ULTRA

Positions and Polarities Beyond Crisis

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Image: Michaelmore, Roeger & Russell, *Chester House*, Belair 1966, State Library of South Australia BRG 346/28/6/2.

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Engineering Melbourne's "Great Structural-Functional Idea": Aspects of the Victorian Post-war "Rapprôchement" between Architecture and Engineering

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Keywords

Post-war architecture
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Professional representation

Abstract

In 1963, Robin Boyd wrote about a post-war "rapprôchement" between the disciplines of structural engineering and architecture. Etymologically, the term suggests the movement of two entities that draw closer to each other, either in an unprecedented fashion or resuming a suspended interaction.

World War II and the "anxieties and stimulations" of the post-war period, to use Boyd's expression, accelerated the process of overcoming longstanding educational and professional disciplinary barriers. They were the driving forces behind what he denominated the "great structural-functional idea" of the 1950s. Architecture schools embraced modernist/functionalist ideals, producing graduates with considerable technical knowledge - true "romantic engineers." The global post-war fascination with unconventional structures played its part. Occasionally, Antoine Picon argues, architecture's "symbolic and aesthetic discourses" walk a "strictly technical path." Under the banner of Le Corbusier's *Esthétique de l'Ingénieur*, architecture and engineering converged.

New technologies made collaborations with engineers habitual. According to Andrew Saint, however, partnerships were rarely affairs of equals since "architectural jobs came to architects first." The diversification and growing number of engineers also transformed them into a labour force, Picon suggests, affecting their prestige and, possibly, their historiographical fortune. Scholarship on post-war Melbourne architecture has generally privileged the architect as the protagonist in the creation of innovative structures, only occasionally acknowledging consultants. This does not reflect the concerted nature of design commissions and frequent evanescence of disciplinary boundaries.

This paper aims to highlight the major playing grounds for this alignment within design professions. It also hints at the complex relationship between the contributions of Victorian engineers and their recognition by post-war newspapers and architectural journals, opening the analysis of Melbourne's post-war architecture to the discourse of professional representation and arguing the importance of "unbiased" histories of the built environment.

Introduction. Melbourne's "Great Structural-Functional Idea"

In "The State of Australian Architecture," Robin Boyd explained how two buildings on opposite sides of the Yarra River, the 1956 Olympic Pool and the Sidney Myer Music Bowl, could be seen as climactic of the architecture of post-war Melbourne, examples of a peculiar design approach. The two structures were characterised by "a great structural-functional idea carried out with an enforced austerity and voluntarily cavalier technique,"[1] and were both products of the collaboration between young Victorian architects and engineer William 'Bill' Irwin (Figure 1). The way Boyd described Irwin suggests that his role within the architectural scene of post-war Melbourne was one of great importance. To use Boyd's words, the engineer had "the courage of his architects' convinctions."[2] Afterall, the great "structural-functional" ideas for both buildings demanded a degree of willingness to work with unconventional construction systems.

1. Robin Boyd, "The State of Australian Architecture," *Architecture in Australia* 56, no. 3 (June 1967): 459.

2. Ibid.

Figure 1: Engineer William Lyle Irwin inspects the erection of a steel truss at the Olympic Pool building site, Batman Avenue, Melbourne. The image is part of a series of pictures taken in 1955, possibly between the months of April and October by one of Irwin's collaborators. Source: Image courtesy of engineer Phil Gardiner, WSP Australia.

Without needing to use Boyd's article as evidence of the existence of a "Melbourne School," one can agree that his words finely capture one of the key underlying themes that defined a memorable episode of Victorian architecture - the relationship between architectural and structural design. The two buildings he cited belong to a long list of cases where architectural form was directly derived from a specific, radical or unothodox structural concept, an ethos developed by Melbourne architects which Jeffrey Turnbull described as an "unusual emphasis on *firmitas*."[3] This attempt to embrace structural design as the source of architectural expression has been widely documented by historians, to the point that architect Peter McIntyre has been depicted by Philip Goad as a "romantic engineer."[4]

Working with "great structural-functional ideas" required Melbourne

3. Jeffrey Turnbull, "Enterprise in Structure and Form: The Melbourne School and Cross Section 1952-1961," in *Proceedings of the International Conference of the Society of Architectural Historians, Australia and New Zealand*, (Melbourne: SAHANZ, 1986), 118.

