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We acknowledge the people of the eastern Kulin Nations on whose unceded lands we conduct our business and we respectfully acknowledge their Ancestors and Elders, past and present.

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Cover and Inside Cover
Rayon loom tuner, Bruck Mills, Wangaratta, 1950
Photograph: Wolfgang Sievers. National Library of Australia (detail)

Below
David Godsell and Office of Guilford Bell, Feltex House, North elevation, section and stair details, 1957. Public Record Office Victoria

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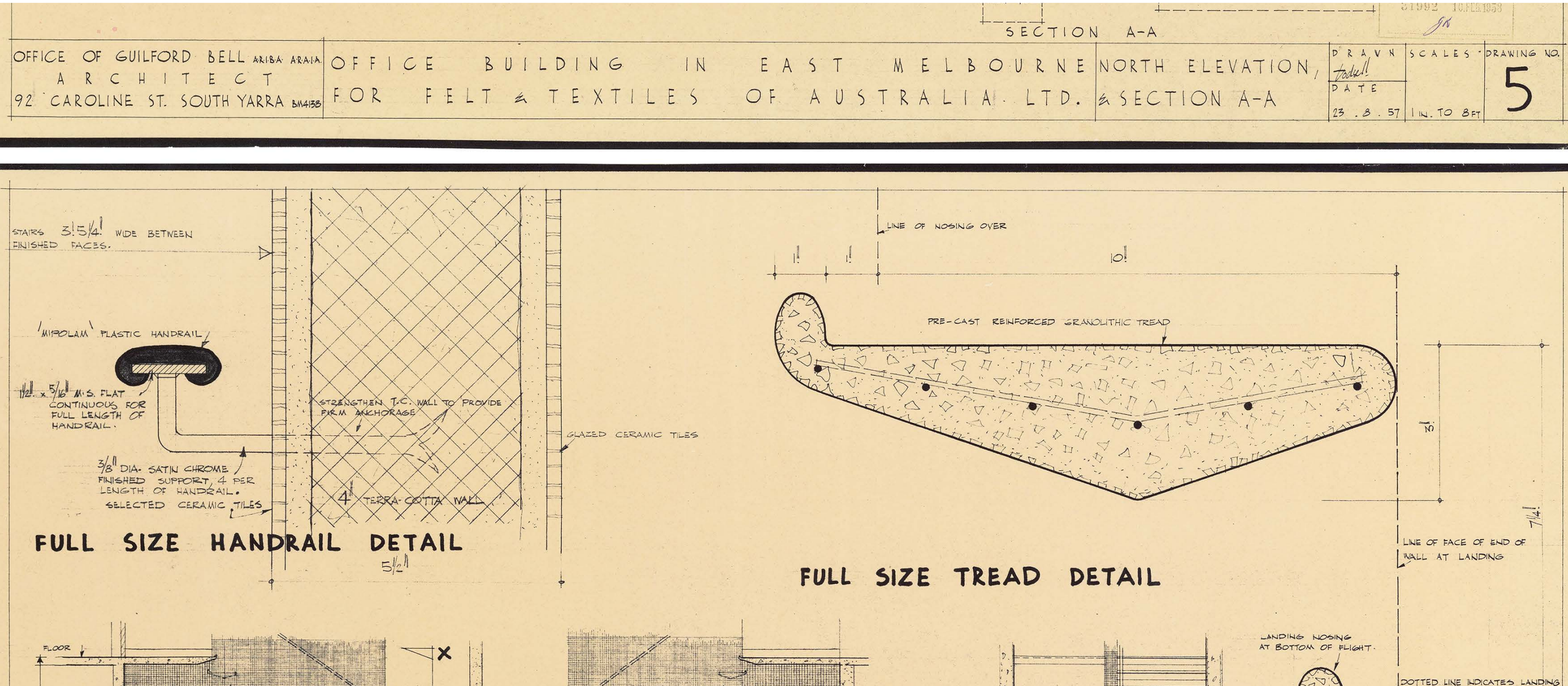


The theme of this issue of the RMIT Design Archives Journal 'Design and Manufacturing' will, we hope, provide an impetus to a field of research which has not yet, in Australia, developed a vigorous discourse.

It is potentially vast if we take into consideration the disciplines of design - from the built environment fields of architecture, interior and landscape architecture to those which rely on prototyping - design for manufacture - as in fashion and industrially produced objects like bicycles. But, as these essays confirm, such a focus has the ability to reconceptualise some of the norms of design history.

Philip Goad opens the collection with an examination of post-war Australia when "architects, artists and designers were enlisted as part of a broader push in a new and vital project of national recovery: the establishment and growth of a resilient local manufacturing industry." What Goad argues for here is multidisciplinary design research, an approach which is not common in Australia, particularly in architectural history. After a survey of both the history and historiography of the field, Goad focuses on the textile manufacturer Bruck Mills at Wangaratta as his case study for it "can be read as a metaphor for the fate of manufacturing in Australia ...when the physical and aesthetic attributes of art, design, photography and architecture could all combine to give image to post-war economic recovery, the building of a multicultural workforce, and above all, pride in the business of making."

Giorgio Marfella, by contrast, focuses on the design of the headquarters of another major textile manufacturer, Feltex on the edge of central Melbourne. Feltex was "one of the largest Australian-owned manufacturing corporations, controlling a network of subsidiary wool and textile manufacturing companies with 7,000 workers and 65 factories in Australia, New Zealand and South Africa." Designed in 1959 by Guilford Bell and David Godsell, Feltex House adjoined ICI House in East Melbourne and Marfella discusses its design as both a study in post-war, American-inspired office typology and an instance of a changing urban morphology which saw major industrial and manufacturing concerns establish their headquarters in central Melbourne.

Laura Jocic and Robbie Napper adopt a different point of view from Goad and Marfella, as both discuss the ways in which manufacturing impacts on the design process. Through her study of the Sara Thorn and Bruce Slorach fashion studio in the 1980s and 90s, Jocic documents the intricate relationship between designer and manufacturer when Melbourne's CBD hummed and Flinders Lane was still a viable fashion precinct. She notes: "Slorach and Thorn produced all their garments locally and drew on the expertise and specialised production processes of local manufacturers and fabricators to create their own highly individual designs."

They also worked with specialised artisans to produce accessories such as belt buckles and belts and, as Jocic observes: "These types of creative and technical-based interactions between designer and manufacturer forged an environment where creativity and problem-solving worked hand-in-hand to flesh out and realise conceptual ideas."

Robbie Napper's examination of bicycle design brings us into the present and provides some respite from the overwhelming sense of loss that one feels contemplating the fate of post-war manufacturing in Victoria. Focusing on bicycle manufacture, Napper comments that his research:

> determines that while the principles of mass customisation create ideal conditions for both manufacturer and consumer with regard to the end product, they also set up conditions for reinvention. Reinvention occurs when consumers conceive of and develop novel product variants, and the bicycle provides an instructive example of design and manufacturing-assembly processes being available at a local level.

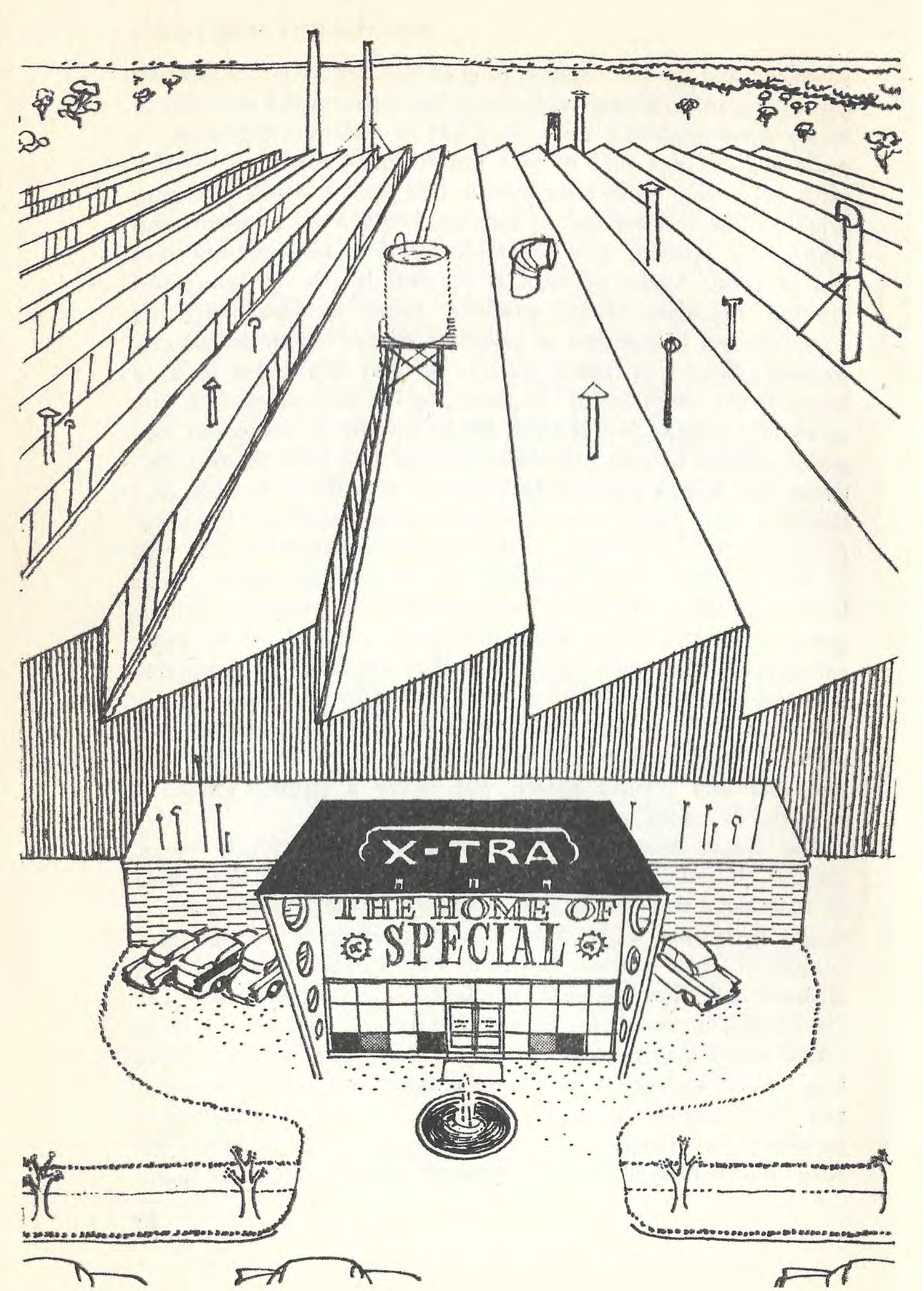
Thus his paper differs from the other three because within the ecology of bicycle design and manufacture the customer has a central role. Not only is there supply of design, there is demand, and demand influences supply. So, from his observations of cyclists in action he notes "a variety of treatments representing reinvention of the bicycle, for example the addition of components such as luggage racks and pannier bags. Also noteworthy are the reinvention acts which remove parts from the bicycle, the extreme example of which turns an otherwise ordinary bicycle into a pared down *fixie*." Central to mass customisation and reinvention is the bicycle shop which provides the space for exchanges between designer, product manager and customer. Napper concludes:

> Manufacturing and design are typically viewed as industrialised practices which occur behind closed doors. In the case of bicycle design, this research has identified that the approach of mass customisation brings design and manufacturing into the realm of the consumer, with one of the main actors in this system being the bicycle shop, which is reconceived as an important outpost of design and manufacturing capability.

There is something optimistic about this statement. As we draw to the end of a difficult year where in isolation we have been driven onto our own resources and led to question the apparent certainties of globalised production and consumption and at the same time observe the fragility of national prosperity and well-being, the image of the local shop where design is embodied and exchanged is comforting indeed.

Harriet Edquist, editor

Opposite
Aerial perspective, ETA Factory, Braybrook, c1957, Architect: Grounds, Romberg & Boyd, RMIT Design Archives (detail)



The Architecture of Manufacturing: Design for Making in Post-War Victoria

Philip Goad

PEER REVIEWED ESSAY

ABSTRACT

Australia was transformed by a reinvigorated focus on manufacturing after World War II. As assembly-line production processes demanded larger spaces and goods transportation was transformed by vehicles of greater capacity and desirable proximity to interstate highways, the peripheries of cities became not just new places of work but also home to an increasingly migrant-based workforce. In the wake of atomic warfare, decentralization too was encouraged: regional Australia became, in a rare occasion in its European-based history, a destination for industry as well as agriculture. Amongst the states, Victoria stood out as the 'workshop' of the nation. Assisting this national project were the design professions, who not only gave fresh imagery to the marketing of products but also to their places of manufacture, sale and promotion.

This paper argues that, despite the rush to post-war recovery, the moments in Victoria's post-war history when progressive art, architecture, interior design, landscape design and often industrial photography became entwined with the process of manufacturing and its broader support mechanisms such as showrooms, housing and urban planning, were few and far between. Amongst these moments, the example of Bruck Mills Australia Limited stands out with the design attention paid to its image, its factory and executive accommodation in Wangaratta in north-eastern Victoria, and its showrooms in Melbourne and Sydney. Today, at a time, when national focus is once again turning to manufacturing as a possible way to ameliorate economic crisis and gain some measure of independence from global markets, these post-war moments offer poignant echo, heralding opportunities for the world of design.

In Australia after World War II, architects, artists and designers were enlisted as part of a broader push in a new and vital project of national recovery: the establishment and growth of a resilient local manufacturing industry. Global conflict had revealed weakness in Australia's facility across a spectrum of issues regarding the supply of energy, fuel, industrial machinery, textiles and a host of everyday specialist and non-specialist goods. Ongoing dependence on overseas imports in an emerging climate of the Cold War was seen to be a risk. The country needed to modernise – and at an industrial scale.

In energy and the provision of a reliable power supply, for example, the construction of the Snowy Mountains Hydro Electric Power Scheme (1949-74) was emblematic of the nation's political will to make that change. It also demonstrated that such a feat was dependent on a new and enlarged labour force, achieved largely by skilled and unskilled migrant workers. It also demonstrated that such projects of modernization would often require the injection of foreign capital in addition to that provided by the Commonwealth and often, but not always, the injection of foreign expertise. These same themes – modernization; labour and migration; and overseas investment and expertise - would permeate the establishment and success of the manufacturing industry in post-war Australia, and which would peak in the mid-1960s.

Victoria, arguably, was the Australian state which experienced the greatest diversity in scale and type of manufacturing in the post-war years. In 1945, following the recently elected Chifley Labor Government's commitment to developing the automotive industry across Australia and with the election late in the same year of John Cain as its Labor Premier, the Victorian state government promoted manufacturing and the decentralization of population and industry, acting upon wartime calls for the establishment of manufacturing centres in country towns. Coupled with advances in automotive handling of goods through the semi-trailer, the container and the fork-lift truck (which led to changes in the design of warehouses), there was, as Graeme Davison and Sheryl Yelland have written in the case of car production, the creation of a 'new landscape' around the edges of both Melbourne and Geelong, where sites were flat, large, cheap and "close to transport, markets, labour and subsidiary manufacturers."[1] But it wasn't just about cars. The manufacturing of food, whitegoods, building materials, industrial and automotive parts, petrochemicals, furniture, footwear, clothing and textiles amongst a host of other products led the Australian Publicity Council to confidently declare in 1962 that Victoria was the "workshop of Australia".[2] Enjoying substantial tariff protections, Australian manufacturing had entered a golden period of manufacturing that would peak in the mid-1960s and decline thereafter.[3] In that new and expanded landscape,

Opposite
Factory, 'X-TRA – The Home of Special', 1960
Drawing: Robin Boyd.
Robin Boyd, *The Australian Ugliness* (Melbourne: Cheshire, 1960). ©Estate of Robin Boyd, courtesy Robin Boyd Foundation

Opposite
New cars outside General Motors Holden administration block (1956), Dandenong, Victoria, 1963

Photograph commissioned by the Department of Overseas Trade, photographer Wolfgang Sievers, National Library of Australia, nla.obj-143316949

Below
Cafeteria to feed 1480 works, General Motors Holden, Dandenong, Victoria, 1956. Architect, Stephenson & Turner, photographer unknown, University of Melbourne, Architecture Library, *Cross Section* Archive

local architects, designers and artists played an important role in the creation of spaces of manufacture and its promotion, the spaces of labour and its visual celebration.

Discourse: Manufacturing, Design and Architecture

Using primarily the holdings of RMIT Design Archives, Melbourne University Archives and the State Library of Victoria, this paper explores a story under-explored by existing Australian architectural and design histories, that of the post-war connections between manufacturing, architecture and design. Internationally, the discourse of a history that connects manufacturing, labour, architecture, design and a product's promotion from c.1900 to 1970 is book-ended by Stanford Anderson's 1980s studies of German architect Peter Behrens and his five-year connection between 1907 and 1912 with Berlin-based electrical goods manufacturer, AEG.[4] At the other end of this chronology of discourse, two examples can be cited: Reinhold Martin's writings on Eliot Noyes's designs for IBM and Annmarie Brennan's accounts of the ambitious urban, manufacturing and labour, architectural, design and promotional programs and showrooms of Italian typewriter manufacturer, Olivetti.[5] These histories present comprehensive accounts of iconic works of industrial design linked across various artistic and professional disciplines, and as such, provide apparently seamless accounts of an overarching ideologies with respect to design and industry.

However, the Australian story, as largely with locations elsewhere in the world, is not so elegantly simple or explicit. Survey studies include Michael Bogle's *Design in Australia 1880–1970* (1998), which ambitiously provided the first national overview in understanding the breadth of the design field, examining themes such as the inclusion of Aboriginal art in Australian design, the design profession, exhibitions and retail culture, and modernism and design during wartime.[6] His chapter, "Design and Industry: Designers and Postwar Manufacturing" highlighted the local designs and making of items like 'Australia's Own Car', the Holden model 48/125 (1948) and Rosenfeldt Gherardin & Associates' Vulcan Conray Room Heater (1957). Just under twenty years later, Ian Wong's *Black Box: design innovation, Melbourne, Australia* (2016) catalogued a similar series of iconic Australian contributions to industrial design.[7] More detailed are the comprehensive monographic studies and exhibition catalogues on individuals like textile designers Florence Broadhurst and Michael O'Connell, the designers Grant and Mary Featherston as well as on product types, most notably Kirsty Grant (ed), *Mid-century modern: Australian Furniture Design* (2014) and Harriet Edquist and David Hurlston's *Shifting Gear: Design Innovation and the Australian Car* (2015).[8] At the same time, Edquist elsewhere is careful to acknowledge the narrow parameters of Australia's design historiography with its focus on domestic products and small-scale design, overlooking large-scale industrial concerns such as the automotive industry.[9] Nanette Carter's *Savage luxury: modernist designing in Melbourne in 1930–1939* (2007) was thus in many respects unusual as its main premise was to map the connections between design, retail culture and urban space in central Melbourne in the 1930s.[10] However these existing histories rarely venture over discipline lines to make connections across the related fields of design, photography, art, architecture and urban planning amongst others. Additionally, none of these studies start with the place of making, the site of manufacturing: the factory.

To date, most documentation on the manufacturing industry in post-war Australia has focussed on economic and social historical accounts. Little has been written on the architecture of the Australian factory apart from often comprehensively detailed conservation studies produced by the heritage profession in response to a complex's imminent demolition or heritage protection or the sale of an extensive industrial site. Survey studies of post-war heritage, local and company histories similarly provide important background overviews. Agencies like Heritage Victoria and the National Trust of Australia (Victoria) have responsibly documented buildings, places and their social significance. The stylish modern factory complex for Kodak (Australasia) Pty Ltd in built from 1957 and designed by Harry Norris, for example, was classified by the National Trust in 2005 but has since been demolished. By contrast, the Fletcher Jones Factory and Gardens at Warrnambool established from 1948 and with numerous additions until 1974, touted by its founder as a "Modern New Decentralised Garden Factory", was heritage listed at a state level more for its enduring social and historical significance than for any contribution to a history of manufacturing, architecture and design.[11]

The modern factory in Australia

In Australian twentieth century architectural histories, the trajectory of modernism has been a key focus as has the documentation of residential architecture as a banner of progressive design ideas. More recently, the key role of hospitals has been highlighted by Julie Willis and others. But a foundational icon of modernism in architecture – the factory - and the trope of the so-called 'factory' aesthetic intrinsic to modernism's rise and its Australian appearance has been – remarkably - little studied. This is surprising given that as early as 1947 in *Victorian Modern*, the first documented history of modern architecture in the state, Robin Boyd was careful to, at the very least, signal Irwin & Stevenson's British Xylonite factory at East Brighton (1932), "one of the earliest examples of the Atelier style" which Boyd defined as "classic Modern", and Buchan, Laird & Buchan's Pilkington Glass factory at Geelong (1936), "looking more like a Gropius design than anything previously seen in Victoria", as being authentic harbingers of Australian modernism.[12] Boyd also correctly noted the significant role of Geelong, which he described as an "industrial city" that "exports to Melbourne, among other things, Fords and architects", citing an impressive list of modernist architects, mostly trained there at Geelong's Gordon Institute under G.R. King.[13]

In Victoria, before World War II, the architecture of the factory was, as elsewhere around the world, an integral and respected aspect of the architecture profession's activity. An architect like William Pitt was just as comfortable in designing the Princess Theatre as the red-brick Bryant & May factory (1909, 1910, 1917)[14] in Richmond. As Bruce Trethowan has written, from the mid-nineteenth century,

industrial architecture was an intrinsic part of the inner urban skyline with the towers and chimneys of breweries and shot makers forming functionally necessary landmark structures.[15] While architects' designs for factories had graced the pages of professional journals for decades, it was only in 1940, that, for the first time, a factory was awarded the profession's highest accolade, the RVIA Street Architecture Medal. Edward Fielder Billson's cream brick Dudok-influenced Sanitarium Health Foods Factory at Warburton (1936) signalled modernism's complete acceptance. The firm's best known product, Weet-Bix, had since 1928 become an iconic brand, its logo, typography and packaging in much the same way as Bryant & May's signature logo for 'Redhead' matches became, from 1946, an enduring graphic design icon: an example of high quality design from the place of making to the place of sale.

