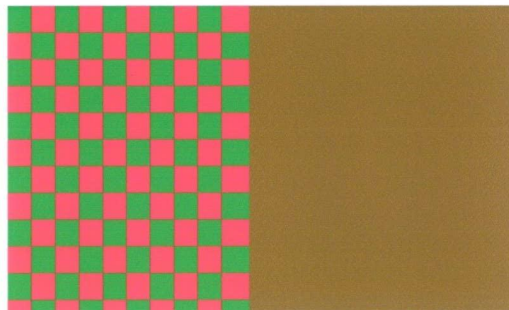


Figure 105. Red-orange and green squares mix optically to produce a golden hue

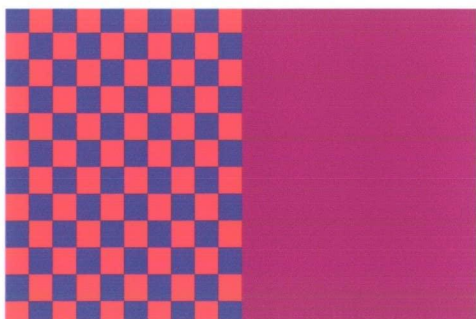


Figure 106. Red-orange and blue-purple squares mix optically to produce maroon

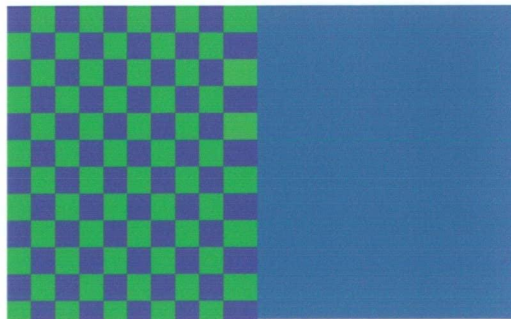


Figure 107. Blue-purple and green squares mix optically to produce toned turquoise

An optical mixture of two subtractive primaries (yellow, cyan and magenta, shown in Figure 107) produce tinted hues. Tinted hues are colours which are lightened by the addition of white. This results from two sets of cones in the eye being activated when we view yellow, cyan and magenta. For example, when we see the colour magenta both the red and blue sensitive cones in the eye are activated. The optical mixtures of cyan and yellow, cyan and magenta, and magenta and yellow, are illustrated in Figures 109 to 111. They all appear to be tinted with white.