4. Philip Goad, "Optimism and Experiment," *Architecture Australia* 79, no. 5 (June 1990): 40.

post-war architects to possess considerable technical knowledge and to be willing to explore beyond typical structural logic - even if, ultimately, the potential of structural experiment never was a solely functional or economic one.[5] They also needed to work with engineers who could understand those same visions and make them technically achievable. The rare flavour of this episode of productive collaboration was the result of a post-war alignment between the disciplines of structural engineering and architectural design. This paper highlights major fields where this alignment can be identified and studied. Gathering fragments of published literature and structured as a framing exercise, it proposes a possible direction for future research and a methodological approach which might enrich our understanding of this period of Victorian architecture. In particular, it raises considerations of a historiographical nature, opening the analysis of Melbourne's post-war architecture to the discourse of professional representation and arguing the importance of "unbiased" histories of the built environment.

5. As suggested by Roy Grounds' published opinions on the "Art of Space," or by Boyd's discussion of the "generating idea."

Boyd's Post-war "Rapprôchement" between Architecture and Engineering

Boyd himself debated the character of this disciplinary alignment, blended with a variety of other aspects, in his articles of the 1950s and 1960s. The theme was given particular relevance in his well-known *Architectural Review* pieces, namely "The Engineering of Excitement" and "Under Tension" (Figure 2).[6] The latter, comparing important episodes of architectural design from overseas to the experimental Melbourne scene of the 1950s and to Irwin's *oeuvre*, explicitly referred to a post-war conciliation which to many heralded "the end of the art-science split": a "rapprôchement" between the two "master designers," the architect and the engineer.[7]

6. Robin Boyd, "The Engineering of Excitement," *The Architectural Review* 124, no. 742 (November 1958): 294-308. Robin Boyd, "Under Tension," *The Architectural Review* 134, no. 801 (November 1963): 324-334.