Common to both companies were their overseas roots. Bryant & May originated in England in 1843 and its Australian offshoot was established in 1885. Sanitarium Health Foods, owned wholly by the Seventh Day Adventist Church of Australia was established in Melbourne in 1898 by US émigré Edward Halsey, a Seventh Day Adventist baker at John Harvey Kellog's Battle Creek Sanitarium. This pattern would continue after World War II, especially in relation to the expansion of automotive manufacturing. American automobile manufacturers, General Motors and Ford expanded their operations dramatically in Victoria in the 1950s, in Dandenong, Campbellfield and Geelong respectively, and in each case, were supported by nearby government-sponsored workers' housing estates (Doveton, Broadmeadows and Norlane) provided by the Housing Commission of Victoria and a local as well as an increasingly migrant labour force. In each case, the locations of these new facilities were on the suburban periphery, signalling a post-war shift away from inner city manufacturing. Dandenong, strategically located at Melbourne's outer east on the Princes Highway and close to the Gippsland rail line, grew on the basis of manufacturing. Joining General Motors there in the 1950s were Heinz, Gillette, International Harvester, Westminster Carpets, and later ACI Pilkington Glass. Closer to the city in nearby Clayton and along the same rail and road route, were Kirkall-Repco, Robert Bosch, Volkswagen and BALM paints, amongst others. As Graeme Davison noted in *Car Wars*:

> Over the next decade the strip of flat land between the Princes Highway and the Gippsland railway line from Clayton to Doveton became the largest industrial area in the metropolis.[16]

Architecturally, the factories on these outer suburban and peripheral sites developed a common theme: vast saw-toothed roofed factory floors fronted by 'smart modern' administrative office blocks featuring glazed curtain walling, and sometimes with designed landscapes and commissioned artworks within and occasionally outside. In 1960, Robin Boyd lampooned the development of this typology in *The Australian Ugliness*:

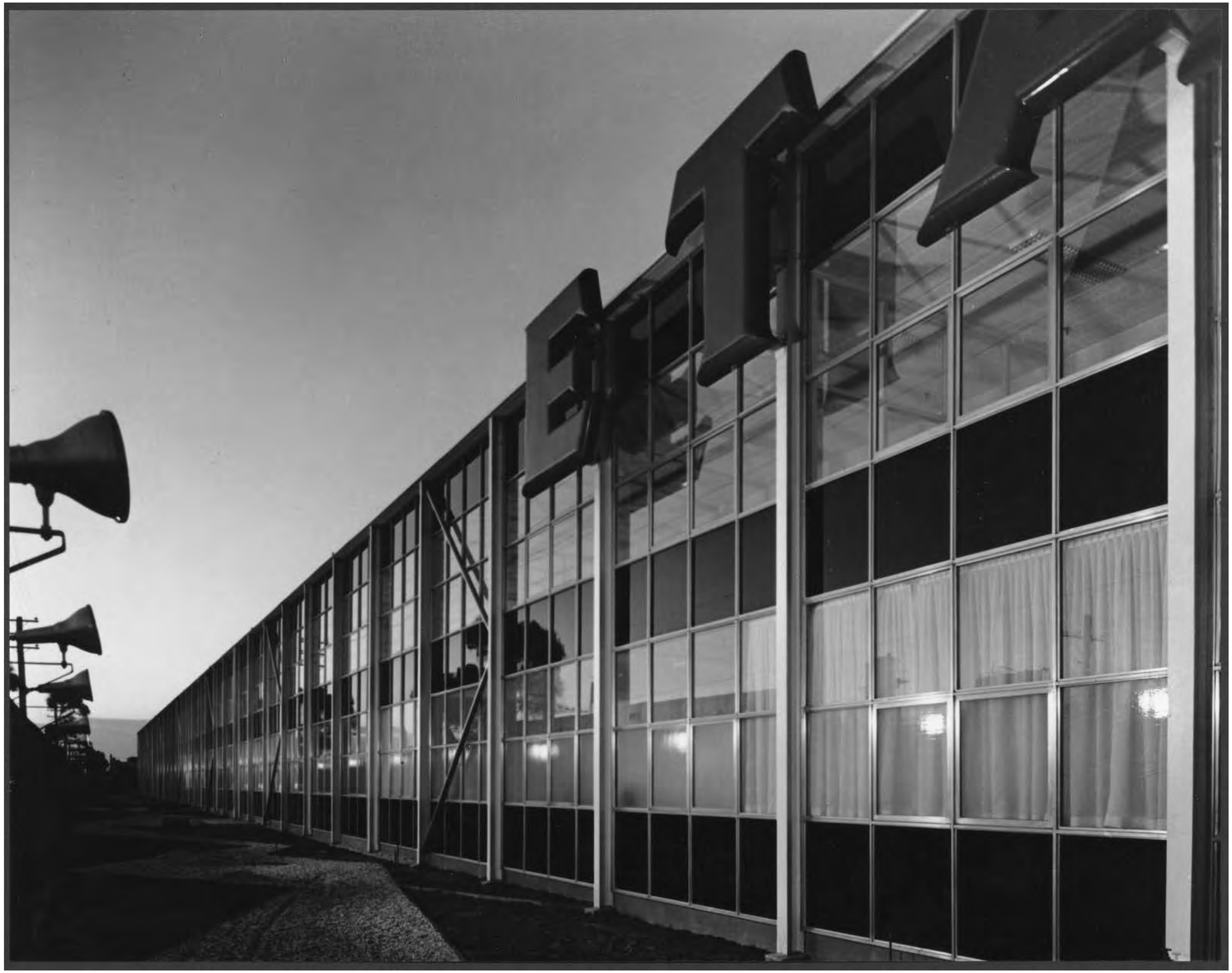
> And meanwhile again the industrial areas keep developing their own separate Featurist style: the featured administration block thrust forward towards the street in front of the plain businesslike works, the featured painting of snow gums on the feature wall in the featured lobby of the feature administration wing.[17]

His drawing of 'X-TRA – The Home of Extra Special' had Holden Specials parked out front, a two-tone glazed wall, giant sign-writing (and even 'X-TRA' written on the jaunty angled and port holed roof structure) and limitless sawtooth roofscape behind littered with chimneys, flues, vent pipers and then an untouched agricultural landscape beyond to the horizon. If Boyd's conclusions about the state of the design of manufacturing was largely accurate – if the dozens of factories featured in the journal *Cross-Section* from 1952 across Australia were any evidence to go by – there were notable exceptions. There was a cohort of architects especially adept at industrial architecture, including the large corporate firms of Hassell & McConnell, Harry A. and Frank L. Norris, Eggleston, MacDonald & Secomb and Buchan, Laird & Buchan but more notably, the office of D Graeme Lumsden (1915-1995), whose career over three decades was based largely around industrial architecture.[18] and whose factory buildings in Melbourne's outer south-eastern suburbs Notting Hill brought a distinct sense of architectural élan to manufacturers like Volkswagen (Australia), Clayton (1958, 1966), Peters Ice Cream, Clayton (1962), Smith & Nephew, Notting Hill (1962) and Murfett Publishers, Moorabbin (1961) amongst others. Lumsden's premises for Nicholas Pty Ltd (Aspro) (now demolished) at Chadstone (1956-7) was a landmark on Warrigal Road. Sitting above an extensive rockery garden with plants propagated from the Nicholas property at Sassafras and sporting a free-form concrete porte-cochere, the factory's administration block had a double-glazed curtain wall with burnt red spandrel panels and end walls in teal blue with the lettering spelling 'Nicholas' held off the wall to create a deep shadow, and in the foyer above a knotty pine feature wall a mural depicting pharmaceutical themes by Wesley Penberthy. This was one of the most stylish local renditions of the modern factory typology then being perfected in the USA by architects like Eero Saarinen and Gordon Bunshaft of SOM. Identified by the National Trust as being of heritage significance in 1991, what was also remarkable about the complex, which made Aspirin in the vast pharmaceutical works at the rear, was the provision of generous health, welfare and recreational facilities for the 250 workers.[19] A commercial kitchen provided subsidised hot meals for all employees in a cafeteria which opened onto its own dedicated garden. The cafeteria had a stage at one end, movies could be shown there and there were spaces for table tennis and pool tables at the other. There was a medical centre, locker rooms, squash court, gymnasium and staff lounge.

Such attention paid to the needs of workers was not exclusive to Aspro. Increasing design attention was given to recreation and service spaces for workers after World War II, indicative of a recognition that optimised working conditions were essential to a productive work culture.

Opposite
Covered entry way for factory staff, Nicholas Factory, Chadstone, 1956–7. Architect, D. Graeme Lumsden, photographer unknown, University of Melbourne, Architecture Library, *Cross Section* Archive

Top
Entry lobby and reception, Nicholas Factory, Chadstone, 1956–7 Mural, Wesley Penberthy, Architect, D. Graeme Lumsden, Photographer unknown, University of Melbourne, Architecture Library, *Cross Section* Archive



At Fishermans Bend, for example, the new freestanding Moderne-styled Social Centre (1945) for General Motors Holden (GMH) featured a 500-person cafeteria complete with a timber parquetry floor, stage and proscenium, commercial kitchen race and above, two murals depicting the 'History of Transport' specially painted by Eileen Robertson, an artist employed in the company's Public Relations Division for the Prime Minister Ben Chifley's launch of the Holden 48-125 in 1948.[20] For the vast manufacturing plant for General Motors at Dandenong (1956), architects Stephenson & Turner provided an even larger cafeteria, but one now wholly modernist in spirit, air-conditioned and able to feed 1480 workers in a veritable sea of linoleum tiles, tubular steel chairs and Laminex-topped tables.[21]

On the other side of the city along Ballarat Road at Deer Park, Imperial Chemical Industries (ICI) had been developing houses for workers at its factories there since 1949 as a way of attracting a labour force. Laid out by the company's architects in association with Best Overend, member of the Architects' Panel of the Housing Commission of Victoria, the plan was to provide housing for 600 workers and their families across 188 acres: "all the houses will be sold to employees of the company constructing them – and at a particularly attractive figure". ICI envisaged "a model and independent community", complete with future plans for shopping and recreational centres, parks and gardens, schools, churches, kindergartens and a cinema.[22] As the suburb grew, the architectural highlight of the extended factory and suburban community was Grounds, Romberg & Boyd's ICIANZ Club (1955). Designed as a staff recreation centre and situated adjacent to sporting fields and tennis courts, the club included a library, billiard room, and, beneath a floating butterfly-shaped ceiling, lounge and dining facilities glazed on both sides and able to be divided in two by timber concertina panels. With polished timber floors and at the lounge end, the dramatic exposed copper fireplace flue, this, in 1955, epitomized the height of industrial munificence for the firm's senior workers – a corporate modernist living room. Betty Grounds specified the furniture and fittings (including the choice of cutlery and china), including a vast Swedish rug, a Ritelite tripod lamp, easy and dining chairs by Grant Featherston with metal legs rather than the normal timber used in domestic settings.[23]

One of the most sophisticated integrations of architecture, structure, art, design and landscape in an industrial setting was Grounds, Romberg & Boyd's ETA Foods Factory at 256 Ballarat Road, Braybrook (1957–61). Designed principally by Frederick Romberg, the two-storey administration building's main front to Ballarat Road was clad in a glass curtain wall with three horizontal stripes of black glass spandrel panels wrapped the entire factory complex, concealing the sawtooth roofs behind. Contained within this 'wrapping' was a Burle Marx-inspired courtyard landscape by designer John Stevens and graced by a fountain and sculpture by Lithuanian-born and trained sculptor Teisutis Zikaras. As Helen Stuckey has written, the ETA factory was also notable for its structure: tubular steel trusses inside and externally, an exposed steel frame wall, diagonally braced on Ballarat Road by steel tubes that, on Robin Boyd's suggestion, were gilded.[24] Seen against the striking horizontal black spandrels and white painted steel frame, these gold 'arrows' pointed to an elevated giant-scaled ETA sign, each letter moulded in plastic and floating proud of the long glass wall.

Previous Pages
Curtain wall,
ETA Factory, Braybrook,
c1957–61
Architect, Grounds,
Romberg & Boyd,
Photogapher,
Wolfgang Sievers,
State Library of Victoria

Right
Manager's Office,
ETA Factory, Braybrook,
1961, Mural by Eric Thake,
photographer unknown,
RMIT Design Archives

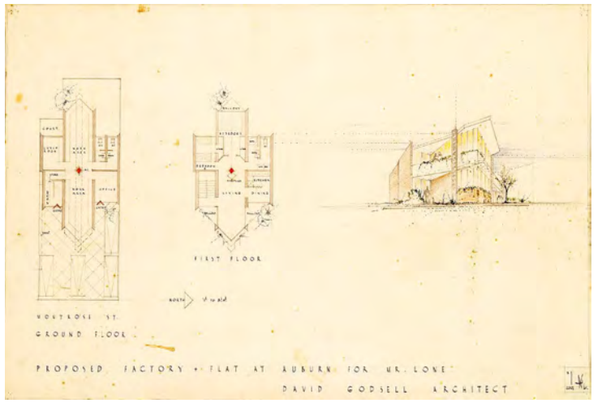
As Stuckey also notes, central to the commission was RC 'Dick' Crebbin (1913–1989), the Sydney-based Managing Director of ETA Foods Australia, whose keen interest in the project also saw artist Eric Thake commissioned to undertake a mural for the Victorian manager's office which depicted peanuts, almonds and cashews spilling their way westward to Asia from ETA's various industrial plants interstate and in New Zealand. Crebbin's personal involvement was important, a patron of modernism – his home at Castlecrag was furnished by Marion Hall Best and he and his wife collected modernist Australian art, owning works by William Dobell, Sidney Nolan, Russell Drysdale, Robert Klippel and Clement Meadmore and he later chaired the interim board of the National Gallery of Australia and then its permanent council (1976–82).[25]

ETA Foods factories in Adelaide and Townsville were given similar design focus. At Renown Park in Adelaide, artist Stanislaus Ostoja-Kotkowski completed a stunning mural wall at the Brazilian-inspired entry sequence to ETA's new factory designed by Cheesman, Doley, Brabham & Neighbour.[26] Photographs by Wolfgang Sievers and Ingerson-Arnold gave these industrial projects new potency as objects equivalent of the glamour of mid-century modern houses. Such examples of patronage and interest in the factory and its facilities as a complete aesthetic work were rare in Australia but the evident resolution of the Victorian factory was such that it was the only Australian example to be published in the important post-war German text, *Industriebau (Vol. 3 – International Examples)*(1962).[27]

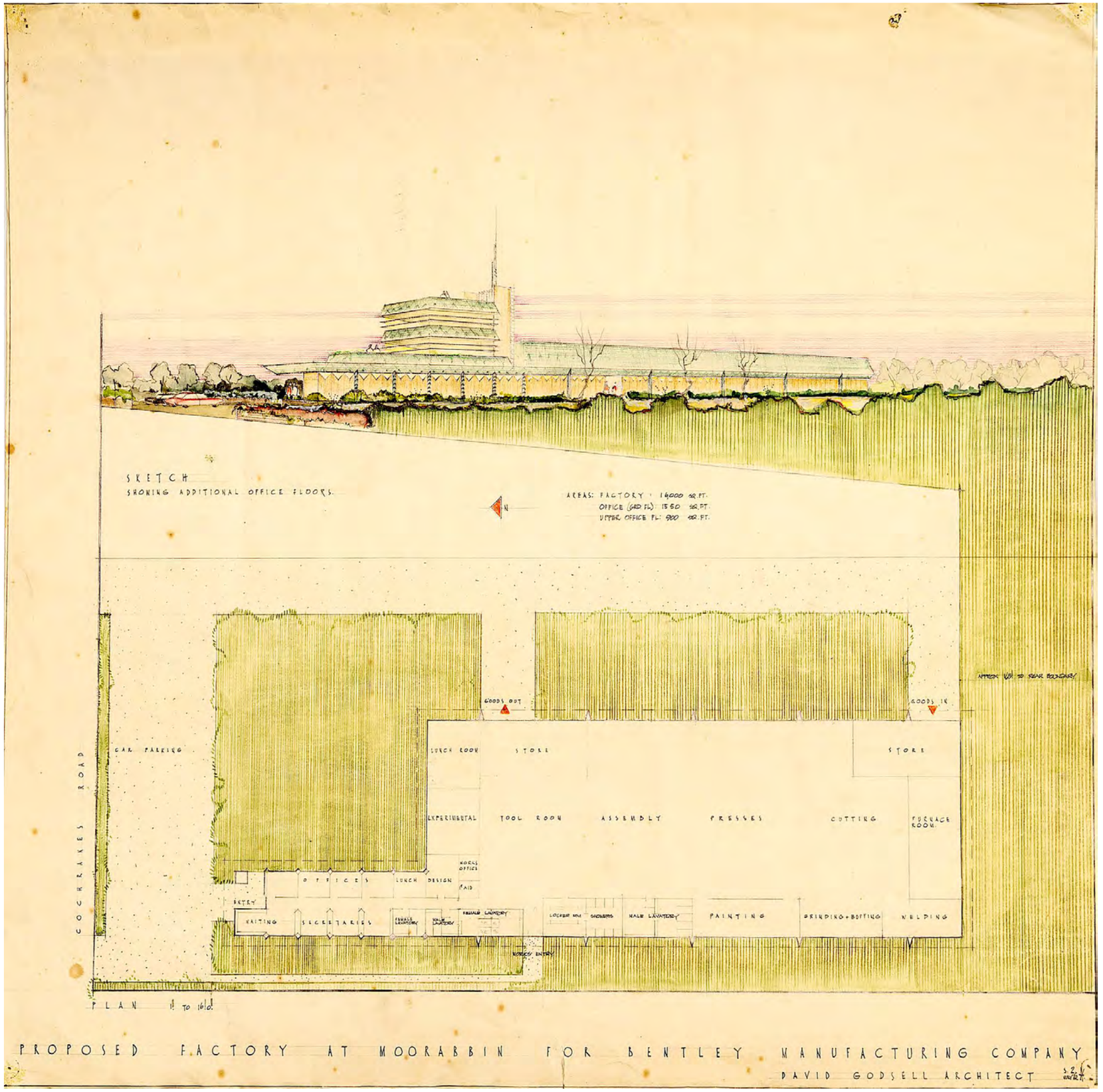
What has been overlooked with many surveys of factory architecture have been associations with other American design traditions. While the figure of Frank Lloyd Wright is most commonly associated with residential design, his practice produced landmark office buildings for the Larkin Soap Company next to its factory in Buffalo, New York (1904) and for cleaning supplies manufacturer SC Johnson at Racine, Wisconsin (1936) but significantly these were not the factory buildings themselves. By contrast, in Victoria, post-war Wrightian adherents, Geoffrey Woodfall and David Godsell, celebrated for their landscape-sensitive residential designs, designed a number of small and medium-scaled factories. Like their houses, the forms of these factories were intended to evoke different ideas. Allusions were not to machines or the efficiency of curtain wall construction but instead to the search for a new language of texture and where applicable, empathy with the landscape. On a sloping site at outer suburban Notting Hill, for the factory for N&N Shopfitters (1963), Woodfall disposed a series of low pitched gable roofs framed in profile by stained timber fascias that marked administration, shop floor and warehouse that echoed distant views of the Dandenong Ranges. Raised garden-bed walls attached to the building's front and a sweeping lawn imprinted its organic undertones. This same use of the factory roof as a compositional principle rather than something to conceal also informed Woodfall's near monumental foundry premises for Wearwell Bronze Co. in Darebin Road, Northcote (1961). There, a single, much steeper gable was given monumental presence hard on the street with clinker brick piers and central pylon and roller door with tall flanking built-in planter bed walls – a composition worthy of the Griffins.

Godsell, like Woodfall, did the same in Bell Street, Preston for Steco Industries Pty Ltd in a design proposal (c1963) for a factory where trailers were manufactured.[28] There, he emphasised a giant flat roof floating above a strip of horizontal glazing and a ground-hugging brick base. While at Cochranes Road, Moorabbin for the Bentley Manufacturing Company, Godsell's unbuilt 1962 design employed the same boldly horizontal mansard factory roof in copper green with a three-storey pagoda-like office block edging above and repetitive lunette windows at eaves level.[29] Comparable compositionally to Peter Muller's Wrightian-inspired factory for Victa Consolidated Industries at Milperra, NSW (1959), Godsell's design would have been a unique addition to Melbourne's manufacturing landscape. Godsell also designed a special form of placemaking, a tiny work-live facility in 4A Montrose Street (1962) in the middle-ring suburb of Auburn, for contact lens manufacturing company G Nissel & Co. (Aust) Pty Ltd, operated locally by Victor Lowe. Lowe and his business associate Gordon Douglas had studied precision optical manufacturing at Royal Melbourne Technical College and from 1954 their company developed a reputation for the optical quality of its contact lenses, becoming one of just four Australian contact lens manufacturing companies operating in the 1950s and 1960s.[30] On the ground level, an air-conditioned linear workshop space with angled glass bays at either end was flanked by a stairwell and lunchroom on one side and on the other by an office and bathroom. Upstairs was a two-bedroom flat with a fireplace located at the very centre of the plan composition.[31] Here, the angled and facetted crystalline form (albeit in earthy brick and timber) made loose reference to the grinding of lenses that took place within.

But in almost all of these cases, connections between what was being made, the design of the container for the making



Above and Right
Proposed factory at Moorabbin for Bentley Manufacturing Co., 1962, Architect: David Godsell, RMIT Design Archives.



of the object, and the subject promotion and marketing of the object at the point of sale was rarely made. In the case of cars, for example, car dealers like Reg Hunt, who had smart showrooms on Nepean Highway at Elsternwick, were the intermediaries between manufacturing and point of sale. In 1956, Seabrook, Hunt & Dale transformed a former service station into a smart drive-by vitrine for the selling of Holdens: a sheer glazed front with giant sliding glass doors, and a diagonal slash of open web steel girders and circular skylights above.[32] Lit up at night 'Reg Hunt' became a regular highlight on the commute home. An example such as this was not the same as Olivetti say in Italy, which had design presence at the point of making and at the point of sale in the city.

For some sites of manufacturing, it should be remembered that this was not always possible nor what was required. Émigré furniture designer and craftsman Schulim Krimper produced his furniture under the name of the 'Futura Furniture Company' at 36 St Kilda Road, St Kilda and it was also his showroom.[33] Designed by another Jewish émigré, the architect Ernest Fooks in 1956, the shopfront (currently at risk of demolition) – marked on its north end by a vertical panel of stacked terracotta tiles and facing due west – had its glazed window set back at a diagonal to assist in shading the glass and the contents within. Behind, the south-facing angled highlight to the workshop was concealed. This was elegant and restrained but hardly the answer to Krimper's contented habit of presenting a "crazily stacked shop" since 1940.[34] As Terence Lane has written, "The new building, comprising work shops, offices and display space, was only fully utilized for a short time. Krimper, not feeling at ease there, soon moved most of his workshop back to the old tin shed he had rented nearby while the new building was being erected."[35] Despite this two exhibitions were held in the Fooks-designed space, one in 1957, the other in May 1958. Lane described his experience of the space:

> I visited the premises with Eric Westbrook in about 1969. I remember part of the building was rented out by that time and little work was being done in the workshop, although Krimper came in to work every day. It was a factory-like space, well stocked with expensive machinery, all under dust sheets. Down one wall was a number of finished pieces, some of them held back since the 1950s, all under dust sheets. Krimper was ever the showman - he kept us waiting and eventually emerged, impeccably suited in tweeds, from a glazed office on the back wall.[36]

Here, it was the presence of the designer rather than the space itself that was key to the promotion of the object. By contrast, and wishing to emulate the corporate brand building successes of Charles and Ray Eames and Herman Miller, that same year (1956), Grant Featherston opened Featherston Contract Furniture (later Featherston Contract Interiors from 1958) showrooms in Davisons Place off Little Lonsdale Street, between Exhibition and Russell Streets, Melbourne. The design of the showroom, executed within an existing building, was claimed at the time to be "first of its kind in Victoria", was based on a system of mouldings screwed together to provide the verticals for a panel system, in some places supporting delicate fishing nets and at others dyed plywood panels, and elsewhere there were 'screens' of glass rods.[37] For Featherston, this was the time, when Denise Whitehouse notes, he remodelled his working practice where he "offered an integrated service to architects and their clients that included the supply and development of furniture together with total interior design needs."[38] In a similar entrepreneurial move but nearly ten years earlier in 1947, Frances Burke opened New Design, her showroom at 55 Hardware Street, the first of a series in central Melbourne (Burke moved the location of her retail outlet again in 1952).[39] Inserted within the first floor of an existing nineteenth-century building, the showroom's main feature was a diagonally placed screen wall draped with bolts of Burke's fabric designs and juxtaposed against chairs and tables of tubular steel. Clement Meadmore's chairs (and later his lights), made from a backyard workshop in Burwood Road, Hawthorn, were sold together with and under architect Kenneth McDonald's auspices from 'Meadmore Originals' at 86 Collins Street from 1952 before a peripatetic movement of premises amidst the selling of the business and legal wranglings over patents. At one point in 1955, Meadmore opened a showroom under the name of 'Calyx, light fittings' back in Burwood Road but this venture too, as Simon Reeves has documented, was shortlived.[40] These spaces, often designed by their designers, were modelled as part exhibition settings and part showroom/retail, often mixing other items and objects by other designers. But mostly, their places of making, through the necessity of economy, were modest, make-do and in existing rather than purpose-built premises.