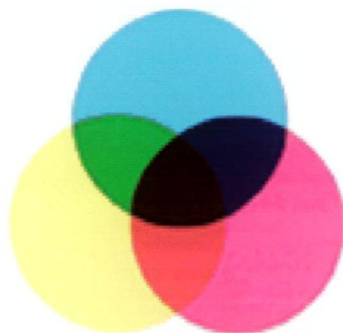


Figure 108. Subtractive primary and secondary colours

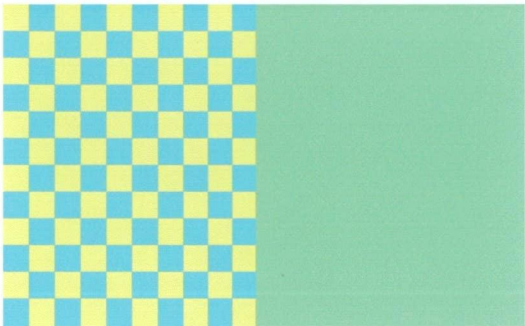


Figure 109. Cyan and yellow squares mix optically to produce light green

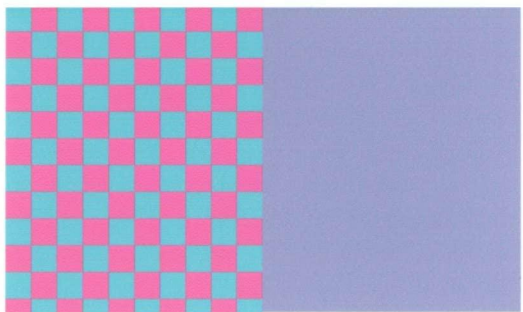


Figure 110. Magenta and cyan squares mix optically to produce mauve

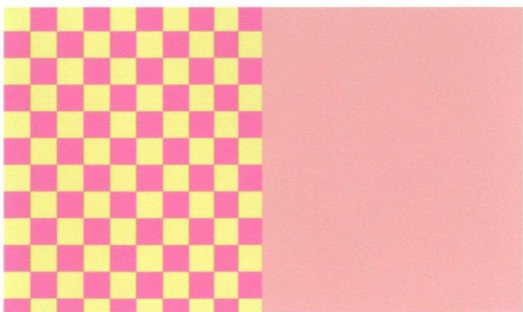


Figure 111. Magenta and yellow squares mix optically to produce salmon

In our daily lives the eye adapts to a natural environment comprised of a multi-faceted array of colours. Plain colours in carpet designs are visually monotonous, whereas optically-mixed colours produce rich effects that provide visual relief from the over-stimulation of the eye by a single colour. The vitality of the surface created by the shimmering effects of optical colour mixing prolongs the fresh, new look of carpet. In the next chapter the attributes of colour and pattern will be assessed in terms of their influence in the built environment.

8. Carpet in the Built Environment

In this chapter I will examine the various expressive and functional roles that carpets can perform in the fit-out of domestic and public interior spaces. The major design theories which have impacted on the built environment during the 20th century, Modernism and Postmodernism, will be surveyed and assessed in terms of their influence on the design of wall-to-wall carpet. A description of my carpet prototypes will also be presented. –

20th century design—Modernism and Postmodernism

For a large part of the early 20th century, decoration and ornament were critiqued by several art theorists as being facile. In 1908, Adolf Loos asserted that ‘ornament is crime’¹ and in 1923, Mies van der Rohe expressed the essential spirit of Modernism when he coined the phrase, ‘Less is more’, effectively rejecting the symbolic and intrinsic values of ornament.² Forty-three years later the low status of decoration was re-evaluated by the proponents of postmodernism. In restating and subverting ideas about history and context, architect Robert Venturi proclaimed in 1966 that ‘Less is a bore’.³ This major recasting of decoration and ornament as a visual language for the contemporary built environment, has activated conditions in which carpet design can again have an important role.

The dominant influence on contemporary built environments and designs since 1950 was Modernism. From its origins in the early decades of the 20th century Modernism saw the new technologies of the machine age as providing the path to a better world order. It emphasised purity of form, the ‘honest’ use of materials, machine techniques, and the absence of traditional decoration. These characteristics were interpreted by design schools such as the Bauhaus which concentrated on producing prototypes of utilitarian objects for mass-production. The famous Marcel Breuer chairs, c.1922 (Figure 112), are typical of this philosophy. Textile design placed emphasis on an abstract use of pattern rather than the floral designs typical of the late

¹ Loos, ‘Ornament and crime’, 1908, in Gombrich, *The Sense of Order: A Study in the Psychology of Decorative Art*, Cornell University Press, Oxford, 1979, p.59.

² Mies Van der Rohe, c.1923, in Patricia Conway & Robert Jensen (eds), *Ornamentalism*, Clarkson N. Potter, New York, 1982, p.1.

19th century. The fabric designed by Otti Berger, c.1922 (Figure 113), illustrates how the passage of the threads interacting in the weave structure form the embellishment. Design approaches of this kind marked a significant change from the earlier textile designs that were embellished by the addition of complex imagery, embroidery or printed patterns.



Figure 112. Chairs, Marcel Breuer, c.1922

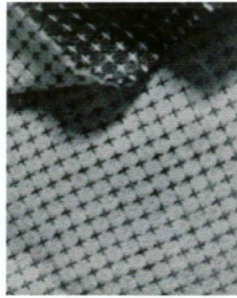


Figure 113. Fabric, Otti Berger, c.1922



Figure 114. Bird, woven fabric, William Morris, late 1870s

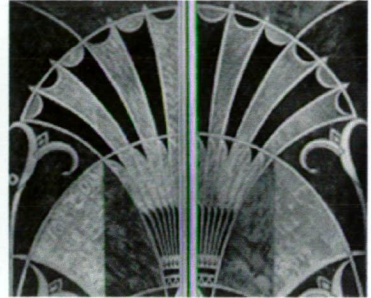


Figure 116. Elevator door, Chrysler Building, William van Alen, 1928–30

Other art and design styles were practised alongside Modernism during the early decades of the 20th century. One of these, the Arts and Craft Movement, reached its high point in England in the late 1800's, with design reformers such as William Morris working extensively with traditional hand-crafted methods to source naturalistic imagery in the production of printed and woven textiles (Figure 114). Art Nouveau, another movement that referenced the natural world, developed in Europe, spreading its influence across the Atlantic Ocean to the United States where Art Deco dominated commercial architecture and design until 1945⁴ (Figure 115).