7. Ibid., 325.

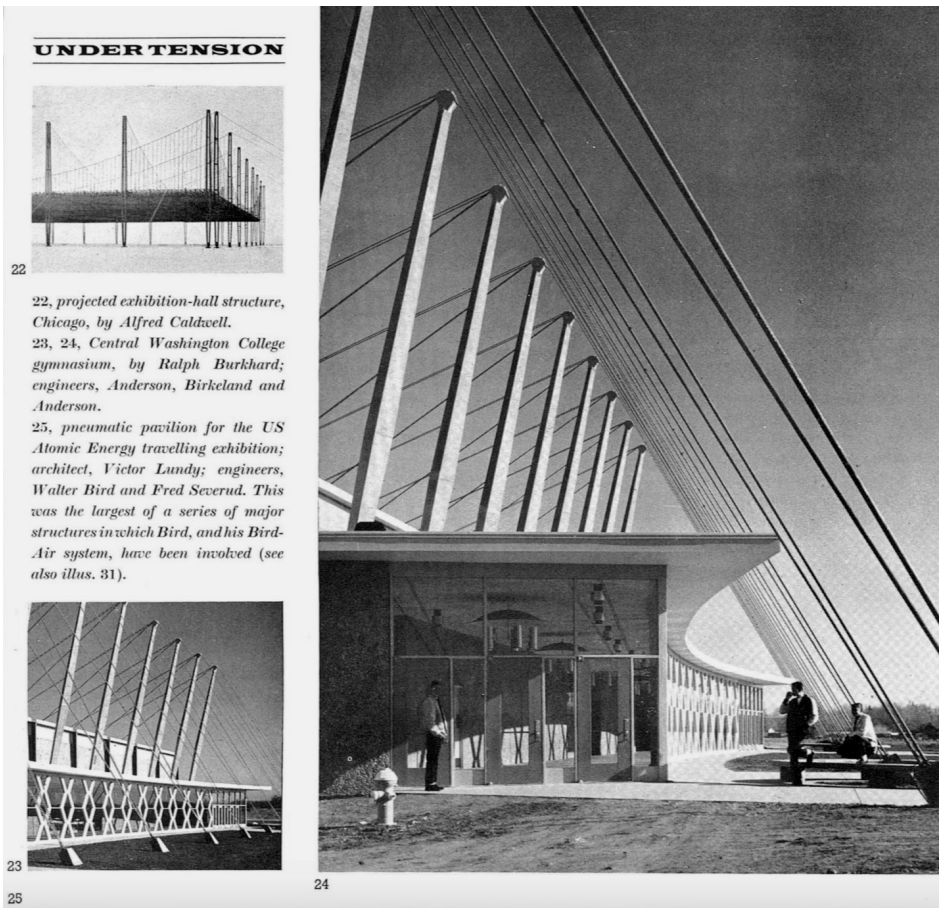


Figure 2: An excerpt from Boyd's AR piece "Under Tension" with an evocative example of the great "rapprôchement" between architecture and engineering from the United States. Source: Robin Boyd, "Under Tension," *The Architectural Review* 134, no. 801 (November 1963): 330.

Etymologically, the word "rapprôchement" suggests the movement of two entities that draw closer to each other, either in an unprecedented fashion or resuming a long interrupted interaction. Andrew Saint has documented how in the Renaissance the words "architect" and "engineer" were adopted to highlight different aspects of the same profession; and how the habit persisted through the seventeenth century when architects and engineers would be distinguished by their tasks rather than by their skills.[8] In many regards, it was after what Antoine Picon has termed the "époque charnière" (France's *Siecle des Lumieres*) that the discipline of engineering progressively developed an awareness that it embodied an autonomous ideal and "reclaimed" a specific knowledge and field of practice.[9] Favored by the advent of mechanisation, a precise definition of responsibilities and duties consolidated in the nineteenth century, emphasising the rupture between the "couples of antagonists" that had appeared earlier: "sensation et calcul, solidité et construction, tradition et innovation."[10] The processes that ultimately led to the overcoming of these theoretical, educational and professional barriers between engineering and architecture saw an acceleration during the Second World War and the global post-war context, eventually resulting in a wide range of interchanges between the two disciplines as well as in the eclipse of the Beaux-Arts-trained architect.

8. Andrew Saint, *Architect and Engineer: A Study in Sibling Rivalry* (London: Yale University Press, 2007), 11-13.

9. Antoine Picon, *L'Invention de l'Ingenieur Moderne: L'Ecole des Ponts et Chaussées 1747-1851* (Paris: Presses de l'Ecole Nationale des Ponts et Chaussées, 1992), 95.

10. Ibid., 11.

Material Driving Forces: "Anxieties and Stimulations of the Post-war Period"

With regard to the material forces driving this conciliation in the State of Victoria, Boyd hinted at the relevance of the historical context.[11] Boyd's "structural-functional idea," a manifestation of the "rapprôchement", was at times an answer to the necessities of a nation which had to confront its post-war development vision with significant practical challenges. Victoria's immediate post-war context became a "playing ground" with strict economic and legislative rules. As Stuart McIntyre has noted, Australia's post-war "reconstruction" took the double meaning of "building again" and "building anew" - making an efficient transition to a peacetime economy and using the opportunity to pursue a "new order."[12] "Building anew" also had a literal meaning, as the nation required large volumes of new structures and infrastructure to sustain the economic and demographic growth it envisioned and to solve its existing housing insufficiencies. The professionals tasked with designing Australia's post-war cities had to deal with frequent shortages of construction material and with severe restrictions on its use. The economic climate resulted in an overall rationalisation of architectural design, in an embrace of functionalism, lean structural expression and, in some cases, of innovation and experiment (Figures 3-4). The single house, the factory, the church and other public typologies became the testing ground for an "engineered" approach towards architectural design - encouraging professional interactions and disciplinary hybridisations.