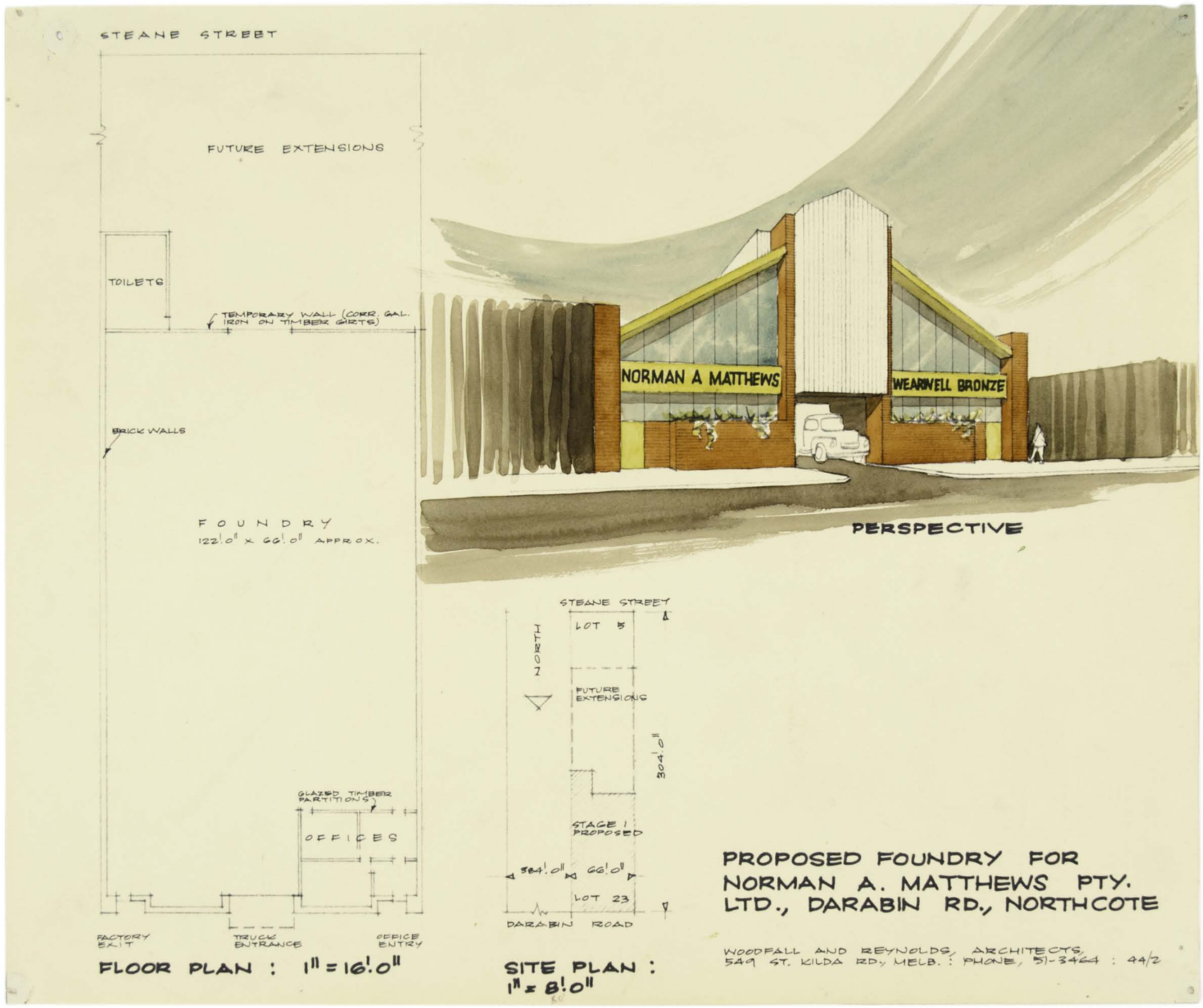
If there was one example in the 1950s that appeared to create a design bridge from manufacturing to point of sale and at a large scale, typify post-war urban planning aspirations for the decentralisation of Victorian manufacturing, involve a migrant labour force, and, which, remarkably, continues to operate today, it was Bruck Mills (Australia) Ltd., the producer of Bruck Fabrics, specialist in production of synthetic textiles.

On October 1, 1946, Robert J Vicars, Director of John Vicars & Co. and Controller of Woollens for the Department of Supply and Shipping gave a wide ranging address to the Institute of Industrial Management in Melbourne entitled, "The Future of the Australian Textile Industry". In response to the position in which Australia found itself after World War II, he noted that prior to the war, certain countries had deliberately reduced their use of natural fibres and built up a textile industry without the need to import wool or cotton: "They learned, in fact, almost to depend on synthetic textiles. Japan became the world's largest producer of rayon."[41] Japan was indeed by far the biggest exporter of synthetic cloth to Australia before World War II, more than double the quantity imported from the United Kingdom. Vicars cited two companies that had already commenced post-war manufacture of rayon: Burlington Mills, operating from a former government munitions factory in Rutherford near Maitland, NSW and associated with the huge rayon producer, Burlington Company (USA) and Melbourne-based textile firm, Prestige Pty Ltd which had established a mill at Ararat in western Victoria after the war. In 1946, the employment of German émigré industrial designer Gerard Herbst as Art Director from 1946 until 1956 at Prestige's Brunswick factory transformed not just aspects of company's fabric designs but also the firm's approach to product design, packaging and advertising through a variety of media, including graphic design, photography (notably using German émigré photographer Wolfgang Sievers), film and exhibitions.[42]

Right
Pages from Bruck Fabrics brochure, (Wangarratta, Vic: Bruck Mills (Australia) 1954), University of Melbourne Library, published with permission of Bruck Textiles Pty Ltd

Above
Factory foundry for Wearwell Bronze Pty Ltd, Northcote, Victoria, 1962
Architect, Geoffrey Woodfall, (Woodfall & Reynolds), Photographer, Lloyd Buchanan Photography, RMIT Design Archives

Right
Proposed factory foundry for Wearwell Bronze Pty Ltd, Northcote, Victoria, 1960–62.
Architect, Geoffrey Woodfall, (Woodfall & Reynolds), RMIT Design Archives



Vicars also mentioned a third company, Bruck Mills (Aust.) Ltd., recently established and about to open its rayon weaving and finishing plant in the former Aluminium Security factory at Wangaratta in northeast Victoria, 236 kilometres from Melbourne. Again, there was an overseas connection, the company was starting business in association with Bruck Silk Mills Ltd. of Canada. Vicars noted the regional locations of each of the three mills, pointing towards a rationale of "avoiding the shortage of female labour existing in all big cities and taking advantage of its availability in country areas."[43] The textile industry had always been a strong employer of women and after World War II, the shortage of female labour was felt to especially acute. Vicars noted that "really good conditions will assist greatly" but added that:

> The main off-setting factor is the decentralisation of industry and its establishment in areas where previously no factory employment was available. I do not know the extent of the female labour already tapped in this way, but it must be considerable. It would appear that, for some time ahead, this system of taking industry to where labour is available will be the only way in which a continual shortage can be avoided.[44]

Wangaratta was ideally positioned. Power was available through three independent lines to Yallourn, Kiewa and the Eildon Weir and, backed by Victoria's State Rivers and Water Supply Commission (SRWSC), the Wangaratta Water Trust guaranteed Bruck Mills 150 million gallons of water a year delivered to a million-gallon storage tank. Bruck's interest in Australia had emerged before World War II, in 1937, when Arthur M. Flanders, Vice President and Director of Bruck Mills Ltd of Canada had come to Australia to develop an export market for high fashion fabrics. War intervened but Flanders and his Montreal directors were convinced of the viability of an Australian operation and on 27 May 1946, Bruck Mills (Australia) Ltd. was incorporated under the Victorian Companies Act and by December, Bruck Fabrics had a home in country Victoria.[45] On 9 March 1947, production began in Wangaratta.

The Canadian Connection

In the late 1940s, Bruck Mills was one of Canada's largest producers of synthetic textiles. Bruck Silk Mills Limited had been established 88km south-east of Montreal in Cowansville, Quebec in 1922 by Austrian-born émigré Isaac I. Bruck, a textile distributor from New York, who converted a former WWI munitions plant there into a textile mill.[46] His company became the first in Canada to weave silk in the modern way - in the gum - and under the one roof. From that point onward, Cowansville experienced an industrial and demographic boom. By the 1940s, rayon 'artificial silk' had replaced the mill's specialisation in natural silk production and the plant had been progressively expanded in 1926, 1931, 1936, 1941 and 1946.[47] In the 1940s, new Bruck plants were opened in Farnham, Saint Jean-sur-Richelieu and Sherbrooke, all close to Montreal and, internationally, in Australia, at Wangaratta.

In 1948, Isaac Bruck died and his son Gerald L. Bruck (1915–2013) became the new president of the company and filled that position until his retirement in 1972 when the company was sold. Gerald Bruck, who had been associated with the firm since 1937, by 1947 was directing sales promotion, public relations and advertising.[48] He was also enthusiastic for his firm's increasing promotion of artificial fibres in textiles. Keenly interested in art and design, he continued the refreshed branding of the firm that had started in 1945 with the adoption of a new typeface for the firm's name and the increased use of industrial photographs of Jewish photographer Hugh (Hy) Frankel (1919-2014). In 1948 and 1949, the company's annual reports were outstanding examples of modernist graphic design employing contrast, geometric asymmetry, abstract graphic symbols interspersed with Frankel's black and white photographs by Eveleigh-Dair, Canada's first graphic design firm. This was a short-lived but brilliant Montreal-based partnership from 1947 until 1951 between Henry Eveleigh and Harrison Carleton (Carl) Dair, who would later achieve fame as the author of Design with Type (1952 and 1967) and as designer of the 'Cartier' typeface commissioned and released for Canada's 1967 centenary celebrations. In 1948, instead of the typical dour report cover, a Frankel photograph of a traditional loom in action was taken to full bleed and the whole report was laid out for the first time in landscape format.

Bruck in Wangaratta

Bruck began operations in Wangaratta in the former aluminium fabrication plant in 1947.

In Wangaratta, the Australian branch of Bruck did not manufacture nylon or rayon yarn but specialised in its weaving, dying and printing.[49] In 1950, for example, 24 new colours were added to its range, including 'Sunlit Hour', 'Lucky Coin' and 'Skyscraper'.[50] The firm made the 'smooth, easy-draping Convoy fabric' used by Speedo knitting mills in making items like men's sports shirts and 'Ranger cloth' for Speedo swimming shorts, and by the late 1960s it also made 'Crimplene'. By 1959, Bruck Mills had become one of Australia's biggest weavers of synthetic cloths and wool-synthetic mixtures destined for the fashion market.

The arrival of Bruck Mills (Australia) in 1947 signalled Wangaratta's rebirth. By 1953, the town's population had doubled to more than 10,000. While noting initial local distrust behind the expansion, popular journal *Pix* claimed that "it has become one of the most prosperous towns in Australia. The reason for its prosperity is decentralisation".[51] The company had also become the largest post-war decentralised industry in Australia. A key issue facing the firm was the sourcing of a labour force and where to house them. While primarily an Australian company with Australian shareholders, its founder was Canadian, co-managing director Arthur M Flanders, who came out after the war, together with technicians and rayon experts from Canada and the United States. The mill employed local tradesmen as well as men and women, who'd moved with their families from Melbourne, and significantly a large proportion of migrants, many of them coming from the migrant hostels at Bonegilla, 80km north near Wodonga. In 1953, of a total of 800 employees, 200 were pointedly noted as being 'new Australians' in addition to '50 British migrants'. Recollecting the multicultural nature of the

Opposite
Bruck Fabrics, stand, fashion fair, Melbourne, Victoria, 1950
Photographer, Wolfgang Sievers. National Library of Australia, nla.obj-16109273

Overleaf
Rayon spinning, Bruck Mills, Wangaratta, 1950
Photographer, Wolfgang Sievers. National Library of Australia, nla.obj-13650570

workforce, a worker recalled:

> At first you have to learn the technical terms you know. They say something and they say, what is that? Explain it to me, what that means. And it takes a bit of time. But you weren't the only one because I would say about, well ¾ of the workforce was migrant stock. Yeah, there were plenty of them. Italians and Germans, and bit of everything.... Czechoslovaks, Yugoslavs. From all countries. It was like the United Nations.... It was a little, sort of a gel pot of what the future of Australia became.[52]

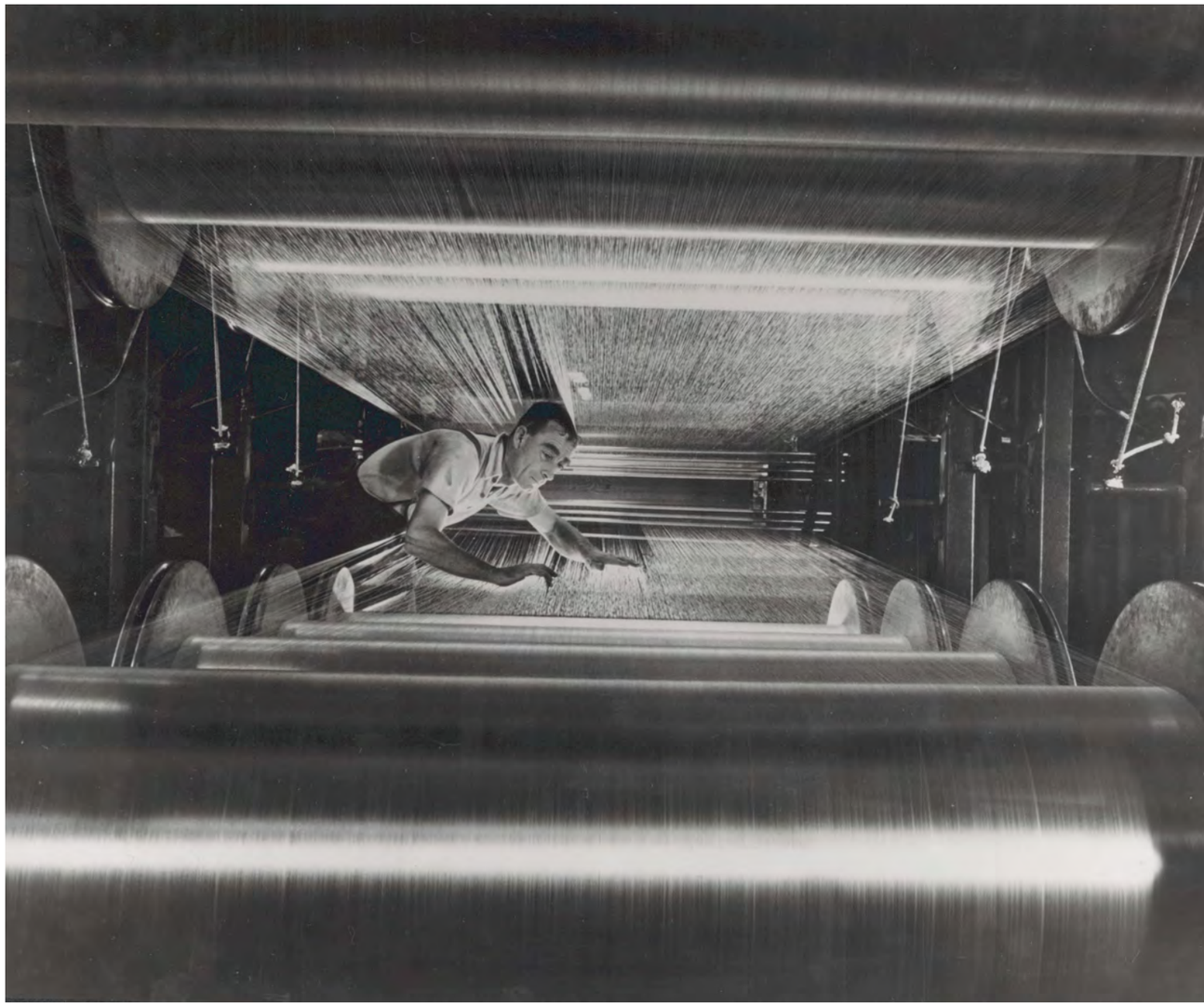
To commence operations at Wangaratta, the former munitions factory had machinery shipped over from Canada and installed by American and Canadian technicians. The front office was refurbished and atop the clerestory highlight of the sawtooth roof of the goods despatch area were placed freestanding letters spelling 'Bruck FABRICS' in the new post-war typeface, lettering that was also applied to all the company's utes and trucks. The factory itself stood on 18.2 hectares (45 acres) and included recreation rooms, sports club and casualty ward for workers, as well as playing fields. The company sports club (the Rayonaires) had 200 members and had teams and activities associated with tennis, soccer, Australian Rules football, ski teams that made use of nearby resorts at Mt Buffalo, Mt Hotham and Falls Creek, film and dance nights while the firm's American/Canadian influence made "Yankee softball popular with Bruck Rayonaires".[53] The Rayonaires' three cricket teams were outfitted with special experimental creams treated with Duraleen, a water repellent, to see if grass stains came off easily.[54]

To assist the development of Bruck's presence in regional Victoria, the State Government promised for Bruck's workers 250 homes to be constructed in two years by the Housing Commission of Victoria. By the beginning of 1953, 450 houses had been built and another 150 prefabricated houses were in process. Private building and co-operative societies erected between 600 and 700 more houses and the Commonwealth migrant hostel housed 200 New Australians and later 60 British families. Extra accommodation for migrant workers was found in the town's old army barracks. For its administrative manager, Stanley M. Arms, who'd moved from Melbourne in 1947 to take up the position, a low-slung gable-roofed and weatherboard house typical of Boyd's 1947 description of the Victorian Type and designed by Melbourne architect L. Hume Sherrard was erected at 21 Vernon Road, Wangaratta in 1953.[55] In addition, Bruck completed for its top technicians between 1953 and 1956 in Bruck Court, a row of five contemporary single-storey modern houses designed by Grounds, Romberg & Boyd and at 11–15 Bruck Court, 'Bruck House', a special double-storey accommodation and entertainment facility for visiting dignitaries and company executives.[56] The single storey houses had modular timber-framed Stegbar window-walls facing the street and rear walls similarly divided – domestic interpretations of the aluminium glazed curtain wall. The roof plane continued seamlessly from house to covered carport/lanai and pergola, all supported off open-web steel girder trusses that floated above a brick screen wall. Landscape design was undertaken by John Stevens.[57] No fences divided the GRB-designed houses and Bruck House at the end of the cul-de-sac giving the feel and ambience of an idealised North American suburban sub-division: a miniature planned 'suburb'. The technicians and executives could walk directly from their house onto the adjacent premises. As with the technicians' houses, the double storey Bruck House was delineated back and front as a 'curtain wall' of glass and panel infill but framed in timber. It was as if the corporate glazed walls of the administration blocks of the outer suburban post-war factory had been transplanted to the domestic settings of those in administration. Inside, the ground floor of Bruck House was devoted to entertainment: it had a floor of chequerboard pattern of Nylex vinyl tiles, timber-lined ceiling, exposed brick and vertical timber-lined walls, and furnished with couches, sofas, standard lamps and Swedish rugs. The three architectural features of the long space were an open tread stair hung from the ceiling, an elevated open double sided fireplace with an exposed copper hood and flue that acted as a room divider, and in one corner, a lavishly stocked bar with its bottle perched on timber and dramatically lit from below. In the link between this lounge space and the billiard room (also on the ground floor) was a floor-to-ceiling photo-mural (presumably by Sievers) related to nature and fibre. Above was a caretaker's flat and guest sleeping accommodation.

Bruck and Design

Bruck's emergence as a manufacturing force in Victoria in the mid-1950s was matched by a concerted campaign to present itself as progressive and up-to-date. In 1950, the company commissioned photographer Wolfgang Sievers to photograph the everyday workings of the factory – a similar tactic to Canadian operation's earlier use of Hugh Frankel. His images of workers and rayon spinning at Wangaratta, especially *Rayon loom tuner at Bruck Mills* (1950) and *Bruck Mills, Wangaratta, Victoria, 1950* (1950) deserve recognition as some of the most important post-war images of Australian manufacturing and need to be seen alongside his more celebrated (and arguably more spectacular) images of nearly three decades of photographing Australian industry, from matches being made at Bryant & May in Richmond (1939) to his now iconic *Gears for Mining* (1967) at Vickers Ruwolt in Burnley. A large-scale suspended image of *Rayon loom tuner at Bruck Mills* featured prominently in Sievers and Helmut Newton's 'New Visions in Photography' exhibition held at Melbourne's Federal Hotel in 1953.[58] Sievers also photographed the Bruck Mills stand at the first Australian Fashion Fair in Melbourne in 1950, where Bruck and other 'decentralised' textile mills such as Burlington Mills from Rutherford, NSW, Godfrey Hirst's mills at Geelong, and Pacific Chenille-Craft Ltd from Goulburn also exhibited Australian-made fabrics.[59]

A 1954 brochure for Bruck Mills (Australia) also indicated the firm's ongoing interest and commitment to design, not only in its spare modernist graphics, typography and use of vividly coloured Sievers and Max Dupain photographs but also in its description of the "courageously-careful design" of the Sydney sales office and the firm's publicity strategy, which was based on analysis of publicity methods used by



Opposite
Rayon loom tuner, Bruck Mills, Wangaratta, 1950 Photographer, Wolfgang Sievers. National Library of Australia, nla.obj-143306895

Opposite Top
Interior, lounge area, 'Bruck House', Wangaratta, Victoria, 1956, Architect, Grounds, Romberg & Boyd, Photographer, Wolfgang Sievers, State Library of Victoria

Opposite Bottom
Senior staff house, Bruck Court, Wangaratta, c.1956, Photographer unknown. RMIT Design Archives

Above
Bruck Fabrics showroom, Trevola House, 118 Flinders Lane, Melbourne, 1956 Architect, Grounds, Romberg & Boyd (attrib.), Photographer, Wolfgang Sievers, RMIT Design Archives

Above
Factory, Goods Despatch Area, Bruck Mills (Australia) Limited, Wangaratta, Victoria, 1950, Photographer, Wolfgang Sievers. State Library of Victoria

similar enterprises overseas. Direct press advertising was subordinated to a policy of supporting retail stores whose advertisements featured by the yard-sale of Bruck fabrics or clothing made using Bruck fabric, like Myer who ran full-page advertisements, promoting:

> Wonderful new Bruck [in the company typeface] fabrics bring you your passport to lightweight living.
>
> Revolutionary Bruck fabrics for Summer 1953–54
>
> Huge range of dynamic new colours and textures
>
> The Store for Men plans your complete wardrobe in Bruck Fabrics. Here's impeccable styling (from your hat to your swim shorts). Here are clothes lighter than anything you've ever worn... clothes that are really top-line value for the money.[60]

Specially designed display cards for manufacturers' showrooms and retailers' counters advertised fabrics woven by Bruck such as 'Milium', metal-insulated lining made under license from Deering Milliken & Co., Inc., New York. Gold-embossed countercards, where the wording was "elegant and unequivocal", simply said 'Bruck FABRICS' and "dramatically illustrated" direct mail brochures were sent to thousands of retailers and manufacturers across Australia, while smart graphics adorned tags for Bruck fabrics like 'Ticatina' (a synthetic version of ribbed Alpaca), 'Baratina' (a luxury crepe in a fine barathea weave), 'Hookster (a slub flannel with Viscose and Acetate), 'Nylo-Mist' (hand washable 100% nylon), 'Topsail' (a Viscose and Nylon gabardine) and finishes used by Bruck like 'Duraleen' (spot resistant, water repellent and crease resistant).