Modernism's supremacy led to the International Style in architecture. The city skyscraper and high-rise concrete and glass apartment blocks were the visual icons of the movement. Eventually, the universal nature of the International Style in architecture and interior furnishings, distanced the individual from connections with the past and the ability to make a statement about the present.

³ Robert Venturi, *Complexity and Contradiction in Architecture*, 1966, in Conway and Jensen, *Ornamentalism*, p.1.

⁴ Patricia Conway & Robert Jensen, *Ornamentalism*, Clarkson N. Potter. New York, 1982, p.10.

For most of us, a home or an office is much more than a simple shelter. It is a place which connects us to the world, embodying identity, memory and security. In the 1970s people began to experience International Style buildings as inhuman and soulless. The rejection of these kinds of buildings was evident in 1972 when the socially undesirable Pruitt-Igoe high-rise blocks in England, built 20 years earlier, were demolished.

The term 'Postmodernism' was coined during the 1970s to describe an attitude in the arts and architecture which removed the modernist barriers to historical reference and began to acknowledge context, mood, culture and ornament. Postmodern buildings were frequently ironic and double-coded in their discursive intent: mixing the architect's professional tastes with those of the clients. This invariably marked wide choice, pluralism and complexities of reference.⁵ The language of Postmodernism cut across high and low cultures and was both a continuation of Modernism and its transcendence.⁶



Figure 116. Copa Banana Lounge, Dolphin Hotel, designer Michael Graves, Florida, 1982

Postmodernism employed irony and parody in a way which allowed the audience to participate in humorous aspects and to know what was genuine and what was not.⁷ For example, the Copa Banana Lounge in the Dolphin Hotel (Figure 116), designed by

⁵ Charles Jencks, 'Death for rebirth', in Andreas Papadakis (ed.), *Post-Modernism on Trial*, Architectural Design, Academy Editions, London, 1990, p.7.

⁶ Charles Jencks, 'The resurrection and death of the new moderns', in Papadakis (ed.), *The New Modern Aesthetic*, p.10.

⁷ Conway & Jensen, *Ornamentation*, p.19.

architect Michael Graves for the Walt Disney Corporation, celebrates a tropical fruit theme, allowing guests to engage in the open fun of it all. Even the title 'Copa Banana' is a playful parody, referring to the summer mood of the Copa Cabana. The carpet installed in the Copa Banana Lounge, shown in Figure 117, is more lively, random and colourful than earlier designs informed by the Modernist aesthetic.

During the late 1980s the ideas associated with Postmodernism were challenged by critics who saw it as shallow, eclectic, disordered and lacking substance.⁸ In subsequent architectural practice, buildings have characteristically cut across taste, cultures and time, referring to the past, present and future as an evolutionary chain.

Postmodernism was effective in re-casting the place of history, symbolism, narrative, pluralism and the role of memory. Significantly, it challenged categories of exclusion and hierarchy. The diminished position of Modernism, brought about by its failure to communicate with a wide audience and its lack of reference to place and context, was an important lesson.

Postmodernism and theming

One of the strategies of Postmodernism was the extended use of theming. Themes are created in the hospitality and leisure industries to enhance the experience of entertainment and to provide a fictional atmosphere which transports patrons into an other-world atmosphere far beyond the everyday. The application of theming has become a widespread phenomenon throughout the western world where entire building complexes now incorporate theming as a commercial strategy.

The hotels which serve the rich and famous have already had a long association with theming. Essentially, theming was used to create a fantasy world for their patrons. For example, the interior of Club El Morocco in Manhattan, built in the mid 1930s, has a faux, North African fantasy theme with a theatrical backdrop of artificial palm trees, cacti, zebra-striped upholstery and tented ceilings (Figure 118). The bar provides a sense of the imagined exotic.

⁸ Philip Cooke, 'Back to the future', in Papadakis (ed.), *The New Modern Aesthetic*, p.23.



Figure 118. Club El Morocco, Manhattan, mid-1930s

Michael Graves' Swan Hotel is a theme park (Figure 119). The swan theme is developed by the two twelve metre tall swans which adorn the roof, the interior lighting and the wall decoration. The theme created here is a make-believe, fun-filled fantasy world.