11. Boyd, "The State of Australian Architecture," 459.

12. Stuart McIntyre, "The Post War Reconstruction Project," in *The Seven Dwarfs and the Age of the Mandarins: Australian Government Administration in the Post-War Reconstruction Era*, ed. Samuel Furphy (Acton: ANU Press, 2015), 33.

NOVEMBER 28, 1944 5

lenry Maitland Wilson inspecting a detachment ral ratings on arrival in Greece. It has been an- General Wilson has been appointed head of the Staff Mission to Washington, and Mr. Churchill's esentative on military matters with President- succession to the late Sir John Dill.—(British off- cial photograph.)

MATERIALS SHORT FOR HOUSE BUILDING

But Manpower is Chief Problem

The rate of progress in Victorian housing schemes is definitely governed by the amount of manpower that is to be made available for the production of the main essentials of construction such as bricks, timber, cement, tiles and plumbers' requisites. Reports and plans there are in plenty, but they are small consolation to the thousands of people who are waiting for houses or better accommodation. There are many problems associated with the shortage, but recent announcements that more manpower will be made available give some hope for relief.

A survey of the manufacturing field shows that stocks were never lower in Victoria than at present. For instance, out of 34 brick kilns in the metropolitan area only five are working, and only 205 men are employed where 1075 were engaged in pre-war days. Brick manufacturers are very much concerned at the low stocks in view of the urgent demand for housing.

A representative of the Vic- fect on the housing shortage (which has existed for years) is startlingly exhibited. The necessity for grappling with the question is urgent, and it is required now—not by bureaucratic trifling with the subdivision of houses, but rather by amendment of building-control regulations in such a manner as would, during the continuation of the war, prohibit the erection, addition, alteration, or renovation of, factories, picture theatres and the like, but permit the erection of dwellings only, at a cost not ex-