This attention to design also applied to the public faces of the firm's involvement with architecture. Visiting company executives and dignitaries would be entertained and often stay in the Grounds, Romberg & Boyd-designed 'Bruck House'. The firm's two capital city showrooms were exemplars of design for display. In Sydney, the Bruck Fabrics showroom (1953–4) at 181 Clarence Street was designed by modernist architect Douglas Snelling (1916-1985).[61] Located within Broughton House, an existing late Victorian warehouse (1900), which had been rebuilt and expanded in 1920 by Robertson & Marks, the tenancy included not just the familiar Bruck typography above a blond panel door framed in black but also in its entry lobby, three Snelling Line lounge chairs in woven green webbing and immediately behind the clear glass entry window three red vertical strands of rayon woven into five horizontal yellow strands.[62] Elsewhere Snelling's dining chairs (also green woven webbing) were used in an office area where back to back desks were separated by black-framed screens of frosted glass and drawers beneath were black and a hovering wall unit in apple green.[63]

More dramatic and with street presence was the Bruck Fabrics showroom in Melbourne. Another insertion within an existing late Victorian office/warehouse, this time on the ground floor of Trevola House at 118 Flinders Lane in the heart of Melbourne's inner city rag trade precinct, the Bruck showroom (1956) was believed to have been designed by the office of Grounds, Romberg & Boyd. It was a stunning piece of interior design, being exhibition space, showroom and workplace all in one. The floor was boldly striped in vinyl tiles. Above was a completely illuminated ceiling, its grid aligning with the stripes below. The regulating lines of both floor and ceiling directed the eye to the showroom's back wall: a stunning photo mural made up of multiple Sievers photographs of the spools and rayon works at Wangaratta. Here in an alcove hidden from the main reception area, salesmen sat on Snelling Line woven webbed dining chairs directly beside the photo-mural. In the foreground was a giant Pop-scaled pair of fabric scissors, while freestanding intervening columns were wrapped in continuous spiralling bands of what appears to be copper roof flashing. Adding to the composition were large cutting tables with bolts of fabric stored and exposed beneath. Here, the art of display was meant to make direct links to the place of manufacture. Looking back the other way, without people, the horizontal planes of the four cutting tables are juxtaposed against the vertical lines of the modular frames of the office partitions marching toward not a mural but the giant scissors seemingly about to cut the full-height curtain beyond. From the street at night, looking through the Romanesque arched windows of Trevola House stencilled with the words 'Bruck Fabrics' and nothing else, here was a window into the artistic possibilities of industry. Seen together, Sievers's photographs of the Bruck showroom in Melbourne and those of the Bruck factory in Wangaratta seem to epitomise a special moment of optimism and progress in Victoria's quest to be the workshop of the nation.

Metaphor for Manufacturing

Bruck's early success took a downturn in 1959 and again in 1960, with the Australian Government's signing of the Australian-Japanese Trade Treaty (1957) – a boon for Australia's wool exporters but a blow for local manufacturing, especially domestic wool and synthetic-fibre weavers: "Japanese penetration is, as yet, modest but quite enough to hurt domestic manufacturers who are vulnerable to any competitive imports produced under a lower cost-structure."[64] This was to be a familiar challenge to all manufacturing (especially the automotive industry) from the late 1950s and into the 1960s, as Australian government policies continued to favour, largely for short term electoral gain, primary industries and the export of minerals over the ongoing consolidation of the secondary industry of manufacturing. On 20 November 1961, John McEwen, Deputy Prime Minister, Minister for Trade and Leader of the Australian Country Party, speaking in Shepparton, openly admitted:

> The Japanese Trade Treaty I am sure has put an enormous amount of money into the pockets of Australian wool-growers. I've said and I believe it to be true, that the strength of Japanese competition has added as much as 50 million pounds to the value of the Australian clip in one season. That's what has gone into the pockets of wool growers in one season from the transformation of the Japanese from modest buyers into the biggest buyers in the world of our wool.[65]

That was indeed the case. Tariff protection for Bruck was introduced in 1963[66] and popular interest in synthetic textiles in the fashion industry continued to grow in the 1960s. Bruck's fortunes began to pick up again though not with the same buoyancy of the 1950s. A continuing thorn though, for Bruck and for the Australian textile industry generally, was as Arnold Piesse, Bruck's manufacturing manager, stated in 1967 that, "We would use wool, but no-one comes to sell it to us." The Australian Wool Board promoted pure wool not mixtures and "this is the rigid attitude of the whole wool trade. The wool boys look on Bruck as a competitor instead of a potential customer. The only other major industry in the town is the spinner Wangaratta Woollen Mills, just a stone's throw away. Come in, spinners."[67]

Over the next fifty years to 2020, Bruck Textiles and its mill in Sisely Avenue, Wangaratta has managed to survive. Today the firm continues its specialization as the major Australian producer and also as a significant global supplier of textiles for industrial, defence, firefighting and emergency services clothing – producing fabrics which have become synonymous with everyday life – a far cry from its overt and ambitious design presence during the 1950s. However, the showrooms have long gone and the houses and executive accommodation in Bruck Avenue have all been sold into private hands. The Sydney head office is currently located in a nondescript brick building in Alexandria. In Melbourne, the sales office is a tenancy located within a similarly faceless 1980s speculative office block in High Street in suburban Kew. If this account of Bruck can be read as a metaphor for the fate of manufacturing in Australia, it is also an unashamedly, nostalgic glance back to a time when the physical and aesthetic attributes of art, design, photography and architecture could all combine to give image to post-war economic recovery, the building of a multicultural workforce, and above all, pride in the business of making.

In the midst of crisis – World War II – politicians in Australia under Labor Prime Minister John Curtin's leadership established the Ministry of Post-war Reconstruction in 1942. Their aim, "Australia's Boldest Experiment", was to plan long term for national recovery and manufacturing was a key plank in the that strategy.[68] On 2 September 1946, in an election speech, Prime Minister Chifley declared of the nation's industrial future: "The stage is set". He was excited about the opportunities ahead, optimistic that Australian secondary industry would hold its place in the world's markets, even making mention of the "Canadian firm of American origin" establishing a rayon mill at Wangaratta.[69] In October 2020 in the midst of a different global crisis – the COVID-19 pandemic - Prime Minister Scott Morrison's Liberal Coalition Federal Government announced Make It Happen: The Australian Government's Modern Manufacturing Strategy, where it is planned to "harness Australian manufacturing capability and drive our economic recovery and future resilience" and with a vision for Australia "to be recognised as a high quality and sustainable manufacturing nation that helps to deliver a strong, modern and resilient economy for all Australians."[70] Grand aims indeed but the lesson of Victorian manufacturing in the 1950s and 1960s shows that, with government planning and support, financial investment and protection, these aims are possible to achieve and that design – in all its facets – and the spaces of our workplaces and production perhaps more than ever have a decisive role to play.

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16 Davison, *Car Wars*, 83.

17 Robin Boyd, *The Australian Ugliness* (Melbourne: Cheshire, 1960), 31.

18 Simon Reeves, "D Graeme Lumsden (1915–1995)", Dictionary of Unsung Architects, online resource. See Built Heritage, https://www.builtheritage.com.au/dua_lumsden.html.

19 Victorian Heritage Database place details – 9/6/2020, Former Nicholas Administration Building, 685–699 Warrigal Road, Chadstone, VIC, 3148 – Property No. B6307. National Trust of Australia (Victoria).

20 GMH Fishermans Bend, 221-226 Salmon Street, Port Melbourne. Recommendation of the Executive Director and assessment of cultural heritage significance under Part 3, Division 3 of the Heritage Act 2017, November 20, 2019.

21 *Cross-Section*, no. 35 (September 1955), n.p.; *Cross-Section*, no. 51 (January 1957), n.p.

22 "A New Suburb: Industry Builds Homes to Attract Workers", *The Age*, June 9, 1950, 2.

23 Kirsty Grant, exhibition wall texts for *Mid-Century Modern: Australian Furniture Design*, National Gallery of Victoria, 58, accessed online September 24, 2020, https://www.ngv.vic.gov.au/wp-content/uploads/2014/12/NGVA_MCF_Label-Book.pdf;. See also *Architect*, 17 (November-December, 1971), 18.

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28 'Perspective of proposed factory for Steco Industries Pty Ltd', undated drawing, architect: David Godsell, RMIT Design Archives, David Godsell Collection, 0004.2015.0012. The drawing does not state the address of the proposed factory. At the time however, Steco Industries was located at 194-198 Bell Street, Preston. It is assumed that Godsell's design was for this expansive corner site but this needs further verification.

29 Perspective and plan for 'Proposed Factory at Moorabbin for Bentley Manufacturing Company', July 1962, Architect: David Godsell, RMIT Design Archives, David Godsell Collection, 0004.2015.0090. Godsell also designed the Neil Morris & Co. Paper Convertors Factory at 38 Alex Avenue, Moorabbin, VIC, 1967. See photograph by Peter Wille, State Library of Victoria, Pictures Collection, Accession No: H91.244/2059.

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32 *Cross-Section*, No. 52 (February 1957), np.

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42 See Veronica Bremer and Anne-Marie van de Ven, "The Bauhaus Link in the Life and Work of Émigré Artist Gerard Herbst", *Electronic Melbourne Art Journal*, 9 (2016), 1–40. See also Anne Brennan, "A Philosophical Approach to Design: Gerhard Herbst and Fritz Janeba", in Roger Butler (ed.), *The Europeans: Émigré artists in Australia, 1930–1960* (Canberra: National Gallery of Australia, 1997), 152–166.

43 Vicars, 18.

44 Vicars, 26.

45 "The Bruck Story", in *Bruck Fabrics/Bruck Mills (Australia) Limited* (Melbourne: Bruck Mills (Australia) Ltd., 1954), 1.

46 Michel Racicot, "Yard of Silk", see Quebec Anglophone Heritage Network, accessed July 20, 2020, http://100objects.qahn.org/content/yard-silk-1922..

47 In 1965, a second Bruck plant was constructed in Cowansville. The company was renamed Consoltex in 1979 and all Cowansville plants were closed in 2010.

48 *The Gazette* (Montreal), March 1, 1947, 20.

49 See *Dun's Gazette for New South Wales*, February 1, 1946, p. 34; *The Bulletin*, vol. 67, no. 3443, February 6, 1946, 21; *The Bulletin*, vol. 67, no. 3468, July 31, 1946, 27.

50 "New Colours Have Original Names", *Weekly Times* (August 16, 1950), 42.

51 "Easing Pressure on Our Capitals, Decentralisation", *Pix*, vol. 29, no. 7, April, 18, 1953, 28.

52 Transcript, video, former employees, Post-war Migration and Bruck Textiles, Culture Victoria. See Culture Victoria, accessed August 5, 2020, https://cv.vic.gov.au/stories/a-diverse-state/wangaratta-textile-town/post-war-migration-and-bruck-textiles/.

53 "Easing Pressure on Our Capitals, Decentralisation", *Pix*, vol. 29, no. 7, April, 18, 1953, 31.

54 "Prosperity is clad in Rayon", *The Argus*, May 18, 1954, 20.

55 Context Pty. Ltd., *Rural City of Wangaratta Heritage Study Review (Part 1) and Urban Precincts 2011*, Volume 1 Urban Precincts, final report 3 June 2013.

56 *Architecture in Australia* (September 1956): 37-41; *Architecture and Arts* (October 1958): 17.

57 Bruck Mills, Wangaratta, 1954. Collection of landscape drawings by John Stevens (1920-2007), State Library of Victoria, Picture Collection.

58 View of Wolfgang Sievers and Helmut Newton's New Visions in Photography exhibition held at the Federal Hotel, Collins Street, Melbourne, 1953. Photograph Wolfgang Sievers. National Library of Australia. Wolfgang Sievers Photographic Archive, PIC WS 1485G LOC PIC Album 1032/65.

59 "Some Fashion Fair Fabrics Made in Country Factories", *Weekly Times*, March 1, 1950, 38.

60 *Bruck Fabrics/Bruck Mills (Australia) Limited* (Melbourne: Bruck Mills (Australia) Ltd., 1954), 8.

61 "Office Buildings Sydney", *Architecture* (April/June 1954): 85.

62 This same motif of woven fibres appeared in the window to the Bruck Mill front office. The architectural detailing of this entry matches the detail of the Sydney showroom and it is possible that Douglas Snelling may have been the designer for the refurbished entry to the factory offices in Wangaratta. Wolfgang Siever's 1954 photograph also shows two Snelling Line chairs and coffee table in the lobby. Bruck Mills Showroom, Wangaratta, photographer Wolfgang Sievers, 1954, gelatin silver photograph. See Culture Victoria, accessed October 1, 2020, https://cv.vic.gov.au/stories/a-diverse-state/wangaratta-textile-town/bruck-mills-showroom-wangaratta/.

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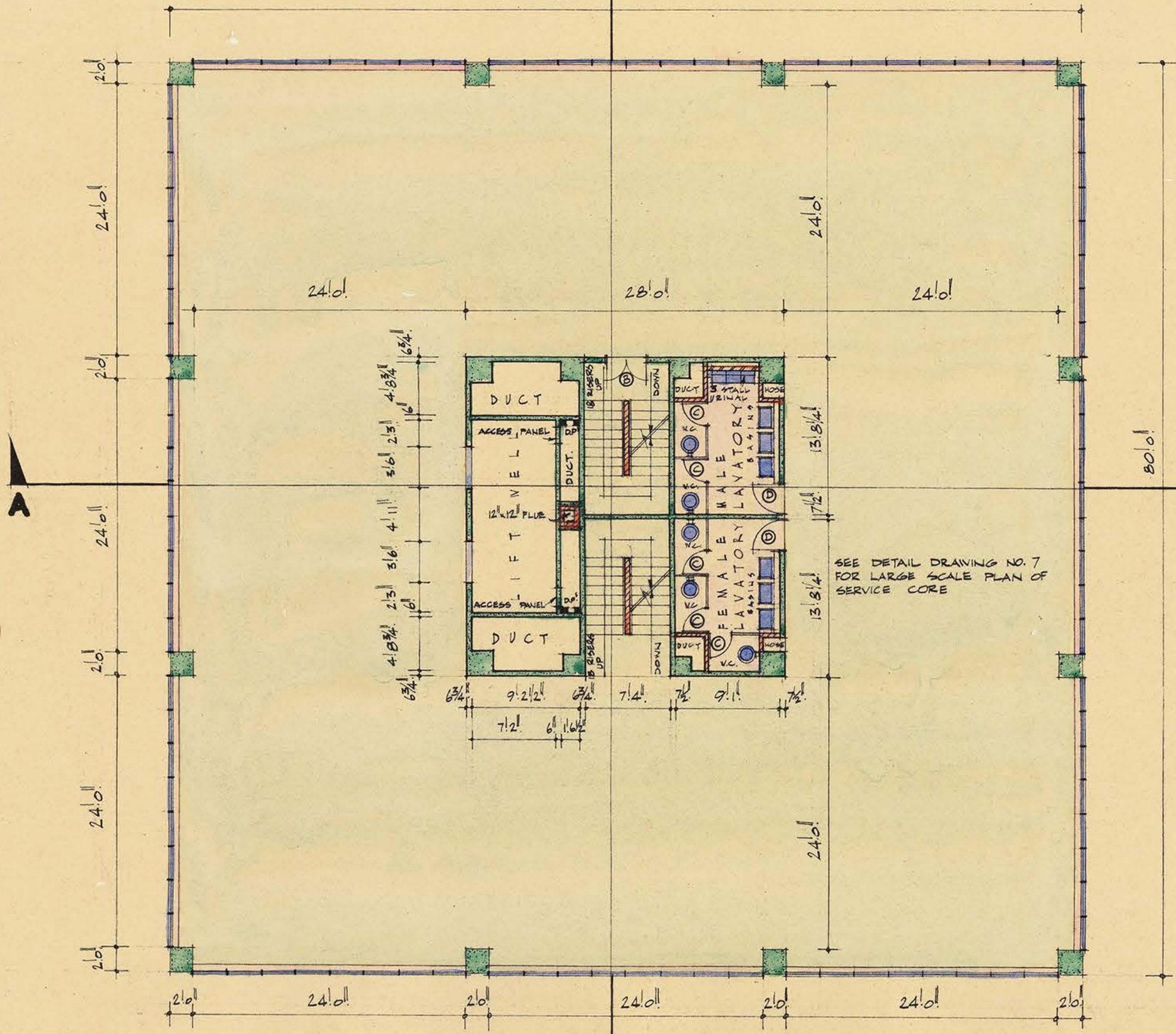
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A
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DOWN
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US STALL URINAL
HOSE
WC
WC
WC
WC
MALE LAVATORY 6 BASINS
FEMALE LAVATORY 6 BASINS
DUCT
HOSE
VC
3'-6"
2'-3"
4'-8¾"
6¾"
4'-11"
13'-8½"
17½"
6¾"
9'-2½"
7'-4"
9'-1"
7½"
7'-2"
6"
1'-6½"
SEE DETAIL DRAWING NO. 7
FOR LARGE SCALE PLAN OF
SERVICE CORE
NORTH

Shaping craft with efficiency: Rediscovering the lost glass box of Guilford Bell and David Godsell for Feltex Australia.

Giorgio Marfella

PEER REVIEWED ESSAY

ABSTRACT

Overshadowed by the fame of its neighbour ICI House, Feltex House was a five-storey office block completed in Melbourne in 1959. Demolished in 1986 with permission by city authorities, the building is today forgotten by most Melbournians. Fortunately - unlike other mid-century modern jewels lost in Australia – publicly available and comprehensive archival sources and working drawings of Feltex House survive at Public Record Office Victoria and the RMIT Design Archives. From these sources, it is possible to reassess the value of this modest and relatively unknown commercial building of the 1950s and appreciate its legacy as a distinctive experiment of industrial manufacturing patronage

In the late 1950s, the skyline of Melbourne changed irreversibly due to the rise of a new generation of 'office blocks',[1] the third in the commercial development of the city, which saw similar bursts of widespread multi-storey building activity at least two times before, in the 1880s and 1930s. Construction was prompted above all by corporations willing to build brand new headquarters for owner-occupation, with insurance companies and banks playing the most prominent part.

After WWII, the prospect of owning and occupying a conspicuously modern workspace was a favourable outlook for most corporate clients. The desire for comfort, productivity, and prestigious corporate address went hand in hand with real estate investments that, due to the introduction of air conditioning, were more valuable than the building stock of the pre-war period.

Several manufacturing companies also followed this real estate investment model. Of these the best-known is ICI House, the headquarters of the Imperial Chemical Industries of Australia and New Zealand (ICIANZ), which still stands today at the corner of Albert and Nicholson Streets. Adjacent to ICI House, at the corner of Nicholson Street with Victoria Parade, stood Feltex House, another industrial-owner-occupied office building. Completed in 1959, only a few months after ICI House, Feltex House was the headquarters of a rising Australian wool manufacturing group. This building was in stark contrast with the taller and sky-reflecting slab nearby designed by Bates Smart & McCutcheon.

Only five-storey high, Feltex House stood out for its new level of architectural purism and modular composition which combined geometric rigour with a domestic taste for finishes and detailing. The plan was a perfect square, shaped around a square core housing services and ancillary spaces. Such symmetrical boldness was unusual for an Australian office building of the 1950s. The headquarters of Feltex attracted considerable interest as recorded by the professional periodicals of the time,[2] featuring on the front cover of *Architecture Today*. The commentary of professional journals exalted the luminous quality of the office space, which was conceived square in plan to admit natural light all-round with "glass walls on four sides"[3]. The building was also praised as a rare example of the integration of "functionalism and artistry".[4] Feltex House reflected the optimist entrepreneurial spirit of the late 1950s, partnering the ambitions of a fast-growing manufacturer of the Australian wool industry with those of a recently established Melbourne architect, Guilford Bell, and one of his employees, David Godsell.

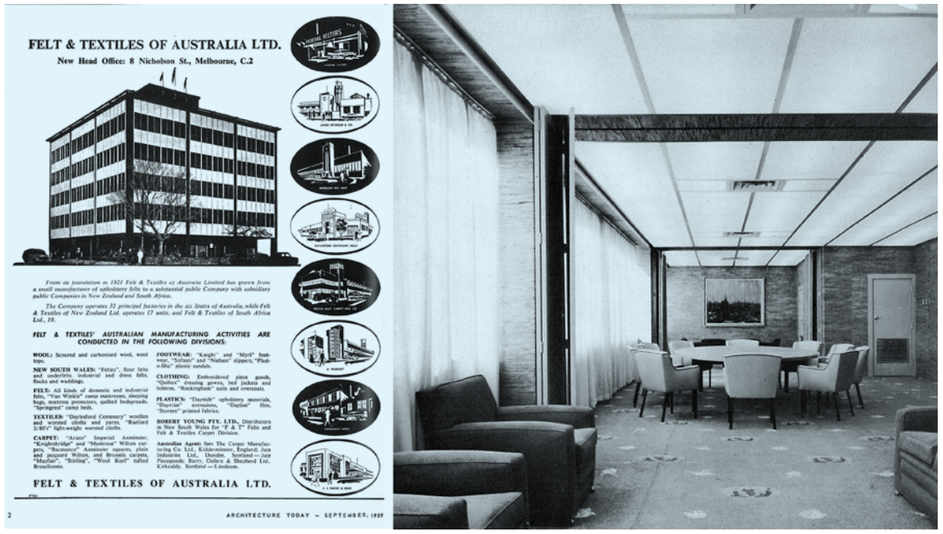
Demolished in 1986[5] with permission by city authorities, and overshadowed by the fame of its neighbour ICI House, Feltex House is today forgotten by most Melburnians. Fortunately - unlike other mid-century modern jewels lost in the city – publicly available and comprehensive archival sources and working drawings of Feltex House survive at Public Record Office Victoria and the RMIT Design Archives. From these sources, it is possible to reassess the value of this modest and relatively unknown commercial building of the 1950s and appreciate its legacy as a distinctive experiment of industrial manufacturing patronage of the Australian post-WWII period.

Housing the largest Australian manufacturer of wool

Established in 1921 as Sydney Felt and Textiles, the company of Felt and Textiles Australia started business as a small manufacturer of felt upholstery and blankets. From 1924, under the energetic direction of Belgian émigré and wool merchant Henri van de Velde, the company grew nationally expanding its market of domestic furnishings and footwear of compressed wool fabrics.[6] From the late 1930s, after

Previous pages
David Godsell and Office of Guilford Bell, Feltex House, Plans of Floors 3 & 4, 1957, (detail), Public Record Office of Victoria.