Figure 119. Swan Hotel, designer Michael Graves, Florida, 1980



Figure 120. Village Roadshow cinema, Jam Factory, Adelaide, 1997

Venues such as cinemas are now also themed. The Village Roadshow chain of cinemas is ornamented with a cosmic theme (Figure 120). The carpet pattern reflects the star-shaped ceiling light which uses the kind of adornment prevalent in the neo-classical style of the mid-18th century. From the moment patrons walk into the star-

studded foyer, the decor creates a sense of expectation and anticipation, transporting patrons away from the world they left outside.

Several themes are often present within a commercial complex, creating a range of environments for the clientele. In the massive Crown Casino complex in Melbourne a sports bar with all its visual associations is adjacent to a colourful bar with a nostalgic motoring theme. The carpet in the nearby Planet Hollywood, depicted in Figure 121, directly references the exotic zebra-striped upholstery in the famous Club El Morocco (Figure 118).



Figure 121. Zebra-stripe carpet, Planet Hollywood, Melbourne Crown Casino

Designers developing carpet within the culture of themed spaces need to accommodate the eclectic ideas and commercial strategies of the hospitality and leisure industry. The danger that exists here, is that carpet designs can become kitsch when an attempt is made to illustrate a specific theme without subtlety, as illustrated in the casino carpet design shown in Figure 122. The most enduring designs are those which communicate as much indirectly as they express literally.

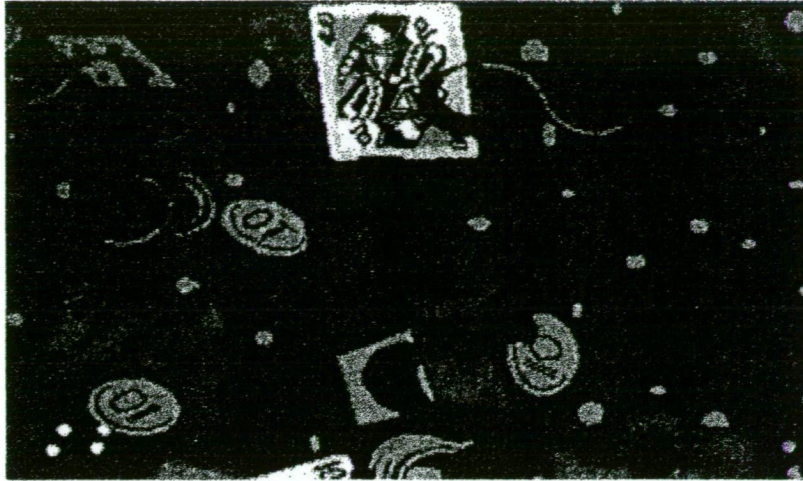


Figure 122. Casino carpet design

Physical attributes of carpet

Carpets generally induce a feeling of warmth, comfort and luxury and these associations are often exploited in the hospitality and leisure industry to promote a sense of opulence, grandeur and invitation.

Carpet is the softest floor covering available and it is the most widely-used soft floor treatment in the industrial world. It also functions as a highly effective sound insulator. This is evident in carpeted restaurants where the sounds of chairs moving and people talking are muted and absorbed by the carpet, creating an environment of relaxed comfort. On the other hand, restaurants with harder surfaces such as ceramic tiles, timber and slate are noisier and less comfortable than carpeted restaurants. These surfaces are easier to clean than carpeted surfaces, however, which is an important consideration for high volume food outlets.

Carpet pattern and room size

Carpet pattern dimensions and the vibrancy of colour impact on the way we encounter space. In my experience, carpets with small patterns which are low in vibrancy have the effect of making a room appear more spacious. They tend to open up the vertical space, making the ceiling appear higher from the floor. An impression of

spaciousness can be created in buildings with small interior areas, by installing the same carpet with a diminutive pattern throughout rooms, foyers and hall areas.⁹

Conversely, carpets with large, bold patterns compress a space and make it appear smaller. The carpet installed in Mario's Palace Hotel in Broken Hill (Figures 123 and 124) has a medium-sized pattern with vibrant colours in contrasting values. The carpet reduces the perception of space in the hotel, making this otherwise spacious area feel claustrophobic.