DEHYDRATION ADVANCES

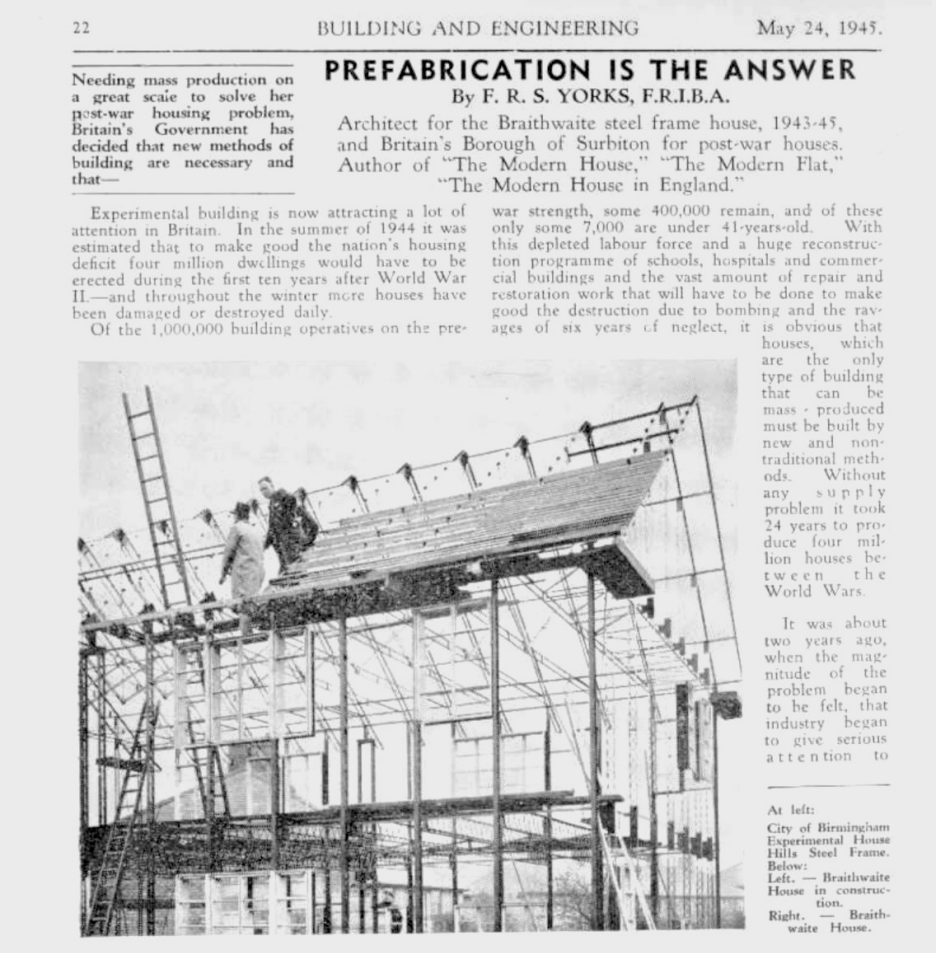
Importance in Front Areas

CANBERRA, Monday.—As a result of the remarkable developments of dehydration it was now possible for an ordinary transport plane to carry sufficient food to feed a battalion in a forward area for a week, said the Minister for Agriculture (Mr. Scully) to-day, when he opened Australia's 32nd vegetable dehydration plant at Batlow, (N.S.W.).

Mr. Scully said Australia was producing about 400,000 lb. of dried vegetables from 1940 tons of fresh vegetables, and production aimed at for 1944 was 13,508,000 lb., all for essential purposes. Mr. Scully said the rate of reduction in the dehydration of vegetables varied between seven-eighths to twenty-three-twenty-fourths.

Vegetable processing was now absorbing a significant proportion—about 160,000 tons—of Australia's increased vegetable acreage. Large quantities of vegetables could now be processed as soon as crops matured, providing an important outlet for primary production.

Figure 3: The economic climate of the post-war period to a degree "prolonged" the challenges faced by the building industry during the wartime years, effectively encouraging design rationalisation, structural optimisation and experiment. "Materials Short for House Building," *The Age*, 28 November 1944, 5.



22 BUILDING AND ENGINEERING May 24, 1945.

PREFABRICATION IS THE ANSWER

By F. R. S. YORKS, F.R.I.B.A.

Architect for the Braithwaite steel frame house, 1943-45, and Britain's Borough of Surbiton for post-war houses. Author of "The Modern House," "The Modern Flat," "The Modern House in England."

Needing mass production on a great scale to solve her post-war housing problem, Britain's Government has decided that new methods of building are necessary and that—

Experimental building is now attracting a lot of attention in Britain. In the summer of 1944 it was estimated that to make good the nation's housing deficit four million dwellings would have to be erected during the first ten years after World War II.—and throughout the winter more houses have been damaged or destroyed daily.

Of the 1,000,000 building operatives on the pre-war strength, some 400,000 remain, and of these only some 7,000 are under 41-years-old. With this depleted labour force and a huge reconstruction programme of schools, hospitals and commercial buildings and the vast amount of repair and restoration work that will have to be done to make good the destruction due to bombing and the ravages of six years of neglect, it is obvious that houses, which are the only type of building that can be mass-produced must be built by new and non-traditional methods. Without any supply problem it took 24 years to produce four million houses between the World Wars.

It was about two years ago, when the magnitude of the problem began to be felt, that industry began to give serious attention to

At left:
City of Birmingham Experimental House Hills Steel Frame. Below:
Left. — Braithwaite House in construction.
Right. — Braithwaite House.