Opposite
Office of Guilford Bell, Feltex House, Melbourne, 1957–59 (Demolished in 1986). Site location within aerial view of Melbourne CBD (City of Melbourne, Melbourne Strategy Plan, 1985) and corner view from Victoria Parade with ICI House in the background. Photographer, Wolfgang Sievers. National Library of Australia, nla.obj-160965813



Above
Felt and Textiles of Australia advertising with Feltex House and internal view of Board Room (from *Architecture Today*, September 1959. Photograph by Mark Strizic)

Opposite
David Godsell and Office of Guilford Bell, Feltex House, ground floor and upper floor plans, 1957. Public Record Office of Victoria

listing in the Stock Exchange, Felt and Textiles continued to grow, diversifying operations, branching out by incorporating other companies as subsidiaries, and expanding into new markets, in Australia and overseas. In 1950, Felt and Textiles was one of the largest Australian-owned manufacturing corporations, controlling a network of subsidiary wool and textile manufacturing companies with 7,000 workers and 65 factories in Australia, New Zealand and South Africa.[7] Despite its origin and felt production centres located in New South Wales, as the company grew, business management operations shifted their centre of gravity progressively in Victoria, where the group had its largest number of subsidiaries and BACM's manufacturing plant for carpets.[8]

In 1957, Felt and Textiles, following the example of ICIANZ, set to build their head office in East Melbourne,[9] relocating from their city premises at Bank House in Bank Place. The company purchased five parcels of land from three different owners at the south-east corner of the intersection between Nicholson Street and Victoria Parade. The consolidated property (5-8 Nicholson Street) was a site of 14,000 square feet (1,300 sqm),[10] a corner block that shared right of way along the southern boundary with the property of ICIANZ.

As the operations for land consolidation proceeded, Felt and Textiles commissioned the design of the new headquarters from the office of Guilford Bell. The engineering firm of Gutteridge, Haskins & Davey was engaged for the design of structures and building services and Rider Hunt as cost consultants. The architect commenced work most likely in the first half of 1957. Bell's 27-years-old colleague David Godsell was project architect responsible, at least, for the preparation of working drawings and liaison with building authorities. Copies of working drawings, kept in the RMIT Design Archives,[11] suggest that he had considerable input and leadership throughout the delivery of the project.

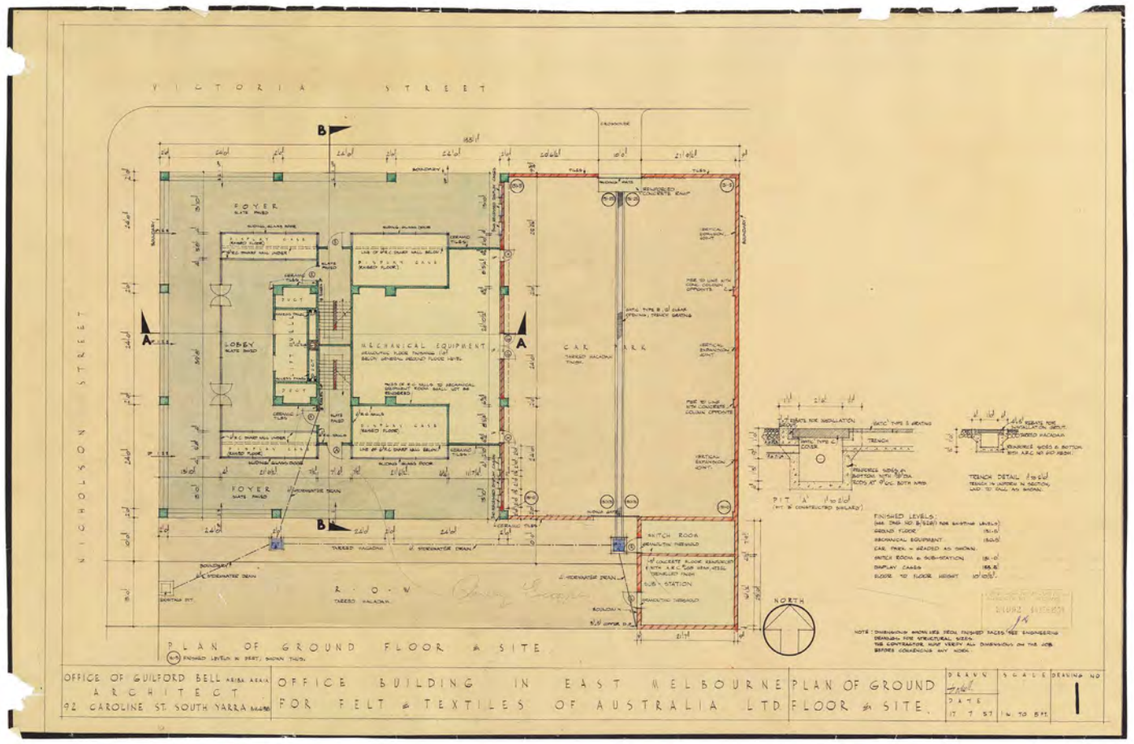
While Felt and Textiles finalised operations of site consolidation, Bell and Godsell started working on the design and documentation. General arrangement drawings, prepared in mid-1957, show the final scheme resolved and in line with the project as built. Godsell completed all the working drawings by November 1957 with plans, sections, elevations, reflected ceiling plans, stair and core details, and construction details of the curtain wall and roof areas.[12] Tendering must have taken place in late 1957, with the winning contractor, John Holland & Co. selected in early February 1958 to build the project for a cost of approximately 240,000 pounds.[13] After a few months of preliminaries, Holland commenced work on the foundations of the new building in May 1958,[14] topping up the concrete structure by the end of the same year,[15] and completing the job with sign off from the Building Surveyor in July 1959.[16]

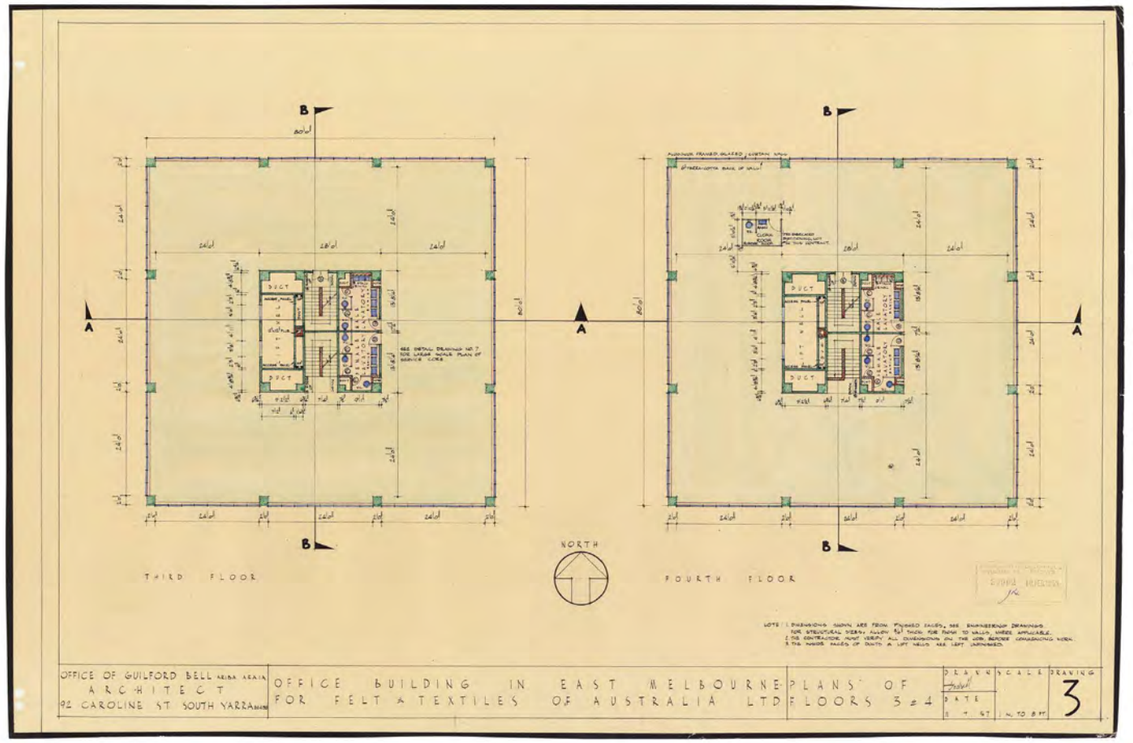
Efficiency and comfort

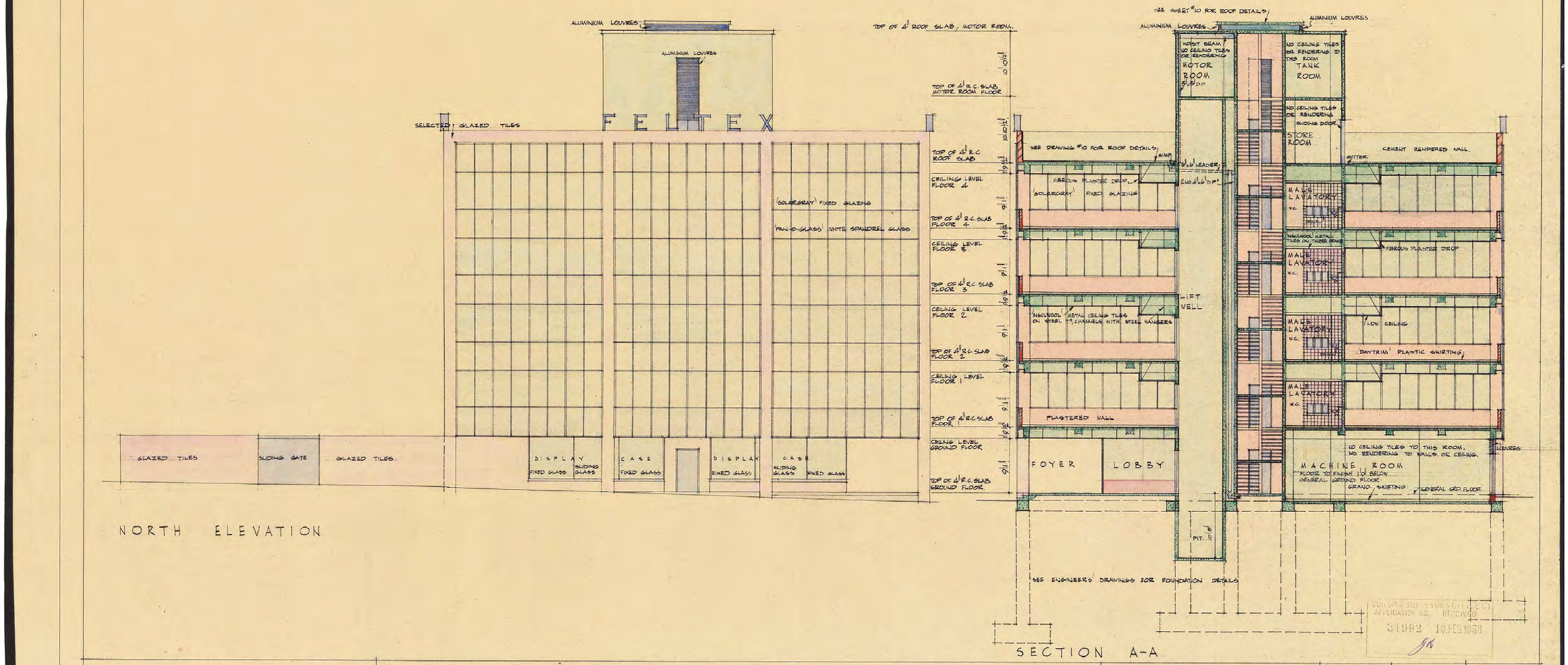
The plan of Feltex House was a perfect square, measuring exactly 80 feet by 80 feet (24.4 m by 24.4 m). Internally, the workspace was arranged on four sides with a consistent, but shallow, 24 feet (7.3 m) leasing depth with column-free space, access to look-outs and natural light. The square plan gave each side of the floor plate equal spatial opportunities for flexibility. Two sides of the square boasted front of house northern exposure on a prominent corner site. The workspace was served by a perfectly square central service core, measuring 28 feet by 28 feet (8.5 m by 8.5 m) wide. Two lifts and two back-to-back stairwells provided vertical circulation. One stair was enclosed for fire-isolation, the other left open and elegantly detailed with treads of reconstituted stone that invited inter-floor circulation. With this arrangement, the floor space of 5,600 net square feet (520 sqm) outperformed for efficiency most contemporary office buildings of the city: the floor plan had a remarkable ratio of net to gross floor area of 87%.

Levels two to five of office space housed the administrative staff of Felt and Textiles. Half of the first level contained a staff canteen. The rest of the first floor and the second and third floors were allocated for the company's personnel. The fourth office floor housed spaces for executives and the Board Room. The building terminated with a tiled terrace accessible by stairs weather-protected by the extension of the service core walls and topped by a flat roof.

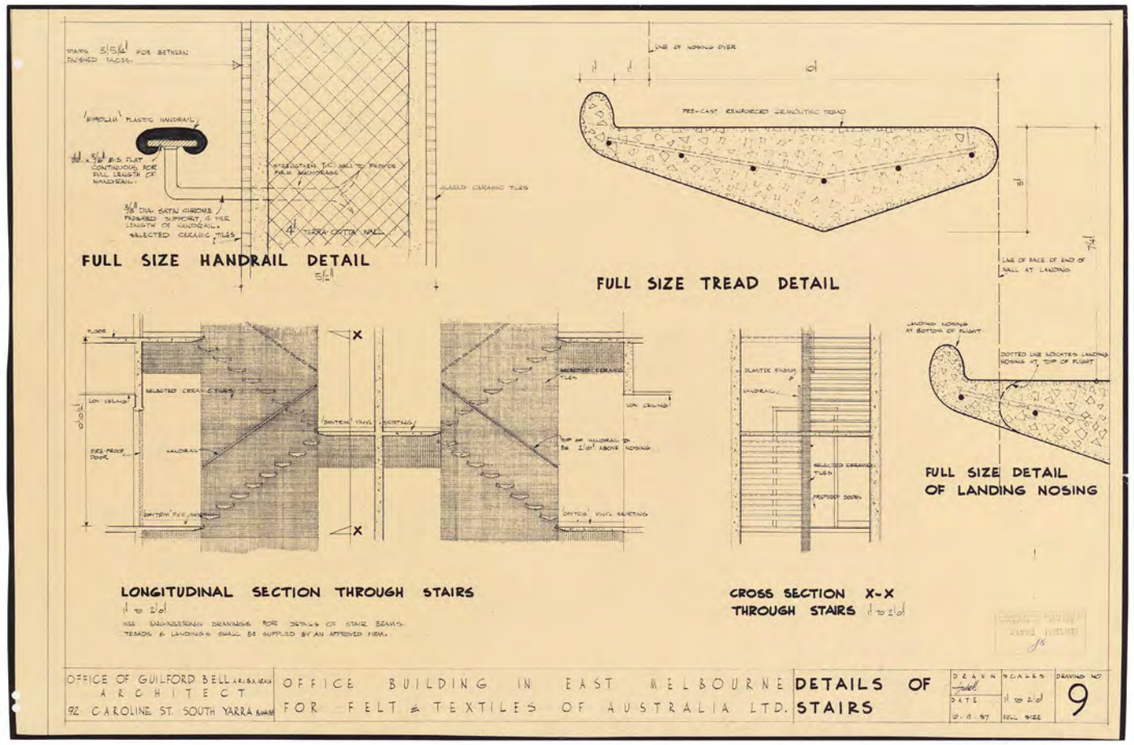
The external walls followed the property boundaries along Nicholson Street and Victoria Parade. The structural columns were expressed externally with facing of black mosaic tiles, a wall covering common in office buildings







OFFICE OF GUILFORD BELL ARIBA ARAIA ARCHITECT 92 CAROLINE ST. SOUTH YARRA BM4138	OFFICE BUILDING IN EAST MELBOURNE FOR FELT & TEXTILES OF AUSTRALIA LTD.	NORTH ELEVATION, & SECTION A-A	DRAWN Tadeu! DATE 23.8.57	SCALES 1 IN. TO 8 FT	DRAWING NO. 5



of the period and used among others by Bates Smart for the ground floor columns of ICI House. At street level, the black columns formed an arcade with slate paving that continued inside the ground foyer and lift lobby. Bound by soft landscaping and surrounding glazed display cases containing products of Felt and Textiles, this colonnade extended the public space on the owner's premises, running along the main streets and on the south where it faced the shared laneway and landscaped garden of ICI House. The squared-off orthogonal design of the colonnade was approved through an exemption to the Uniform Building Regulations, which prescribed the 'rounding-off' of corner shopfronts at street level. At ground level, the rest of the site was occupied by mechanical services and a car park area. Car parking, located on the eastern side of the property, was also accessible by ICIANZ from the shared laneway.[17]

Bell and Godsell designed the interiors and furnishings of the building using, whenever possible, the products of their client. They juxtaposed comfortable finishing with the inevitable austerity required by a corporate workplace - most likely as a response to the sensitivity for industrial design and craft of their client. The internal walls were rendered with grey-green plaster and trim to match, whereas the walls of the lift core were finished with panelling of natural hardwood. The white translucent acoustic ceiling tiles of 'Insulwool', a rock wool insulation product,[18] contrasted with a warm grey-green carpet that matched the colour of the walls.

The architects also designed the internal fit-out. Partitions were demountable, set on tracks of black steel with translucent cast plate glass contrasting with solid doors veneered in bright 'Tibetan' yellow plastic laminate. The latter was also used to cover chairs, also designed by the architects, for the executive offices. Feltex House allowed the owner to showcase their products as an application on their premises. Custom-woven BACM Carpets covered floors throughout the building, and trims, including the bright yellow laminates used in furniture and partitions, were from the 'Daynide' and 'Daytrim' ranges of PVC upholstery also manufactured by Felt and Textiles.

Breaking the glass wall

The dominant external feature of Feltex House was an aluminium curtain wall of dark grey vision glass and white glass spandrels. The glass was fixed to a grid of extrusions produced by the Overseas Corporation of Australia, an industrial manufacturing group established in 1945 by John Stanley Storey and William Wasserman, the leader of the American Lend-Lease Mission in Australia. Apart from aluminium extrusions, the group produced furniture, domestic appliances and components for the aeronautical industry.[19]

Godsell detailed the curtain wall with remarkable skill, putting together a kit of parts from Overseas Corporation. He adapted Overseas Corporation catalogue extrusions in a way that is evocative of the *ad hoc* craft usually needed for small residential projects. The detailing of the aluminium skin differed somewhat from the largest contemporary International Style examples of all-glass facades, and even the smaller contemporary largely glazed office block infills that in Melbourne prospered, for example, along Queen Street and Collins Street.[20] Rather than wrapping around the curtain wall continuously to conceal the structure, Godsell's detailing broke the monotony of the glass wall, resolving it as a multi-storey infill fenestration set proud between the structural columns. Each façade was subdivided in three equal bays framed by the external expression of the structure. The columns were revealed outside, set back behind the curtain wall frame, and recessing even further visually due to chromatic contrast of the black mosaic tile finish with the bright white glass of the spandrels.[21]

The relentless character that is typical of many curtain walls was mitigated by alternating two different mullion profiles. The first mullion, spaced at 6 ft centres, was deeper and assembled with several extrusions fixed to a load bearing strongback supported by a mild steel floor bracket. The second mullion was an intermediate cruciform bar that received glass panels spanning on a module of 3 feet (0.9 metres). With this arrangement the glass was set in the middle of the larger mullions, thus recessing the water-line behind a continuous aluminium ledge, an appropriate – although not necessarily sufficient – measure to mitigate the likely risks of water intrusions that were quite common in the curtain walls of the 1950s.[22]

The glazing contractor, E.L. Yencken, supplied and installed glass imported from overseas. The vision panels were 'Solargray' heat-absorbing glass, a product of the American Pittsburgh Plate Glass Company. The white spandrels were toughened 'Pan-O-Glass', a product of the Belgian glassmaker Sobelever, the same used next door for the spandrels of ICI House.[23]