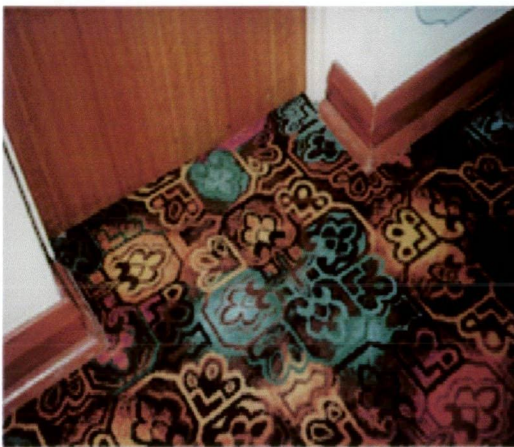


Figure 123. Carpet, Mario's Palace, Broken Hill



Figure 124. Carpet detail, Mario's Palace

In large buildings the appearance of the overall volume of the interior can be reduced by the use of carpets with pattern formations that are closer in size to the human scale, as well as by combining carpet sections.¹⁰ This is apparent in the carpets installed in the main entrance hall in the Crown Casino, Melbourne (Figure 125). The overall size of the entrance foyer is reduced by the small scale of the pattern in the background carpet. The foyer is carpeted with a combination of the background carpet and gold carpet panels. The placement of the gold carpet sections directs the flow of patrons through the building's interior.

Wall-to-wall carpet can be installed to indicate a change of function between spaces in a building. For example, in a multiple purpose arcade, the position where a restaurant adjoins a passage can be identified by installing different carpets in each area.

⁹ Elizabeth Wilhide, *The Flooring Book*, Ryland Peters & Small, London, 1997, p.129.

¹⁰ Conway & Jensen, *Ornamentalism*, p.4.

Expressive capacity of carpet

In the contemporary built environment the decorated carpet surface is able to communicate images of corporate identity, tone, theme and function to an audience by the use of logos, emblems, motifs, colour and pattern. Carpet design can project qualities of desired social status and lifestyle in a similar way to clothing. The old English rose carpets were successful in creating an atmosphere of homely opulence and comfort in their heyday during the 1940s and 1950s.



Figure 125. Carpet in the foyer of the Melbourne Crown Casino



Figure 126. Living room in Coober Pedy, 1986

Figure 126 is a photograph, taken in 1981, of a carpet installed in an outback preacher's home in Coober Pedy. In this remarkable underground setting the choice of carpet is curious, given the Persian pattern it emulates. The carpet invests the room with a feeling of middle-class, homely luxury; however, it tells us little about the Australian context. This contextual visual information is only provided by the framed prints hanging on the wall which depict the Sydney Harbour Bridge, the Opera House and an Australian vernacular settler's timber cottage. Evidently, the images in these prints are important to the home owners and one can ask why carpet in a Persian style

was selected. It is likely that it was because there was little choice in Australia in the 1960s.



Figure 127. Carpet in the Centennial Hotel, Launceston

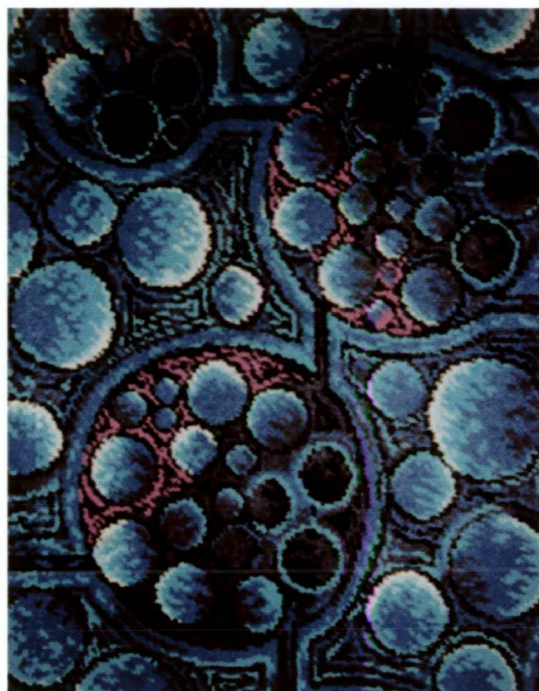


Figure 129. Detail, carpet in the Centennial Hotel

In my view, many contemporary wall-to-wall carpet designs fail because they do not utilise the expressive quality of the carpet surface to engage us. The carpet from the Centennial Hotel in Launceston (Figures 127 and 128) satisfies the criteria that I have identified for retaining a fresh new appearance for a significantly longer time than a plain-coloured carpet. The carpet illustrated in Figures 127 and 128 includes an illusion of depth, a pattern structure which is easy to recognise and a predominance of mid range colour values. While the carpet will be successful in retaining its fresh new appearance, it remains, however, a disappointing example because it fails to take up the challenge of expressing an aspect of contemporary life. It tells us little about the Australian context or culture and fails to delight or inspire. In effect the carpet design does not rise above the formal, visual structures of decoration.