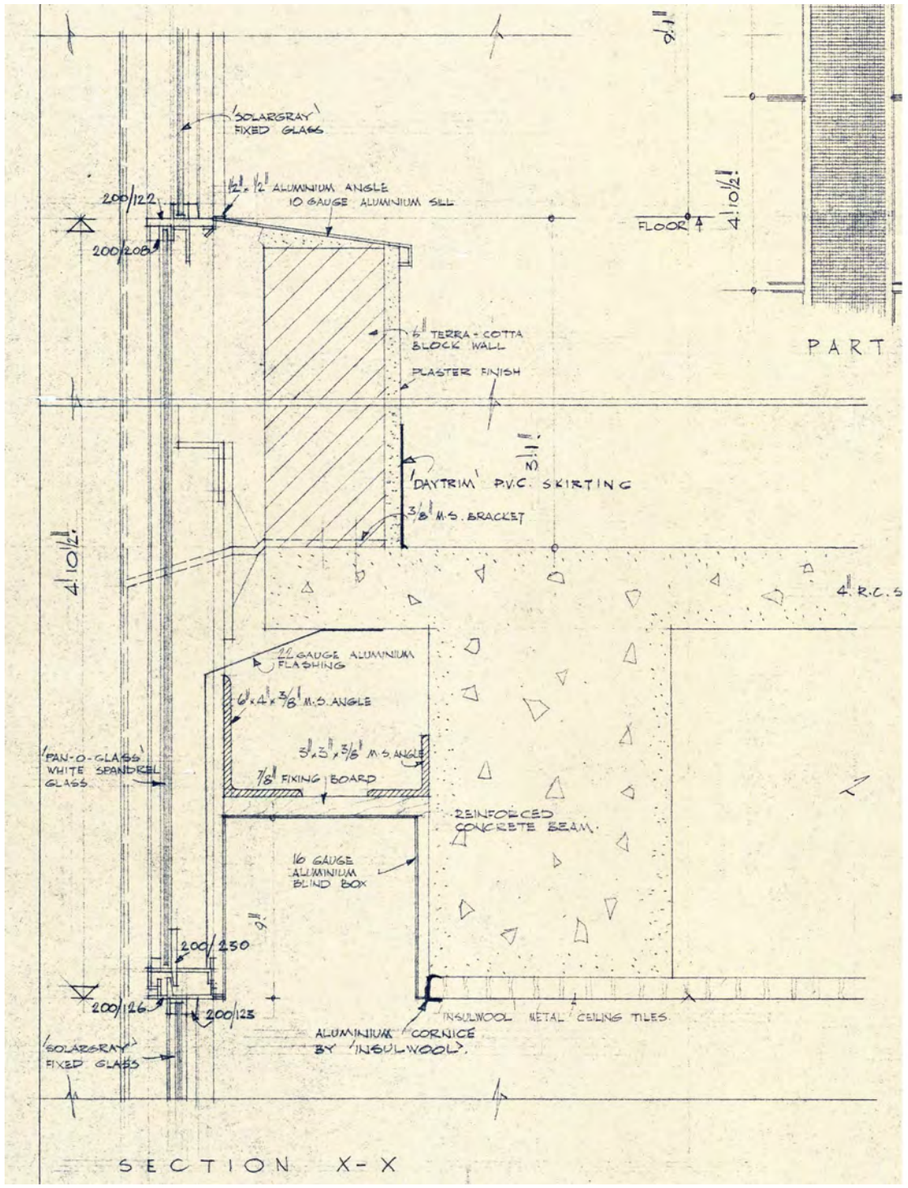
Vertical extension plans and demise

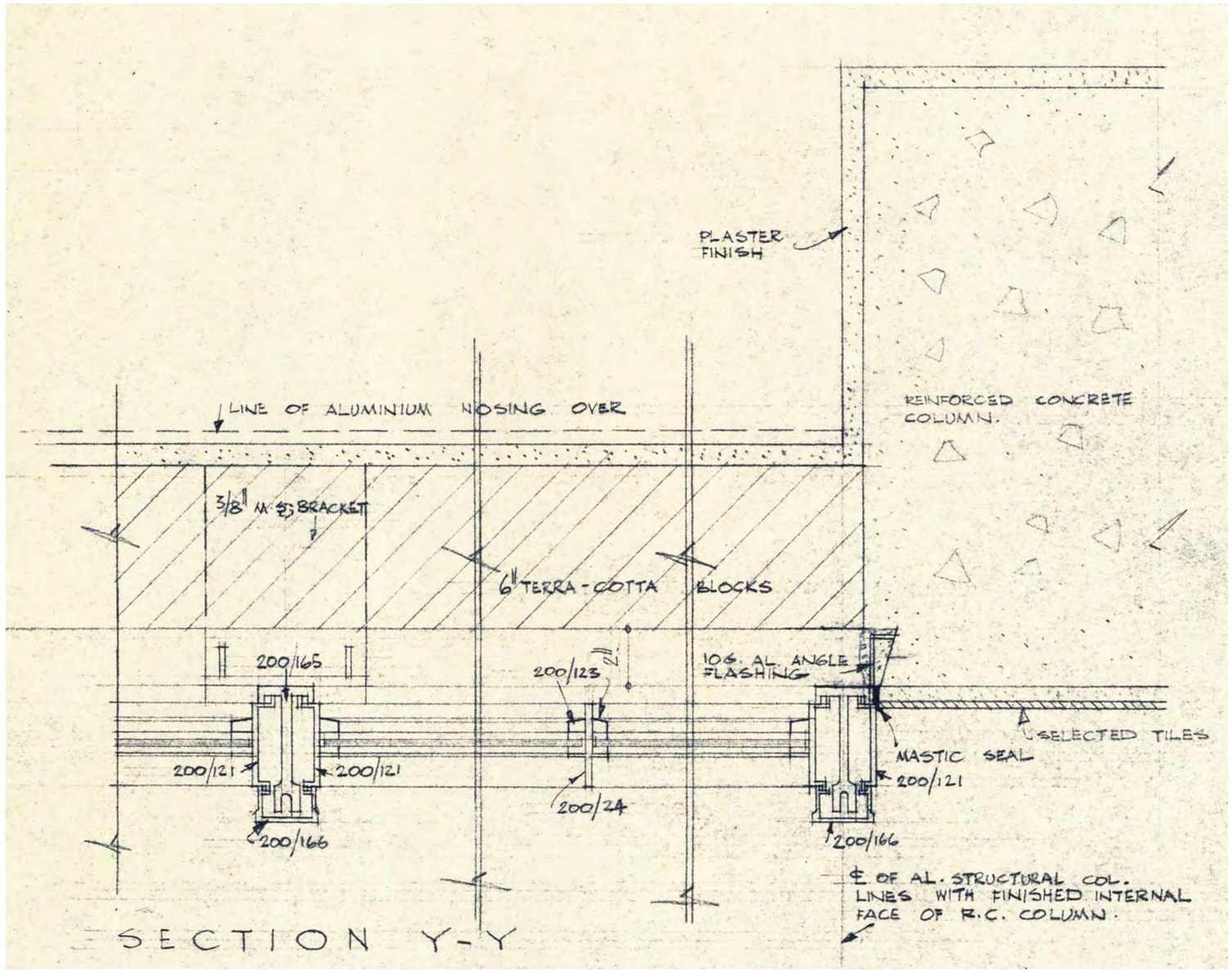
According to *Architecture Today*, Feltex House was envisaged as a two-stage development. The building completed in 1959 was to be followed by a vertical extension to 'the usual' height limit.[24] The 'usual' most likely meant 132 feet (40 metres) from street level, the maximum height prescribed by the Victorian Universal Building Regulations (UBR).[25] Staged plans for the development and the somewhat condensed chronology of the design recorded by project files and drawings suggest that Felt and Textiles was keen to relocate to the new headquarters as soon as possible. In this context, the company may have preferred avoiding negotiations with city authorities to build a modern structure outside the prescriptions of the code - as in the case of ICI House. It is plausible that Felt and Textiles intended to expand vertically at a later stage either to cater for anticipated company growth or speculative reasons. The hypothetical extension could have been negotiated on a site-density basis by using the development control of the plot ratio. ICI House, on a site of 25,300 sq ft area, was approved with a plot ratio of approximately 1:9, equal to a total 237,000 sq ft gross floor area. Transposing an equivalent density on the site of Felt and Textiles, the five-storey square block designed by Bell and Godsell could have been a tower almost twenty floors high, equivalent to 126,000 sq ft gross floor area.

The foundations, core and concrete framed structure designed by Gutteridge, Haskins & Davey, however, were

Previous Page and Opposite
David Godsell and Office of Guilford Bell, Feltex House, North elevation, section and stair details, 1957. Public Record Office Victoria

Overleaf
David Godsell and Office of Guilford Bell, Feltex House, aluminium curtain wall details, typical section and plan details of mullions, 1957. Public Record Office Victoria


SOLARGRAY FIXED GLASS
200/122
200/208
½" x ½" ALUMINIUM ANGLE
10 GAUGE ALUMINIUM SILL
FLOOR
4'10½"
PART
6" TERRA-COTTA BLOCK WALL
PLASTER FINISH
DAYTRIM PVC SKIRTING
3/8" M.S. BRACKET
4'10½"
4" R.C.S
22 GAUGE ALUMINIUM FLASHING
6" x 4" x 3/8" M.S. ANGLE
3" x 3" x 3/8" M.S. ANGLE
7/8" FIXING BOARD
PAN-O-GLASS WHITE SPANDREL GLASS
REINFORCED CONCRETE BEAM.
16 GAUGE ALUMINIUM BLIND BOX
200/250
200/126
200/123
SOLARGRAY FIXED GLASS
ALUMINIUM CORNICE BY 'INSULWOOL'.
INSULWOOL METAL CEILING TILES
SECTION X-X


PLASTER FINISH
LINE OF ALUMINIUM NOSING OVER
REINFORCED CONCRETE COLUMN.
3/8" M.S. BRACKET
6" TERRA-COTTA BLOCKS
200/165
200/123
10G. AL. ANGLE FLASHING
SELECTED TILES
MASTIC SEAL
200/121
200/121
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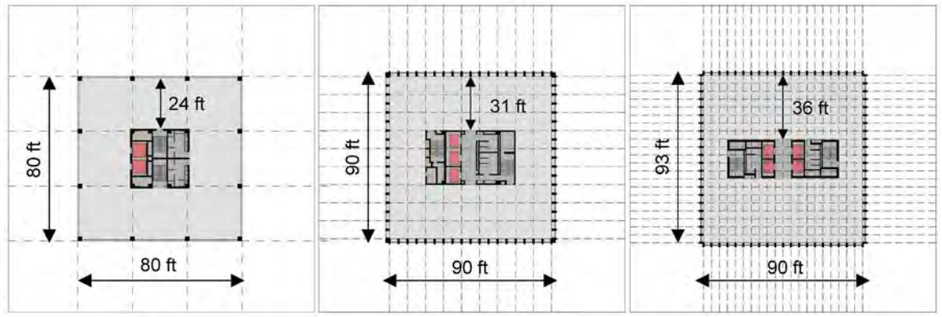
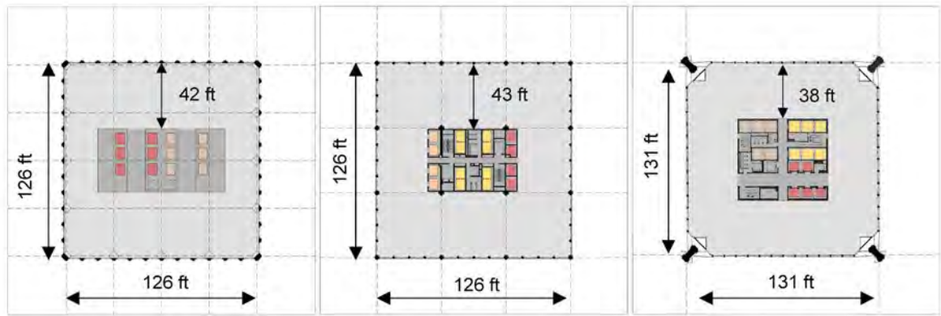
200/166
℄ OF AL. STRUCTURAL COL. LINES WITH FINISHED INTERNAL FACE OF R.C. COLUMN.
SECTION Y-Y





1959	1966	1968	1969	1972	1978
Feltex House	**ACI House**	**State Government**	**AMP Square**	**BHP House**	**National Bank House**
8 Nicholson Street	550 Bourke Street	1 Macarthur Street	535 Bourke Street	140 William Street	500 Bourke Street
Height: 56 ft (17m)	**Height: 210 ft (64m)**	**Height: 194 ft (59m)**	**Height: 372 ft (113m)**	**Height: 500 ft (152m)**	**Height: 528 ft (161m)**
GUILFORD BELL	BUCHAN LAIRD & BUCHAN	YUNCKEN FREEMAN	SOM AND BATES, SMART AND MCCUTCHEON	YUNCKEN FREEMAN	GODFREY SPOWERS

ACI House Image
Adrian Crothers Pty Ltd, A.C.I. House - Melbourne c. 1950s from *No title The Buchan group* album 1950s–60s. National Gallery of Victoria, Melbourne

designed to support only up to 12 floors, as Bell showed with a preliminary model of the project.[26] With each floor height measuring approximately 11 feet (3.35 m) twelve floors would have met the 132 feet heigh-limit allowed by the UBR.

In the following decades, changes to the industrial corporate environment must have induced decisions that eventually led Felt and Textiles to sell their property to the adjoining owner, ICIANZ. In a city heavily transformed by new planning controls and high-rise speculative developments, the highly underdeveloped status of the five-storey Feltex House became untenable. In 1973, ICIANZ submitted plans for a radical redevelopment of the site proposing to replace Feltex House with a 37-storey-high tower. The City of Melbourne rejected the proposal for exceeding the plot ratio allowed on the site and car park provisions.[27] Similar schemes aiming to amalgamate the site of ICI House with that of Feltex House for a new high-rise development were submitted again, still without success, in the early 1980s.[28]

The *coup de grace* to the crafty glass box of Guilford Bell and David Godsell, however, was only postponed. In 1986, a speculative developer finally gained approval from the City of Melbourne to demolish Feltex House making way for a fourteen-storey high office block that 'turned its back' on ICI House.[29] Two years later, insurance company National Mutual Life purchased the new property as an investment, only to resell a few years later, after the early 1990s recession, at a loss of 14 million dollars.[30]

Post-industrial reflections

The events that led to the loss of this small office block may seem contingent to the inevitable regeneration of a city like Melbourne. Nevertheless, they are representative of the dynamics that transformed cities and architectural practice from the post-WWII to the late 1980s. Office building for owner occupancy was a common, if not a characteristic trait, of the commercial development boom of the post-WWII years. Owner occupancy in Melbourne was propelled by a multitude of players, not only industrial manufacturers, but also banks, insurance companies and even Government agencies. In this context, the case of Feltex House illustrates the peculiarity of projects driven by a local industrial patronage, where owner-occupation went hand in hand with the opportunity to showcase and test building products manufactured directly by an Australian client. It may be tempting to portray such trends as derivative of international corporate business influences in Australia, mainly of American origin, but the case of Feltex explains the smaller and equally significant relevance of these trends during the 1950s as a locally-driven phenomenon.

In many respects, the perfect square footprint of Feltex House was ahead of its time in the Australian context. It anticipated the typological development of many office buildings that would follow in the next decade, in Melbourne and elsewhere, that used the square centre core plan for high-rise architecture. It is uncertain to what extent Guilford Bell and David Godsell's bold scheme was influenced by international sources. Any Australian architect engaged to design an office building in the late 1950s must have felt the impression of contemporary projects designed by Skidmore Owings Merrill and Mies van der Rohe in Chicago and New York. These predictable influences, however, can be observed more directly at work in the projects of other Melbourne-based architects – like Bates Smart & McCutcheon and Yuncken Freeman - than in the compact central plan devised by Bell for Feltex House. Albeit radically different for function, structure and materiality, the first paradigm of a compact central plan glass tower that comes to mind is instead Frank Lloyd Wright's SC Johnson Research Tower at Racine, Wisconsin.[31]

Leaving aside the highly publicised slabs of the International Style, a more pertinent typological affinity with Feltex House can be found in a handful of regional

Above
Comparative chart of square plan office building in Melbourne, 1950-1980 (drawings by the author), Feltex House, State Government Offices, AMP Square, BHP House, National Bank House, photographer, Giorgio Marfella, ACI House, photographer, Adrian Crothers Pty Ltd

office buildings of the same period in the United States, like I.M. Pei's Mile High Center at Denver, Colorado,[32] or SOM's Warren Petroleum Building in Tulsa, Oklahoma,[33] LOF Building, in Toledo, Ohio,[34] and John Hancock Western Home Office in San Francisco,[35] the latter designed by Chuck Bassett of the San Francisco branch of SOM – the same office engaged for the design Shell Corner in Melbourne – who would later on design the square tower of AMP Square in Bourke Street.[36]

It is plausible that the purist, almost monumental, squareness embodied by Feltex House responded to a general acceptance of simple and economic plan forms among post-war architects as they aimed at controlling floor space and cost efficiency in buildings subject to radical processes of industry-wide innovation.[37] The idea of a square plan may have thus originated endogenously, with Felt and Textiles allowing Bell and Godsell to put it in practice for the first time in Melbourne, perhaps following suggestions from the cost consultant of the job, Rider Hunt, led at that time by experienced quantity surveyors like Harry Wexler.

Wexler, some years later, explained in the journal *Building Economist* the impact of cost management logics on the design of Australian high-rise office buildings.[38] Compact floor plates, like a square plan, and centralised service cores gave long-term investment benefits to clients because they reduced cost and cooling loads of the building envelope while maximising space quality with all-round access to light and views. Feltex House was undeniably a deliberate response to this dictum of spatial efficiency and office productivity. Despite the right shape and core position, however, the building had some inherent limitations that compromised its ability to extend vertically as planned. In essence, the footprint was too small. Any additional vertical growth would have required an expansion of the core, therefore taking away precious space from an already very shallow leasing depth.

The limitations imposed by a small footprint and the correlation of floor plan shape with the economic feasibility of tall buildings can be understood by comparing Feltex House with similar office buildings that were built, taller and wider, in the 1960s and 1970s.

As office buildings grew taller and taller, reflecting the rising costs of land, so grew their footprints to accommodate more complexity and space required for services and vertical circulation. In turn, any additional space needed for services required additional area to offset the cost of the non-productive areas of the floor plan. The logic of growth and evolution of high-rise buildings is not only a matter of vertical height but also one of surface growth on the horizontal plane. These formal implications of the logic of high-rise development explain why the well-crafted building of Feltex House, despite its numerically efficient floor plan area, could not survive the speculative development pressures of the 1980s.

Industrial influences on architecture are often mistaken, or said to happen, as a matter of knowledge transfer on the premise that the construction industry must catch up with the higher levels of productivity of the manufacturing industries. It is often missed, however, that the built environment already has its own rules of productivity. Such rules are, above all, project-specific, but they can be generalised for some building typologies. In tall office buildings, productivity depends on the ability to create attractive workspace with efficient design means that are also eminently architectural, and not merely controlled by quantitative parameters of economic return.

There is another avenue through which one should appreciate the perennial nexus of correlation between manufacturing and architecture. Industrial manufacturing is not foreign and disengaged from the built environment. On the one hand, the built environment is an important market for industrial manufacturing. On the other, industrial corporations, when they are willing to do so, can be catalysts for construction innovation and unique design experiments in architecture.

Ultimately, the story of Feltex House shows the value of this nexus between the two industries. The small head office of Felt and Textiles was a unique experiment in the panorama of Australian commercial building of the 1950s. It is hard to imagine that such a building could originate from a large corporate client of the banking or the insurance industries. In the hands of Bell and Godsell, who in their separate careers shone more for smaller private jobs than large corporate endeavours (although Bell had a few industrial and corporate jobs before Feltex),[39] the design commission of Felt and Textiles created the conditions for a unique architectural experiment at the forefront of innovation in commercial building design.

By integrating Australian manufacturing products with imported materials and technologies, and by channelling sensitivity for detailing within a plain modular envelope of white glass and black mosaics, Guilford Bell and David Godsell crafted a building type that had never been used before in the city. The very same seed that they had planted in East Melbourne through bold design innovation was, as a paradox, also the beginning of the process of creative destruction that will annihilate what they had designed. The glass box of Feltex House was the embryo of a building type that would evolve to drive, and represent physically, the same dynamics of urban transformation that would eventually condemn it to a fleeting presence in the history of the city.

Endnotes

1 David Saunders, "Office Blocks in Melbourne," *Architecture in Australia* 48, no. 2 (June 1959): 90–93.

2 "Office Building Melbourne," *Architecture and Arts*, no. 68 (June 1959): 42–43; "Glass Walls on Four Sides," *Architecture Today* 1, no. 11 (September 1959): 18–23; *Cross Section*, no. 83 (1 September 1959).

3 "Glass Walls on Four Sides," *Architecture Today*, 18.

4 Ibid.

5 Public Record Office Victoria (PROV), VPRS 8945/P2, unit 228, City of Melbourne, Development Approvals Committee, application no. DP/0329, 10 September 1986.

6 N.T. McLenna, s.v. "Van de Velde, Henri (1878–1947)," *Australian Dictionary of Biography* 16, (Melbourne University Press, 2002).

7 J.B Were and Sons, *Felt and Textiles of Australia: Brief History and Description of Activities*, (Melbourne, 1950), p. 3. The core business of Felt and Textiles was wool processing, spinning and weaving, and the production of felt products. The company built its success with the soft floor covering trademarked 'Feltex', a product for which the entire enterprise was often identified. Felt and Textiles, however, manufactured a variety of other felt, wool and textile products, including clothing, shoes and slippers, domestic upholstery and fabrics, and body furnishings for the automotive industry. In 1938, the company began manufacturing carpets at Tottenham, on the western outskirts of Melbourne, with the establishment of British Australian Carpet Manufacturing (BACM). By the end of the 1950s, Felt and Textiles could promote itself as 'Australia's largest domestic user of wool'. In the same decade, the line of its products diversified, including plastics for interior furnishing like 'Daynide' plastic upholstery, 'Daytrim' skirtings, 'Daylon' films and 'Storeen' printed fabrics.

8 J.B. Were and Sons, 5–7.

9 In the 1950s and early 1960s, several businesses considered the fringes of the Hoddle Grid more suitable than the inner city for locating their headquarters, mainly to avoid traffic congestion. Esso and BP, for example, built headquarters in Southbank and St Kilda Road, respectively.

10 Public Record Office Victoria, VPRS 11200, City of Melbourne, Building Application Files 1916-1959, Building Application no. 31992 [hereafter PROV BA 31992]; Site Plan, 11 February 1958; Certificates of Title, vol. 3962, fol. 376 (January 25, 1957), vol 646, fol. 18[?] (January 25, 1957), vol. 8162, fol. 370 (October 22, 1957).

11 RMIT Design Archives, 0004.2015.0016, David Godsell Collection.

12 PROV BA 31992, Office of Guilford Bell, building application drawings.

13 PROV BA 31992, Internal Paper no. 3, 6 February 1958 and no. 6. 3 March 1958.

14 PROV BA 31992, City of Melbourne Laboratory Concrete Test no. 1119, May 9, 1958.

15 PROV BA 31992, City of Melbourne Laboratory Concrete Test no. 1197, October 23, 1958.

16 PROV BA 31992, Internal Paper no. 18, July 9, 1959.

17 PROV BA 31992, Office of Guilford Bell, building application drawings. David Godsell, Drawing no. 1, Plan of Ground Floor and Site, July 17, 1957.

18 Miles Lewis, "Insulation & Roofing Felts," in *Australian Building*, 10.7, https://www.mileslewis.net/australian-building/pdf/10-climatic-design/10.07-insulation.pdf.

19 John Lack, s.v. "Storey, Sir John Stanley (1896-1955)," *Australian Dictionary of Biography* 16, (Melbourne: 2002). After the war, Overseas Corporation, with its subsidiary OCAL, transferred aluminium know-how and technologies from aeronautics to building construction, becoming the leading manufacturer of aluminium framing systems, and supplying stick curtain walls for the most prominent Australian modern buildings of the 1950s.

20 For an overview of Melbourne's office buildings contemporary to Feltex House, see David Saunders, *Architecture in Australia*, 92-95. For a more comprehensive treatment of post-WWII curtain walls in Melbourne, see Marika Neustupny, *Curtain Call: Melbourne's Mid-Century Curtain Walls* (Melbourne: RMIT Publishing Press, 2006).

21 PROV BA 31992, Office of Guilford Bell, building application drawings. David Godsell, Drawing no. 13, Details of Curtain Wall, November 7, 1957.

22 Although no evidence of building failures related to Feltex House was found by the author, the early curtain walls built in the period were notoriously 'leaky', as noted by John Maxwell Freeland, John M. Freeland, *Architecture in Australia: a History* (Melbourne: Cheshire, 1974), 298.

23 The toughened glass supplied by Sobelever was the same that ICI House failed to stop problems of spontaneous breakage. Giorgio Marfella "From Heat Absorption to Speculation: The Troubled Evolution of International All-Glass Architecture in Melbourne (1955-1985)." In *Proceedings of the Society of Architectural Historians, Australia and New Zealand: 33, Gold*, edited by AnnMarie Brennan and Philip Goad, 404–417. Melbourne: SAHANZ, 2016.

24 "Glass Walls on Four Sides," *Architecture Today*, p. 18.

25 Uniform Building Regulations (UBR), Victoria, Victorian Government Gazette 87, June 28, 1945, clause 901, "Maximum Building Height."

26 Anne Imrie, *1952-1980 Architecture of Guilford Bell* (South Melbourne: Proteus, 1982), 27.

27 PROV VPRS 8945, volume 203, Building and Town Planning Committee, September 1973–74, Application no. MELB 1705, April 24, 1974.

28 PROV VPRS 8945, volume 216, Building and Land Use Committee, 1980-81, Application no. CM 1152, 28 January 1981.

29 PROV VPRS 8945, volume 228, Development Approvals Committee, September – November 1986, Application no. DP86/0329.

30 Core Logic, East Melbourne Cityscope, map 1, property 1.

31 "Wright's Core-Supported Towe Unveiled in Photographs," *Architectural Record* 110 no. 6 (December 1951).

32 "The Impact of Mechanical Equipment on Design," *Architectural Record* 115, no. 4 (April 1954): 204–205.

33 "Unique Double Skin, Functions Well – Looks Good," *Architectural Record* 124, no. 3 (August 1958): 152–158.

34 'Executive Office Building Libbey-Owens-Ford Glass Co.', *Architectural Record*, vol. 128, no. 4, October, 1960, 187–196.

35 "Four Office Buildings, Four Different Schemes," *Architectural Record* 125, no. 4 (April 1959): 163–174.

36 Richard Foster, personal communication with the author, December 11, 2013.

37 Australian Building Industry Productivity Team. *Australian Building Industry Productivity Report 1954*, (Melbourne: Building Industry Congress of Victoria, 1954).

38 Harry Wexler, "The Economics of Construction Cost of High-Rise Buildings in Australia," *Building Economist* 10, no. 1 (June 1971): 2–5.

39 For the work of Bell and David Godsell see: Leon van Schaik (ed.) *The Life and Work of Guilford Bell*, edited by (Melbourne: Bookman, 1999); Rose Onans, "The Godsell House: The Mid-Century Modern Masterpiece Inspired by Frank Lloyd Wright," *The Local Project*, available at https://thelocalproject.com.au/articles/godsell-house-by-david-godsell-project-feature-mid-century-modern-architecture-beaumaris-vic-australia; "491 Balcombe Road," in Fiona Austin, *Beaumaris Modern*, (Melbourne: Melbourne Books, 2018).

Bruce Slorach and Sara Thorn collection: a window onto fashion production and supply in Melbourne 1983–1994

Laura Jocic

PEER REVIEWED ESSAY

In 2010 the RMIT Design Archives received an extensive collection that documents Bruce Slorach and Sara Thorn's dynamic fashion and textile design partnership from 1983 to 1994. Based in Melbourne, the pair variously worked under the labels Sara Thorn, Abyss, Funkessentials and Konka, while also running their retail outlet, Galaxy Emporium, on Chapel Street, South Yarra, from 1986 to 1992. In the 1980s Slorach and Thorn were amongst a new wave of independent Australian designers who challenged mainstream fashion with their experimental, multidisciplinary design practices.

While documenting Slorach and Thorn's creative processes and output, their archive also provides a window onto a network of fashion production and supply in Melbourne in the 1980s and early-1990s. Slorach and Thorn produced all their garments locally and drew on the expertise and specialised production processes of local manufacturers and fabricators to create their own highly individual designs. A distinctive aspect of their collections was the design and creation of screenprinted, woven and knitted fabrics and custom-made details, such as buttons, buckles and woven badges.

Throughout the twentieth century, the inner city and surrounding suburbs of Melbourne had been home to a vibrant textile and clothing design and manufacturing industry. This included a network of buyers, wholesalers, retailers, importers and related industries, such as pleaters, pressers, milliners, embroiderers and shoe and boot makers. Many were located in Flinders Lane and the surrounding suburbs of Fitzroy, Collingwood, Abbotsford and Richmond, which had supported a hub of interrelated clothing and textile industries since the nineteenth century. Lesley Sharon Rosenthal's research into the histories of the Flinders Lane fashion businesses, that formed the backbone of Australian fashion production throughout most of the twentieth century, gives an insight into the workings of a long-established industry which was on the verge of major change when the new wave of young designers in early-1980s Melbourne began to make their mark.[1]

Like many of their contemporaries, Slorach and Thorn worked from the upper floor of an old inner city building in the heart of Melbourne, close to many of their manufacturers and suppliers. Working from a studio on the 5th floor of Commerce House, 328 Flinders Street, Slorach and Thorn produced everything they could in-house, including one and two-colour printed textiles, while outsourcing specialist production to manufacturers. They also worked in conjunction with niche artisans, such as the sculptor and medal maker George Friml, to produce custom-made accessories, in this case the metal Abyss buckles, which were made up by the belt manufacturer Le Sac de Mode, who later made their US-style military webbing belts for Funkessentials in the early-1990s.[2]

Working at the nexus of fashion and art, the experimental nature of much of their output meant that Slorach and Thorn were continually pushing the boundaries in design and production. This was the case when they developed their groundbreaking jacquard knits for the Winter 1986 Abyss collection titled 'Deep Sea Galaxy'. Beginning in 1983 with original screenprinted designs on woven textile lengths, Slorach and Thorn extended their canvas to create their first knits, 'Bomb' and 'Deep Sea Galaxy'. As with their printed designs, the jacquard knits incorporated complex imagery that had to be translated to the knitted medium. Eighteenth century bewigged heads and African profiles are intertwined with bombs that signify the weapons of colonial domination, while marine animals swim in a galactic sea of planets. Slorach and Thorn worked closely with Melbourne Textile Knitting (MTK) to produce their first collection of knits, which were made in a number of colourways. Thorn recalled how the owner, Mr Joseph, engaged with the creative process and the challenges involved in realising their designs.[3]

These types of creative and technical-based interactions between designer and manufacturer forged an environment where creativity and problem-solving worked hand-in-hand to flesh out and realise conceptual ideas. Not all the businesses and fabricators that Slorach and Thorn worked with are recorded in their archive but many of those

Preceding Pages
Bruce Slorach and Sara Thorn for Funkessentials, Catalogue, Second Summer, 1993
RMIT Design Archives (detail)

Above
Bruce Slorach and Sara Thorn for Abyss, Buckles, c. 1989 ,
RMIT Design Archives.

Opposite
Bruce Slorach and Sara Thorn for Shrubbery, Jacket in 'Tropical Russian' print, 'Moderno Tourist' collection, Summer 1985, RMIT Design Archives.

Left
Bruce Slorach, and Sara Thorn for Abyss "Deep Sea Galaxy' jacquard knit textile attached to card, Winter 1986, RMIT Design Archives

Centre
Bruce Slorach and Sara Thorn for Abyss, Bomber jacket from the 'Deep Sea Galaxy' collection, Winter 1986, RMIT Design Archives

that are, were well-established, intergenerational family businesses, some of which continue to this day. Founded in 1929, MTK remained in the Joseph family for three generations and today it is owned by Stephen Morris-Moody, who had worked alongside the family for twenty years.[4] As with many of the long-running manufacturers, MTK positioned the business in the 1990s and 2000s to meet the challenges of working in a restricted and competitive market. They produce specialist knits for Australian and international designers on machines (some of them as old as the business) to make fabrics that cannot be created with high-volume technology.[5] Slorach described being inspired to create designs that responded to the capabilities of the old machinery owned by a number of their manufacturers, some of which had not been operated for years.[6] At the same time, Slorach and Thorn were rummaging through old stock and buying dead or damaged yardage from many of the suppliers around town. Places like Job Warehouse in Bourke Street were a treasure-trove of interesting and otherwise unobtainable lengths of old fabric.

Knits of various types continued to feature in Slorach and Thorn's collections for Abyss, Funkessentials and Konka. One of their most successful designs was the reverberated stripe that they created for their Funkessentials label in 1992. It was a yarn-dyed stripe based on Navajo Indian and Mexican blankets, and having never seen the concept before, many of the knitting companies they approached were unwilling to take the order. Eventually Slorach and Thorn found Supreme Knitting Mills. The stripes were knitted in numerous colourways and were immensely popular when made up into men's and women's cotton-blend T-shirts and tops.

While Supreme Knitting Mills folded in 2005, A&B Knitwear, who Slorach and Thorn also used in the early-1990s, survived the contraction of local manufacturing in the textile and clothing industry by specialising in high-end products using ultrafine wool and expanding their production from cardigans and jumpers to include beanies, socks, throws and scarves.[7] In 2014, Adrian Bressan, who founded the company in 1988, stated that, of the hundreds of Australian knitting companies that once existed, there are now only a few who have survived the influx of cheap imported goods.[8]

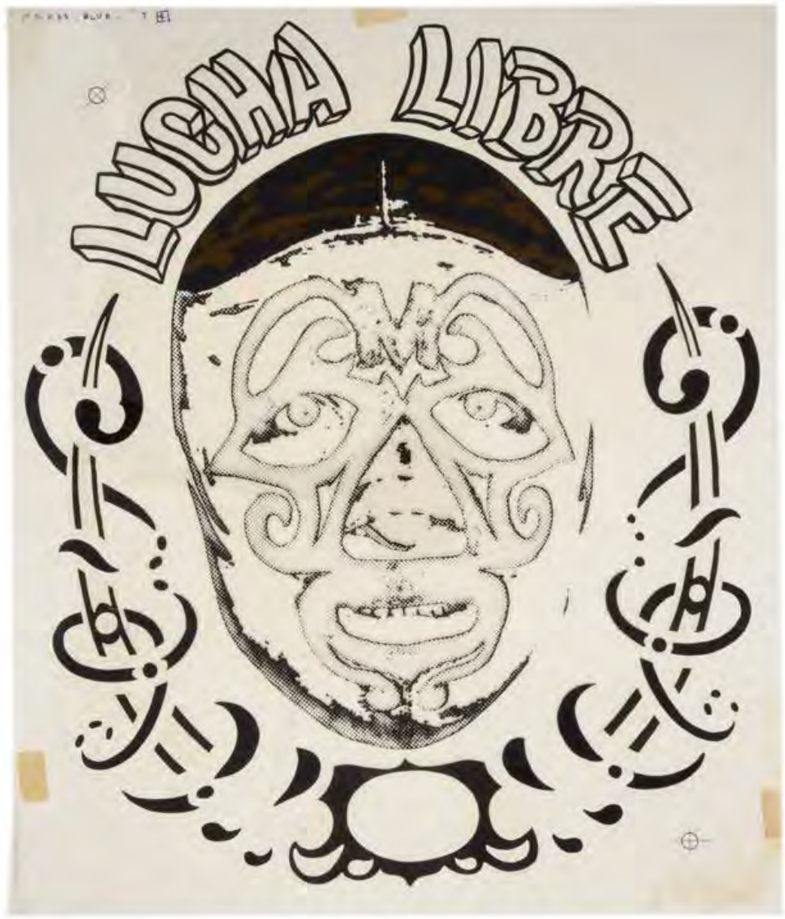
During the 1980s and 1990s the Australian government dismantled protectionist import quotas on footwear and clothing and liberalised import tariffs, resulting in manufacturing moving to Asia where production was cheaper.[9] Shifts in government policies began at the time Slorach and Thorn were starting out in 1983, and as the 1980s progressed, Slorach noted that many of the manufacturing options had begun to constrict, which had an impact on their production.[10] While on-shore textile manufacturing and garment production were being threatened, the renewed interest in placement prints (a single, featured image) created a boom for screenprinters and woven label manufacturers in the early-1990s.[11] In the late-1980s Slorach and Thorn were designing distinctive graphics that appeared as placement prints on their Abyss clothing. These became a feature of their street-oriented Funkessentials and Konka labels in the early-1990s.

Working in a pre-digital era, Slorach and Thorn's archive includes numerous examples of transparencies, specifications and samples that trace the process from original artwork to screenprinted garment or accessory. Many of these relate to placement prints dating from 1991 to 1993 that were printed by Screenprint Concepts, a specialist garment printing company established in Melbourne in 1987 and which continues to operate in the suburb of Alphington.[12] For their Transeasonal Summer 1991 Abyss collection, Slorach and Thorn created the 'Cyber-Funk', 'Luche Libre Mexican Mask', 'Galaxy Reservation-Totem Stripe' and 'Techno-Op' print collections. Design sheets in the archives show how the prints were placed on each garment, from shorts and T-shirts, to bomber jackets and mini dresses.

A 1993 sampling order to Screenprint Concepts for the prints 'Konka Nouveau', 'Subway Train' and 'Wrestling Juggler' includes six-colour designs in discharge printing – a type of printing process that is used to print white or coloured designs on a dark-coloured ground by applying a discharging agent which removes the ground colour.[13] Other popular designs produced for Funkessentials that are well-documented in the collection are 'Lucky Low Rider' and 'Teen Angels'. Slorach and Thorn used a range of printers with different capabilities and technologies to produce various effects. The Konka '70s Swirl', based on automotive art for cars and vans, was a water-based print executed by Smooth As Silk.[14] Slorach and Thorn also used Flockmaster for novelty printed finishes.[15] Still in business, Flockmaster's website announces that it is "The heat transfer expert", and attributes its more than thirty years of success, to innovation and keeping abreast of changing technologies and trends globally.[16]

Another type of featured graphic which Slorach and Thorn used to great effect was custom-made woven badges which they stitched onto garments and accessories. Their designs, which included pirates, mermaids, cartoon characters, anatomical hearts and fried eggs, were woven locally. One of the manufacturers was TMG Woven Labels. In 1993 TMG acknowledged that the new technologies they had invested in enabled the company to respond to increased demand, stating, "Five years ago we only had the capacity to produce about 300 different designs per year. Now with new technology, brought about by the increased demand,

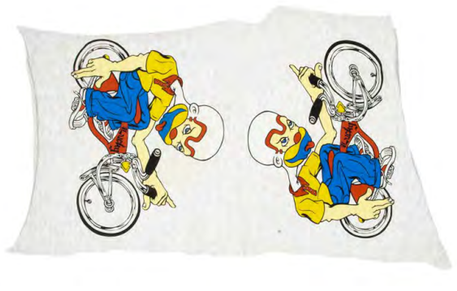
Above
Bruce Slorach and Sara Thorn for Funkessentials, Catalogue, Second Summer, 1993, RMIT Design Archives



Top
Bruce Slorach and Sara Thorn for Abyss, Transparency for t-shirt screen print 'Lucha Libre' design, 1991, RMIT Design Archives

Left
Bruce Slorach for Funkessentials, Drawing for 'Teen Angels', 1993, RMIT Design Archives

Right
Bruce Slorach and Sara Thorn for Abyss, Retail display of sew on patches captioned 'Badge it!?', 1986, RMIT Design Archives



Left
Bruce Slorach and Sara Thorn for Abyss, Printing sample with 'Galaxy Reservation' print, c. 1991
RMIT Design Archives

Middle
Bruce Slorach and Sara Thorn for Funkessentials, Textile samples for 'Lucky Low Rider', c. 1993
RMIT Design Archives

Opposite
Bruce Slorach for Funkessentials, artwork for 'Lucky Low Rider', c. 1993
RMIT Design Archives

we have the design capabilities of producing around 5000 different designs per year."[17] This meant that they could not only produce larger quantities, but also execute smaller orders (sometimes of only fifty badges) for niche markets with a quick turnaround.

Producing only limited numbers of each garment design, Slorach and Thorn had to be both creative and practical when it came to production. They cut and bundled their designs in their workroom and formed relationships with local manufacturers who were prepared to make up their small runs by fitting them in around high-volume, commercial orders for chain stores.[18] For many years Slorach and Thorn also sent out garments to a skilled seamstress who worked from her home in an outer suburb of Melbourne.[19]

Slorach and Thorn's use of local manufacturers to produce their niche collections meant that they were able to address design development and production on the spot and in a timely manner. Visits to factories, where they could see the capabilities of the machinery and draw on the expertise of specialised manufacturers, stimulated Slorach and Thorn's creative thinking and engendered a symbiotic relationship between designer and manufacturer. In documenting manufacturing details, the Slorach-Thorn archive illuminates the to-and-fro nature of checking and tweaking pre-production samples and design specifications.

Such is the constant work and attention to detail that is involved in bringing creative ideas to fruition. As Slorach observed, in this pre-internet world, energy was centred in the community.[20] In 1980s Melbourne this energy was very much alive in the fashion and design world of studio-based practices and the manufacturing businesses with which they interacted.

Acknowledgements
Much of the primary material in this article is based on interviews and correspondence with Sara Thorn, Bruce Slorach and Alasdair MacKinnon, who worked in the business in its later years. The author wishes to thank them for their generous input.

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Endnotes

1 Lesley Sharon Rosenthal, *Schmattes: Stories of Fabulous Frocks, Funky Fashion and Flinders Lane*, (South Yarra: Lesley Sharon Rosenthal, 2005).

2 Sara Thorn, personal communication, September 28, 2020 and Alasdair MacKinnon, personal communication, October 8, 2020.

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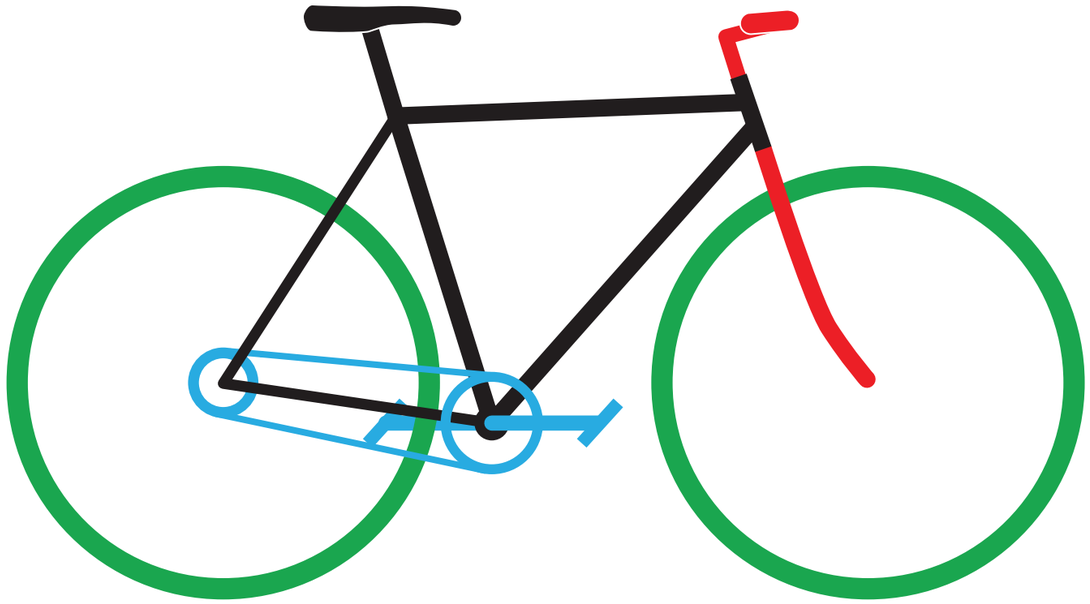


PEER REVIEWED ESSAY

Manufacturing, mass-customisation and reinvention: The curious case of bicycle design.

Robbie Napper

ABSTRACT

This research examines the practice of mass customisation in bicycle design and manufacturing. The dynamics of manufacturing and design in the bicycle market are illustrated in theory and validated in the field, with implications for theory and practice of design and mobility. The research determines that while the principles of mass customisation create ideal conditions for both manufacturer and consumer with regard to the end product, they also set up conditions for reinvention.

Reinvention occurs when consumers conceive of and develop novel product variants, and the bicycle provides an instructive example of design and manufacturing-assembly processes being available at a local level. This more convivial design and manufacturing has implications for how we conceive design, as well as for the effectiveness of the bicycle to provide mobility. The research notes that the design and manufacturing processes extend in time and place beyond the drawing board and the front end of design, into the product's complete life cycle.

Over 200 years of its history, the bicycle has become a ubiquitous vehicle. The successive rises and falls in various cultures of this vehicle overlap with other transport modes such as the horse, railways, and automotive. Technological and social developments continue to shape the bicycle and our views of it.[1] As a manufactured article, the bicycle is subject to a variety of endeavours in design in order to maximise the performance of the manufacturing company; these may be but are not limited to the related metrics of profit and quality; with profit being driven by sales on the demand side, as well as streamlined manufacturing on the supply side.

1. Introduction

This research is concerned with two of the avenues used to improve bicycles; on the supply side, mass customisation and on the demand side, reinvention. In this research I aim to determine whether the manufacturing advantages bestowed by mass customisation to both manufacturer and consumer can also have implications on how the bicycle can be used for utility purposes. Knowing this could assist in a transition to designing bicycles better suited to commonplace, utility or "quotidian" cycling.

Despite, or perhaps because of its ubiquity, the bicycle tends to evade detailed attention. Much research in the field of active transport relates to cycling – the action, rather than the bicycle – a vehicle. That the cycling research deals with the habits, motivations, safety etc. of this action is no bad thing, save for the observation from an industrial design perspective that the design of the object can and does have profound consequences upon the manner in which the object is used. To take but one example, the geometry of the handlebars relates strongly to the affordances of steering the vehicle, comfort of the rider, and entanglement in parking. [2, 3]

History shows that cycles (an inclusive term capturing two and three wheeled vehicles) underwent profound changes in design and manufacture in the first 100 years of their development. Successive redesigns refined concepts, brought new innovations to bear, and exploited the emergence of new technologies to arrive at the rear wheel drive safety cycle of 1890.[4] This vehicle, with wire-spoked wheels, was then enhanced with the introduction of the pneumatic tyre and by the late 1890s was a more or less obdurate form; what you and I know as a bike. The essential characteristics of this single-track two wheeled vehicle are shown in schematic form, synthesised from Wilson.[5]

The design and manufacturing of the bicycle are an important a part of this vehicle's history. Pre-1890 cycles were made in smaller quantities by local workshops. Along with the emergence of a dominant vehicle typology was a more serialised manufacturing approach. The safety cycle was manufactured in great quantities in Coventry, UK, as a development of that city's existing manufacturing expertise and capability in sewing machines.[4, 6] As the popularity of the bicycle spread, so did the manufacturing. Colonel Pope's facility in Massachusetts, USA developed into the first example of production line manufacture which was to

Preceding Pages
Detail of bicycle spokes. Stock photo.

Opposite
Schematic of rear wheel drive safety bicycle. Black main assembly, red front assembly, green wheels, and blue transmission.

inspire the adoption of this process by cycling enthusiast and industrialist, Henry Ford.[7] Manufacturing at scale requires repeatability and quality control on the factory floor, and this was achieved through design. On the demand side, it was also necessary to accommodate the needs of the consumer – lest they purchase their bicycle from another manufacturer – and hence some necessary variations are introduced into the manufacturing process.[8] Processes which we would later come to call mass customisation. Industrialised manufacture led to the emergence of some dominant technologies, such as the bicycle chain, which over time has settled on stable dimensions. Such sizes of bicycle components have come to be regarded as "standards". It would be more accurate to describe them as obdurate since no higher authority exists to actively standardise these parts, but the observation remains that a lot of bicycle parts became, and still are, interoperable at the factory level. The interoperability is an enabler of reinvention, something that bicycle users have been exhibited to undertake for as long as the vehicle has existed.

Changing focus to the present day, one more introductory point should be made. In response to the profound challenges of anthropogenic climate change [9] and liveable cities in the context of an urbanising global population [10] there is a global push to replace motorised vehicle trips with active and micromobility such as those offered by the bicycle as documented by lobby groups.[11] Examples of this tend to be enacted in local government policy. [12,13] While this challenge is one of the complete transport system, the vehicle is a necessary part of the picture and so this research also aims to determine if there are any favourable implications of the design and manufacturing of bicycles which may be brought to bear on this problem.

2. Literature review

This review will provide a basis from which to analyse bicycle design and manufacture. At first setting out some considerations of the bicycle from basic principles, then design and manufacture. Then a basis is provided in mass customisation and reinvention as a basis for sections 3 and 4.

The Bicycle

As consumer products, bicycles attract media attention as objects of technology, sports, and to a lesser but still important extent, popular culture. There is an abundance of periodicals dealing with bicycles and cycling, which tend to provide guidance and opinion to the bicycle user and consumer. Such periodicals can be general and broad ranging with regard to subject matter and geography, and others can be specialist in both types of cycling, and the readership they target, for example written in a particular language. Most developed countries have their own periodicals catering to the various branches of cycling as a sport. Some of these deal peripherally with utility cycling, a task that is taken up more willingly by support and advocacy organisations such as Australia's Bicycle Network, and the Netherlands *Fietsersbond*. Scholarly literature is far less abundant, and has tended to triangulate on several key works which will be the focus of this literature review.