Unlike the example from the Centennial Hotel, contemporary carpet surfaces can provide a useful format for the expression of cultural beliefs, including identity, humour, symbolism, beauty, meaning, context, time and place.

My carpet prototypes

In the previous chapters I have set out to describe the background of wall-to-wall carpet design and discuss how an analysis of historical models is able to contribute to the design process of contemporary prototypes. In particular, the use of optical colour mixing, an illusion of depth, and selective pattern structures and colour application provide an important technical basis for the realisation of contemporary prototypes which have heightened appearance retention qualities. In addition, the expressive role of carpet, which was fundamental in early hand-knotted examples, has been reinstated in my prototypes to articulate cultural meaning.

With this understanding I chose a number of images from our natural, urban and social environments as starting points for surface design prototypes to illuminate the Australian experience. In tackling the subject matter, I became aware of the visual motifs invested with iconographic meaning, that had their genesis prior to Federation. As well, there are other visual icons that have undergone continuous revision by succeeding generations. For example, the Opera House, the Sydney Harbour Bridge, the Australian flag, and the kangaroo and emu represent long-standing and immutable signs of place. On the other hand, icons such as Uluru, the Eureka flag and particularly, the Australian wilderness, are visualised in ways that project a much more modern, outward-looking, confident Australia.

The Dingo Fence design constructs an image of Australia's interior and the farming activities upon which much of the country's early prosperity was founded. Many urban Australians have never ventured into the interior landscape, even though the red centre forms a part of the popular sense of our national identity. This has evolved in two ways: firstly through images in tourist brochures, coffee table books, and national team uniforms, including the athlete's uniform designed for the 2000 Olympic games. And secondly, the heroic exploits of discovery and settlement of inland Australia. The dingo fence is a remarkable structure given that it runs from South Australia through New South Wales and on into Queensland. This 'running fence' silently divides Australia into territories. It segregates the fertile from the arid, the moderately populated from the sparsely populated, and the contained and controlled from the expansive and wild.

Designs incorporating representations of Australia's flora and fauna are suitable for export to international venues such as Australian consulates, overseas offices of Australian companies and hotels and night clubs utilising antipodean themes. The Currawong design presents an image of this familiar bird along with a symbol representing a river. Birds are dependent on the availability of water. Rain in arid areas will bring flocks of birds to feed on the shrimps and larvae which have hatched following the down pour. The Currawong design has been set in Mount Eagle, a late Georgian home situated in Ireland.

Several designs make oblique and subtle reference to their Australian source including the Spotted Box Fish design, the Pelican design and the Tiger Cup design. The abstract appearance of these designs makes them suitable for a wider export market than carpets, incorporating literal references to Australia's culture or flora and fauna. The Tiger Cup design which is composed of patterns derived from the extinct Tasmanian Tiger and gecko skins, is not immediately apparent to the audience. However, the beauty and vitality of these naturally occurring patterns imbues the carpet designs with a fresh, sublime and potent quality which increases the potential for export. The Tiger Cup design has been incorporated into a bar in the Manchester Bridgewater Hall, U.K.

The decorative aesthetic framework which I have chosen references Australia's natural, urban and social environment to articulate cultural meaning and to imbue the carpet surface with enhanced appearance retention qualities.

Importantly, my carpet prototypes have sought to capture the beauty, vitality, sense of order, structure and majesty of Australia's natural flora and fauna in ways that serve the demands of the hospitality and leisure industries. My treatment of images sits outside of the myth-making, sentimental and inward looking visual methods of the period between the wars, and the facile, literal renditions of Australia associated with the modern souvenir.

Conclusion

Throughout this exegesis I have consistently made the case for carpet as an important vehicle in visualising the aspirations and cultural values of our society. In making this proposition, I have drawn attention to historical precedents and different forms of floor coverings before the advent of wall-to-wall carpet in Western society. These examples were often rich in cultural value and were created with the same authority as other interior elements to give form and meaning to the spirit of the time.