As introduced above the obdurate form of the bicycle is as the single track, two wheeled rear wheel drive safety cycle. This basic form has been manipulated over the last 100 or so years to produce a variety of derivative designs for different purposes. The terms bike and bicycle will be used in this paper to describe this family of vehicles. I aim to include the range of "cycles" in these terms as well such as trikes, recumbents and velomobiles which are a smaller part of the bicycle market. Bicycle design is strongly related to purpose, and although any bicycle can successfully carry a rider, the manner in which this is done varies accordingly. A key differentiation is made between the purposes of sports and utility. [14] Sports bicycles tend to optimise speed as a design consideration, and as such compromise cost, comfort and durability. They are also designed within the scope of rules for the sport, rules which are determined to prevent unfair advantage in competition. A purpose built utility bicycle will tend to offer a range of practical affordances such as luggage capacity, lights, kickstand, fenders and sometimes electric assist, all of which are in line with the idea that the bicycle is used for non-deferrable trips regardless of weather or time of day. Utility bicycles are mostly based on the double-diamond frame design. At the extreme end of utility bicycles are cargo-bikes, those in which the frame has been manipulated to increase the ability to carry goods or passengers. At their most extreme this can include four or more wheels.

The science of the bicycle relates to all types – that the vehicle is human powered is presented as the main consideration of bicycle science[5], design and engineering.[6,15] Thus even a utility bicycle will be designed to be as easy to propel as possible and thus is likely to carry over some characteristics from sports bikes. Burrows[15] demonstrates that some characteristics such as aerodynamics, can be directly transferred from the velodrome to the town bike with little harm, but some implications on cost. From a manufacturing perspective this is significant, since any carry-over parts from one type of bicycle to another will produce more end-product permutations than there are components.

While considerable variation exists in bicycle design, there exist dominant forms in each family of functional parts[6]. Taking wheels as an example, while developments in technology continue, much of the work centres around the established wire-spoke wheel. At their outer edge, wheels exhibit a family of sizes in alignment with tyres; and at the middle, hub sizes are found in a small family of variations around which frames can be designed to hold them. This is a matter of convenience for manufacturing and maintenance and so is useful for both supply and demand sides of bicycle manufacturing.

Much mobility research tries to approach the activity of "cycling" by subdivision. This is useful as it can provide an understanding of different individual behaviours as well as cultures. However since bicycles and cycling mean different things to different people and even different things to the same people, these categories can be misleading. The categorisation can also lead to market segmentation which plays out favourably for sales figures in sports and leisure markets but does not seem to provide the specific segmentation in more quotidian uses of the bicycle. Just as we see automotive vehicles applied to a variety of non-specific uses such as the off-roader in the supermarket car park, bicycles too can easily cross boundaries of supposed applications. Forester[16] for example identifies that a bicycle marketed as a touring machine will be quite well suited to middle and long distance commuting, while Burrows[15] notes the benefits of rugged off road bicycle wheels are quite well suited to the structural stresses of utility cycling. Much of the innovation developed on the race track can and does have some impact on utility cycling, so long as the necessities of transport are also accounted for. [17,18]

Cycling: bicycle use and culture

The manner in which bicycles are used varies. At an individual level a user may employ one bicycle for different tasks, or use several bicycles for several tasks; whereas at a cultural level we can see some generalisable uses for the bicycle such as the Dutch and Danish utility culture and the Southern European sporting culture.[19] Generalisations are useful, for example when studying cultural propensities to cycle we can see that the Dutch and Danish have high mode share whereas the Australians and Americans low. Within these broader cultures though there are pockets of individualism, so it is still easy enough to find a *Nederlander* who does not and will not cycle or an *Aussie* who uses little else apart from the bike for mobility. Sticking with the focus on bicycles rather than cycling, what we can see from the various cultures is that they employ different bicycles. There is a correlation between the high rates of bicycle use in the Netherlands and Denmark and their ownership of utility bicycles. Causality is less certain, and Bijker[1] provides the view that taken as a sociotechnical system, the intrinsic properties of something like a bicycle matter less than the socially constructed assessment of them. A utility bicycle is more likely to be socially constructed as a useful transport vehicle than a highly strung, delicate racing bike. From a culture and history perspective, Oosterhuis[19] provides the balanced view that the technological and cultural aspects of bicycle transport interact to form a self-supporting system in which it is both culturally and technologically easy – or difficult – to ride a bicycle.

The transport system requires an interaction of vehicles, ports and ways.[20] The literature on bicycle use for transport, generally called utility cycling, tends to be dominated by discussions of the ways; that is, the infrastructure. While "port" facilities seem to rate a mention in the form of bicycle parking, the vehicle can evade critical attention. One often cited review of the determinants of commuting by bicycle returned no search results about bicycles, and hence provided no analysis of how the bicycle vehicle may be part of this mode of transport.[21]

Manufacturing and design

Full accounts of how design and manufacturing interact are provided in the literature as a means to instruct and improve processes.[22] In a simplistic description, design interacts with the manufacturing process in a two-way negotiation. First, manufacturers aim to sell what they can make. Efforts in sales and marketing will provide some assistance to this process, but the goods on offer must fundamentally appeal to the market. Thus, second, manufacturers make what they can sell; and what they make is determined to some extent by design.

When we consider bicycle manufacturing, two distinct parts deserve our attention. Firstly, the manufacture of bicycle components from basic materials requires the manufacturing capabilities such as forging, moulding and extruding to make tubes for frames, and other operable components such as wheel rims and pedals. Various original equipment manufacturers (OEMs) produce parts in this fashion and make them available to the consumer market as well as to the bicycle OEMs. The bicycle OEMs, in their turn, take tubing materials and manufacture these into bicycle frames. Again these can be sold on to the consumer market but are much more commonly combined with components and assembled into complete bicycles. This second manufacturing activity – assembly – can exploit a wide range of interoperable components to produce a large array of end products. The designer plays a role in all of the above, but increasingly it is the role of a "product manager"[22] to align the assembly of particular bicycles to market demand. Thus the designer's frame may be combined with different components to satisfy different markets.

Product managers and designers mediate between the capabilities of the manufacturing process and the demands of the customer base. Industrial scale, serial production of the same widget will afford a manufacturer economies of scale, however this economy is false if it does not align to market demand. On the other end of the spectrum, bespoke production of unique articles can provide very close alignment to individual consumer or user needs, but with no economy of scale are not viable as the extreme production costs must be passed on to the consumer and are usually more than the market will bear. Exceptions to this include small volume high end products which are niches in their relative end user sectors, for example tailor made suits. Design of components, and the select assembly of these components into bicycles give us the results that we see on the market.

Mass customisation

To balance the seemingly irreconcilable approaches of production scale versus consumer taste, the principle of mass customisation (MC) emerged in the 1980s as a management paradigm dismissing this difference as a false dichotomy.[8] Previous decades of mass production had developed new approaches to the "sell what you can make" and "make what you can sell" frames of mind by developing and exploiting approaches in the industrial production complex which offered the scale and repeatability required by manufacturing, as well as the granular appeal of product characteristics to appeal to a wider range of user preferences. An early and clear example of this are the "platform strategies" used by auto manufacturers to produce four or more model variants of cars using one fundamental chassis; a measure which has as much to do with technology as it does marketing.[23] MC is a family of approaches, all of which provide practical ways to navigate consumer and manufacturer needs, the core principle of

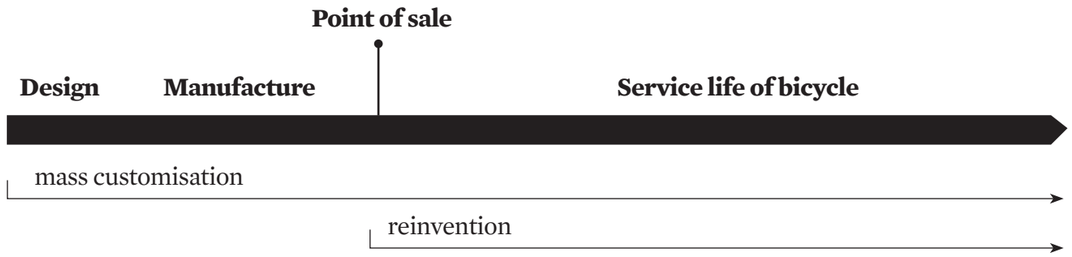
which is to offer economies of scale in production, and economies of scope in the marketplace. One of the key approaches to this is product modularity, whereby a product can be changed through the modification or replacement of one of its parts. This process is very closely suited to the bicycle manufacturing approach outlined above, whereby the specification of OEM components into a bicycle assembly can create variants to suit consumer demand.

Of particular interest to this research are the MC processes carried out at the point of delivery. Although a customer can expect to find an array of bicycles in the market, there is an opportunity to fine-tune the specification of the bicycle at the point of sale, or even after sale during the bicycle's service life. The modularity of the bicycle which has served the manufacturer well, also serves the consumer at point of sale by affording changes in the bicycle. Bicycles are relatively simple machines and thus it is possible for a bicycle shop's mechanic to undertake all the bicycle assembly tasks which originally occur in the factory. Indeed, completely bespoke assembly of bicycles is a possible – albeit high labour cost – option in the marketplace. A modular system provides the underlying interoperability of components, and the overlap in tools and skills between bicycle repair and bicycle assembly mean that point of delivery customisation provides consumers with the ability to "design" their bicycle to some extent. An important note in this process is that the ability to change a bicycle is not limited to original purchase, but extends throughout the bicycle's life, including renewal and reinvention.

Reinvention

Following on from the design-for-mass customisation ideas above, the resulting modular product is also ripe for reinvention. The term reinvention is used from the diffusion studies tradition and includes notions of do-it-yourself and bricolage.[24] Here, in the context of the bicycle, I frame reinvention as a design and manufacturing phenomenon that is undertaken by the end user. Reinvention of a product occurs for a variety of reasons, both on the supply and demand sides.[25] On the supply, or design, side a product is more apt for reinvention when comprised of a *loosely bundled* set of parts – such as the bicycle, which despite their interdependence, owing to interoperability they can be changed to enhance functionality while still fundamentally working. On the market, or user side, reinvention of a bicycle is quite likely because bicycles can be interpreted in many ways, for example for sport and for transport. General tools with many possible uses tend to be reinvented.[25]

The act of reinvention provides an insight into the socially constructed, and inherent characteristics of product[1]. In the manufacturing process and at the designer's drawing board, a product can be reinvented through reconfiguring in an MC process. Thus it becomes a new product. If this product does not fit a user's socially constructed view of what it should be, then this end user can engage in point-of-delivery customisation and reinvention to make it more suited to purpose. The result is that the typical boundaries between manufacturing, design, and service life are significantly diminished in the case of the bicycle.



Opposite
Design and manufacturing dynamics using bicycle lifespan as baseline.

MC Strategy	MC Method	Observed example
Product Modularity	Component swapping	OEM drivetrain components vary to create different price point bicycles on the same frame.
	Component sharing	Identical bearing assemblies used across variants
	Cut to fit	Length of cable assemblies suit frame sizes
	Mix	Paint colours
	Bus	Components added to handlebars e.g. bell and reflector.
Point of delivery customisation	In store fitting	New bicycles are sold through a dealer network of approved retailers
Cosmetic customisation	Colour variants	Frame and component colours

Summary

Design and manufacturing of the bicycle is clearly a broader activity than the confined scope of this research. In the scope of this study, looking at design, manufacturing, mass customisation and reinvention, we see that an interrelated system is emerging that has implications for design, and the mobility culture of the bicycle. It is to these implications that this paper now turns, organised as follows. Section 3 takes a sample from the field to see whether signals of activity are present which represent mass customisation and reinvention and in doing so will determine how the above theories exist in the field. Section 4 brings together the continuum of design, manufacturing and application into a model to explicate the dynamics of this system. Section 5 examines the implications of the system for design and bicycle mobility.

3. Observational study

Mass Customisation in the field

Marketing materials are a direct interface between bicycle manufacturers/assemblers and the consumer. While there are other methods of purchasing a bicycle, for example private sales and custom builds, the sale of complete bicycles dominates the market. A scan of a major manufacturer's marketing materials,[26, 27] reveals several MC practices. Product modularity is the dominant method, with each manufacturer exhibiting several types detailed in table 1.

Summarising these sources and table 1 we can see that a manufacturer may have a small family of bicycles which serve a broad purpose, for example a "city" bike. In this category, the manufacturer then has two designs, each of which are available in three variants which carry a different balance of cost and quality. Each variant then has three or four frame sizes available, and perhaps two or more colours. Finally, at the point of sale minor adjustments are made to fit the bicycle to the rider and perhaps add or change some components, for example adjusting the saddle height and replacing tyres. This provides an example of how the design process, by applying MC, extends the manufacturing process through to the shop floor. At the same time, design extends too, transitioning from the top-down drawing board and strategy activity at the manufacturer to a design-to-fit customisation activity with the end user.

Note that there may be some MC practices which are invisible and not communicated to the consumer. For example a large scale manufacturer can manipulate the wall thickness of frame tubing to balance cost, strength, weight and ease of manufacturing[15] but because this manipulation occurs on the inside of the tube wall, it is not visible once the frame is welded together. In addition to MC offered by one manufacturer, it is also important to note that in this example the new bicycle market bears some of the scope of variation. Although at a high level, the bicycles available bear much similarity to one another, the manufacturers tend to follow a differentiation market strategy and thus offer bicycles which vary to their competitors in some way.

With some dozens of manufacturers offering products in this market the level of customisation – choice – afforded to a consumer is high.

Reinvention in the field

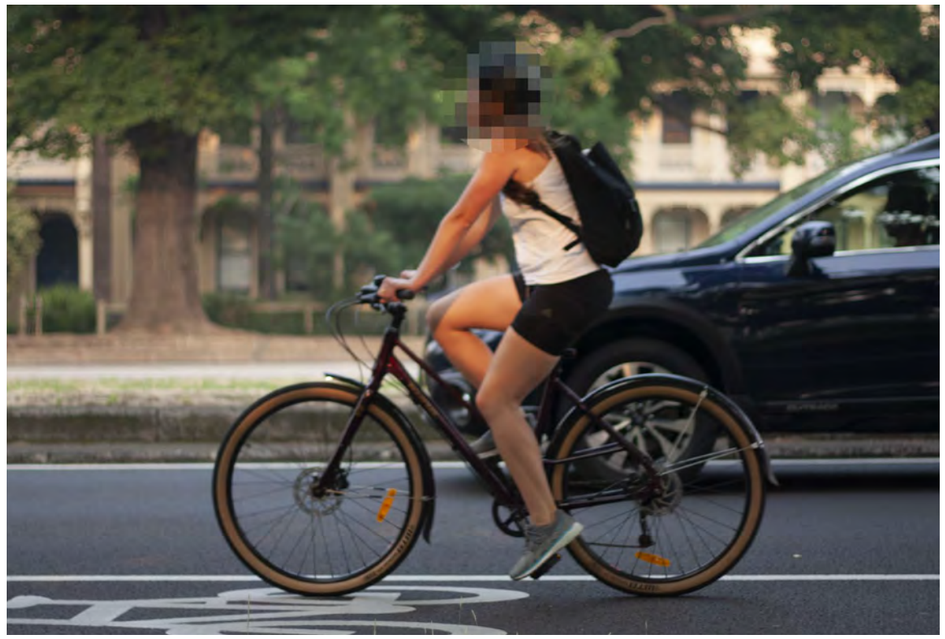
Does reinvention of the bicycle occur, and if so, what is the nature of this reinvention? To answer this question I used field observation to see if evidence was visible based on the bicycles people ride. A sample of bicycle and rider combinations was photographed in order to detect reinvention and understand the nature of this practice. A statistically representative sample was not attempted as this isn't the intent of the research. The observational study was carried out under an approved low-risk human research approval from the Monash University Human Research Ethics Committee, number 16987. The observational method was chosen in this instance to minimise inconvenience to users and to base the research on what people do, rather than what they say. Thus the acts of reinvention are noted as variants to bicycles and provide a simple, yet robust insight into the physical changes that are made to the vehicle forming an adequate, designer's view into the bicycle's inherent characteristics. An alternative approach would be to conduct interviews with bicycle owners to determine the *intent* of their reinventions and discover how they may conceptualise their bicycles. This would be an area for further research.

Field observation reveals varying levels of reinvention. The first shows a rider on board what appears to be a "stock" bicycle – ridden as if straight from the showroom. The following photograph shows quite the opposite, with the bicycle reinvented into a utility bike with carrying capacity through the addition of a jury-rigged milk crate. We can determine the change in function this reinvention brings by observing the inherent characteristics of the artefact, however it hints at a broader change in "meaning" of this bicycle which would require further research to understand. The field work revealed a variety of treatments representing reinvention of the bicycle, for example the addition of components such as luggage racks and pannier bags. Also noteworthy are the reinvention acts which remove parts from the bicycle, the extreme example of which turns an otherwise ordinary bicycle into a pared down *fixie*.

4. Mass customisation and reinvention in bicycle design and mobility

When we combine theories of design, manufacturing, mass customisation and reinvention in the context of the bicycle, we can gain an understanding of the dynamics of a larger process at play. This should be informative for our understanding of design, and also of bicycle based mobility – or lack thereof. The diagram on this page illustrates a possible combination of these theories.

Starting with a design process as we understand it, we can easily conceive that the bicycle is designed according to some process of research and development, with some concept of application in mind. The application of the bicycle on the drawing board may be specific, for example to win a particular genre of race, or it may be broad, as



Above
Stock bike.
Photography by author.

Opposite
Reinvented bike.
Photography by author.

a utility bicycle. We can expect that in a mature product category there is a strong baseline of knowledge, topped up with current market understanding based on research to inform some kind of prediction as to what will sell.[22] The design process is engaged with manufacturing, which given the mix of OEMs in the bicycle industry is likely to be outsourced at least to some extent – no manufacturer of bicycles makes everything in-house. Thus the designer and product manager engage in an act of mass customisation to create economies of scope and we see one bicycle frame "dressed" with different components to create bicycles which have different prices, and marketing approaches. The consumer is provided with an array of choices across many intersecting bands; price, function, size, colour to name a few. At one point in the bicycle's life it will be purchased new, and at this juncture there is a possible final step of mass customisation where the bicycle shop plays a role in changing or adding some of the components in accordance with the customer's requests. Here we can observe that the bicycle shop staff are at once designers and manufacturers, taking advantage of their position at the coal-face to closely align user needs with the bicycle's inherent characteristics.

At this handover stage there is something of MC and reinvention both at play. Since the bicycle is already "mass-customised" through modularity, continuing to customise at the bicycle shop makes sense. The shop can be conceived as an outpost of the design and manufacturing capability, is just as equipped to make mechanical changes as a factory, and has the benefit of direct end user contact. Mass customisation then becomes a platform upon which reinvention is facilitated. This adds to what we already know about reinvention – that it is more likely when the innovation has broad uses and the adopters are heterogeneous – effectively removing any mechanical barrier that may be present in the bicycle's inherent characteristics. A skilled bicycle mechanic can easily persuade a bicycle to become a different vehicle altogether.

According to the owner's will, the bicycle can return to the shop at any point over the service life. Thus we can re-engage with the more formal capability of mass customisation as a platform for reinvention as many times as needed. Aside from this, we also understand that as a piece of machinery the bicycle can be modified by the end user. These user-based reinventions exist on a spectrum from highly skilled quasi-mechanical undertakings for the desirous, to simple jury-rigged additions and modifications carried out with nothing more than cable ties. These acts can transform a bicycle from an unlikely machine into a utility thoroughbred, or a collection of rusted parts into a thief-deterring "trashmobile".[16]

The end of life phase for a bicycle is worthy of analysis too, and forms part of the reinvention process. Again owing to their inherent characteristics as mass customised, modular assemblies, a bicycle that may be past the best of its mechanical life can still be employed for less rigorous uses, or disassembled into parts, some of which can become donors for a new bicycle. Social enterprises excel at activities such as this, and can create significant mobility opportunities at very low costs.[28]

5. Discussion and implications

Configuring new and unique types of bicycle from the same parts is a key activity in readying an offering for the market. The product modularity and point-of-delivery customisation at the heart of this ability leave a residual mass customisation ability after the sale of a bicycle. Extending throughout the bicycle's life, types of mass customisation can be practiced to maintain, change and reinvent the bicycle. The implication for design is that in addition to the industrialised top-down approach, a more convivial, accessible and personal type of design is being practiced. Further, this second convivial practice is in harmony with the industrialised practice rather than in opposition to it. In a way, the bicycle's life capitalises on both very nicely – the industrial practice brings the bicycle to market with suitable quality and cost (to name but two benefits) and then the personalised, continued design practice carries on from the point of sale, enabled by the modularity and component interoperability of MC.

A second implication for design is that the reinvention of bicycles in the field provides visible evidence for the types of bicycles people need. That a consumer can fairly easily reinvent their bicycle – with or without the help of a professional mechanic – means that these acts of reinvention could be considered as a strong signal to the bicycle designer and product manager of consumer needs. Studying the types of bicycles used on the street can, and should form part of our knowledge into the act of transport cycling if we are to understand the vehicles that policy is pressing into service, and would find a natural home in the work of this archive.

For mobility culture

It follows that if we collectively view these reinvented bicycles as a culture, rather than individual vehicles, it begins to tell us something about utility bicycles and the current state of the local bicycle transport culture. Bicycle reinvention is not practiced by all bicycle users, which may mean that some vehicles are fit for purpose as-sold, or may mean that the user can't or won't engage in reinvention. This is a point of departure for another line of reasoning that follows the cultural problem in sustainable transport of "cyclists" versus "people on bicycles".[14] The nature of a "cyclist" label is one of enthusiasm for the mode, and so such a user may be willing and enthusiastic about reinventing their bicycle. The more benign approach of a person who happens to use a bicycle but doesn't fit the label of cyclist may make reinvention less accessible and thus there may be a widening technology gap between these two user groups. This line of reasoning is a matter for further research.

For bicycle mobility

The ability to re-invent an innovation has some important consequences for how that innovation may be adopted.

Above
Detail of bicycle.
Stock photo.

When we consider that the bicycle, as a vehicle category, is put to a variety of tasks this aligns with the understanding of reinvention. Tools with varied applications are more likely to be reinvented.[25] Outside of what may be known behind locked company doors, the phenomenon of bicycle reinvention is an under-studied part of transport and design research. Bicycle design itself does not normally figure in studies of the determinants of cycling[21] which is a shame since the characteristics of the vehicle have a strong effect on how it is perceived and used.[29] In situations like urban Australia, where populations are increasing and government ambitions are to replace car trips with bicycle trips, we would do well to understand the nature of the vehicles on which this policy depends. Field work revealed the practice of reinvention, especially where sports bicycles are given utility bike properties such as luggage capacity.

Conclusion

Manufacturing and design are typically viewed as industrialised practices which occur behind closed doors. In the case of bicycle design, this research has identified that the approach of mass customisation brings design and manufacturing into the realm of the consumer, with one of the main actors in this system being the bicycle shop, which is reconceived as an important outpost of design and manufacturing capability. Mass customisation and the inherent characteristics of the bicycle create conditions for reinvention, where a more convivial practice of manufacturing and design are carried out in the field.

Such practices are noteworthy for design strategy as they work in harmony with existing industrialised practices. In the specific case of the bicycle, the implications for mobility are that the opportunities for reinvention should be equally bestowed on all bicycle users in order that the vehicles can become more fit for purpose as policy shifts towards using bicycles for mobility. In converting a sports bicycle fleet into a utility bicycle fleet such as may be the task for Australia, the act of reinvention could be a determinant in how much of our mobility can be carried out with sustainable modes.

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