Modernism and two of its instruments for making a break with the past—new technology and industrial manufacture—initially side-stepped the medium of wall-to-wall carpet as a foregrounding device in the expression of the era. While the theory of Modernism rejected decoration and ornament from the past, motifs copied from other cultures continued to be reproduced in carpet, particularly Persian-style designs. These remained popular throughout the 20th century and as a result, most Western industrial carpet manufacturers operated outside the sphere of modernism's influence for many years. The high cost of carpet and the desire for it to endure many years of use meant that it often remained in place well beyond the fashion that was current at the time of its installation. This also had a tempering effect on the customer and the manufacturer's desire to embrace new Modernist design modes. The perennially 'safe' designs of the English rose patterns and Persian style gul motifs were preferred, particularly by the conservative sectors of society. Consequently, carpet manufacturers lagged well behind the adoption of Modern design tenets apparent in furniture, ceramics, glass and printed fabrics. When carpet manufacturers eventually adopted the flat-coloured geometric patterns associated with Modernism, the movement was soon to be overtaken by Postmodernism.

Since the 1980s there has been a reluctance by carpet manufacturers to move on and embrace Postmodern sentiment. I have presented evidence to show that the carpet industry continues to develop designs associated with Modernist composition, even though characteristics such as an illusion of depth, optical colour mixing, colour gradations and selective use of pattern have much to contribute to extending the appearance retention of Axminster carpet.

Essentially the importance of this project has been to reassess the role and purpose of the decorative patterned surface, particularly the Axminster carpet pile surface, in the

period following the 1980s. Through a series of Axminster design prototypes, I have demonstrated how the important functional characteristic of appearance retention can be successfully integrated within a decorative aesthetic framework that references contemporary life. The research outcomes also attempt to show how the two pillars of industrial production—design and technology—can be joined by art’s capacity to question and articulate meaning in the carpet product. In that context, wall-to-wall carpet does not need to be passive or continually subservient to other elements of the interior setting. An art, design and technology partnership in the manufacture of contemporary Axminster carpet will ensure that the medium has a persuasive voice expressing the realities and imaginings of our time.

Appendix 1

Wall-to-Wall exhibition catalogue



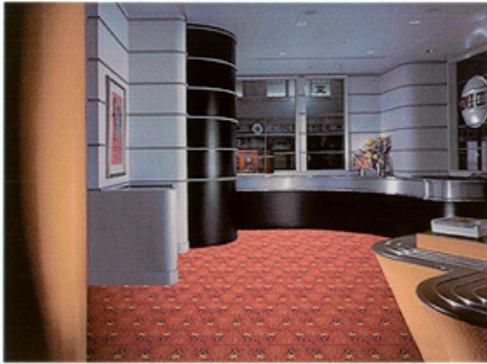
Wall-to-Wall

Axminster Carpet: Visual Design
Strategies for Appearance Retention

Master of Fine Art (Research) submission

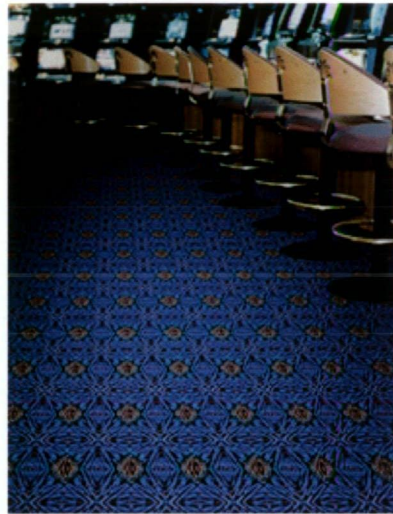
Robyn Glade-Wright

Prototype Designs Incorporated in the Built Environment



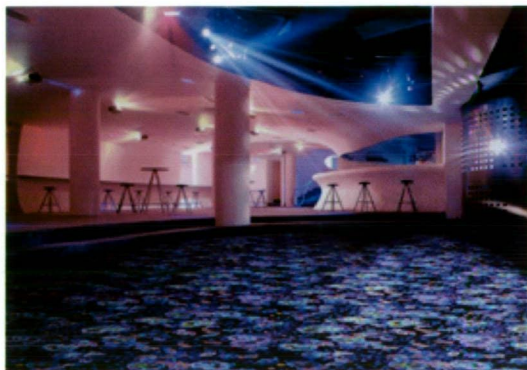
Dingo Fence Design (left) is based on a dog sign which hangs on a farm gate on the Australian dingo fence. The carpet is shown in the Gower Cafe. Source: *Gensler, The Architecture of Entertainment*, Anthony Iannacci, l'Arca Edizioni, Bergamo, 1996, p.49.

Pelican Design (right) used pelican feathers as a source for the design. The carpet is shown in a Melbourne casino. Source: Tascot Templeton Brochure, 1997.



Tiger Cup Design (left) is composed of dots and stripes sourced from gecko and Tasmanian tiger skins. The carpet is shown in a bar in the Manchester Bridgewater Hall, Manchester, UK. The architectural firm is Renton Howard. Source: Wood Levin, *World Architecture*, no. 57, June, 1997, p.115.

Swan Bay Shell Design (right) is shown in the Melbourne Capital Nightclub, Melbourne, 1994. The architect is Tom Kovac. Source: *Architectural Monographs no. 50*, Tom Kovac, Academy Editions, Chichester, 1998, p.46.



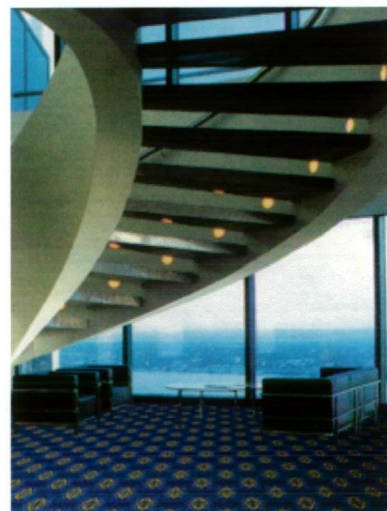


Crayfish Creek Design (left) is shown in the Ebel Stand Restaurant, Basel. Source: Sophie Tasma-Anargyros, Andree Putman, Laurence King Publishing, London, 1993, p.50.

Currawong Design (right) is shown in Mount Eagle, a late Georgian home situated in Ireland. Interior renovation by John Pawson. Source: *London Minimum*, Herbert Ypma, Stewart, Tabori & Chang, New York, 1996, p.141.



Eureka Design (left) utilises an iconic image from Australia's past. The design is shown in a foyer by Amtico, Resilient Flooring. Source: *Architectural Review Australia*, no. 64, Winter, 1998, p.101.



Spotted Box Fish Design (right) was developed from the fish skin of the Australian spotted box fish. It is shown in a virtual installation provided by Tascot Templeton.

Axminster Carpet Prototypes

These prototypes demonstrate how visual design strategies which are effective in disguising wear can be incorporated into the aesthetics of Axminster carpet. The design strategies that extend the fresh, new appearance of the Axminster carpet surface include: illusion of depth; pattern structures which are easy to identify; a predominance of mid-range colours; the use of colours which mix optically; and expressive content. The Axminster carpet prototypes have been designed for the hospitality and leisure industries and they are presented in the following formats:

Hand trials produced by Tascot Templeton

The hand trials emulate the surface of Axminster carpet. They are constructed from the actual woollen yarns that are used for weaving the carpets, although the hand trials are not woven samples. The hand trials are 46 centimetres square, illustrating a section of the design, and are limited to a maximum of 18 colours. Two factors have impacted on the final colouration of the hand trials: first, the availability of yarn in the specified colours and, second, the manner in which the colours have been interpreted between the Macintosh and the IBM computer and printer platforms. These variables have sometimes resulted in colour shifts.

Full scale prints

The full scale prints are 69 centimetres wide, in a grid format of 2.8 columns and 3 rows per centimetre. This is a frequently used production setting for Axminster carpet weaving. Each design is repeated in the length direction, therefore creating a portrait format.

Repeat pattern prints

A printed image illustrating the pattern repeat is shown as a scale of 1:6

Additional colour ways, designs and support material

Additional colour ways and designs are presented in the black folder, along with support material and a sample of carpet which I have spun and woven to demonstrate the possibility of incorporating optical colour mixing into the Axminster carpet product.

Prototype designs incorporated in the built environment

The prototype designs have been incorporated into existing built environments, using computer generated images. Acknowledgment of the source of the architectural images is provided in the captions on the previous two pages.

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