Figure 4: Francis R. S. Yorke, "Prefabrication is the Answer," *Building and Engineering* 38, no. 5 (May 1945): 22.

Assessing The Relevance of War

The direct involvement of some architects and engineers in wartime activities between 1939 and 1945 may have represented a form of collateral education that prepared them to face the challenges of the post-war period, as well as one that favored the "rapprôchement" (Figure 5). During wars, Saint suggests, architects are generally eclipsed and engineers "come to the fore."[13] A technical-practical engineering approach to design proves successful in managing wartime construction tasks – after all, it is in the field of military construction that the first modern engineering schools have their roots. The architectural legacy of war, consequently, is not one that only involves physical structures and innovative wartime designs, but makes itself felt, as Jean-Louis Cohen writes, "in the more immaterial field of skills and experience"[14]. To designers, conflicts can represent great schools to learn "expedients."[15] The adoption of a scientific approach to problem solving (a sort of "managerial expertise" in architecture, to use Stan Fung and Mark Jackson's term[16]) played a particularly crucial role during World War Two and persisted during the post-war years worldwide.

13. Saint, *Architect and Engineer*, 273.

14. Jean-Louis Cohen, *Architecture in Uniform: Designing and Building for the Second World War* (New Haven: Yale University Press, 2011), 388.

15. Saint, *Architect and Engineer*, 184.

16. Mark Jackson and Stan Fung, "Years of No Significance: Architectural Professionalism in Australia during the two World Wars," in *On What Ground(s)? Proceedings of the Annual Conference of the Society of Architectural Historians, Australia and New Zealand, 1997*, eds. Sean Pickersgill and Peter Scriver (Adelaide: The Society, 1997), 114-115.

Figure 5: John Lysaght Pty. Ltd. wartime advertisements highlight the conversion of major building industry companies to military construction and munitions industry tasks. Source: *Building and Engineering 37*, no. 7 (July 1944): 43.

17. Philip Goad and Julie Willis, "Invention from War: a Circumstantial Modernism for Australian Architecture," *The Journal of Architecture* 8, no. 1 (Spring 2003): 41.

18. Ibid., 44.

Julie Willis and Philip Goad have demonstrated how these aspects apply to the Australian case as a consequence of the nation's involvement in the building of crucial infrastructure and structures that serviced the battles in the Pacific.[17] The influence of war, they suggest, has been overlooked in terms of the development of a peculiar post-war architecture scene in Melbourne, the city which hosted the headquarters of the Allied supreme military command in the Southwestern Pacific, of the US Army Forces in Australia and, meaningfully, of their Engineers' Section. The interactions between Australian designers and military engineering "fostered innovations, in terms of construction methods, structural experimentation and architectural practice, which had long-term effects on Australian design and its profession."[18] Australian architects were forced into a well documented wide range of different wartime experiences, which exposed them to construction processes and applications of technical *savoir faire*, at times influencing their post-war production.

The Role of Tertiary Education

19. "Architectural Training: Ex-Servicemen at Unversity," *The Age*, 13 July 1946, 5.

Academic architectural education in Melbourne contributed greatly to the disciplinary alignment. An increasing emphasis on technical subjects characterised architecture curricula at the University of Melbourne and at the Melbourne Technical College (MTC) during the post-war years. The reasons behind this transformation had to do with the academic institutionalisation of architectural modernism as much as they were of political nature. Victorian institutions acknowledged the importance of training technical professionals as an instrument to achieve their ambitious "post-war building programme"[19] and to facilitate the conversion of the wartime workforce back to civilian occupations. Among other things, the establishment of a new architecture professorship at Melbourne University, funded by *The Age* newspaper,

20. "The Age Chair of Architecture," *The Age*, 13 November 1945, 3.

reflected the generally perceived strategic role architecture played in post-war "reconstruction."[20]

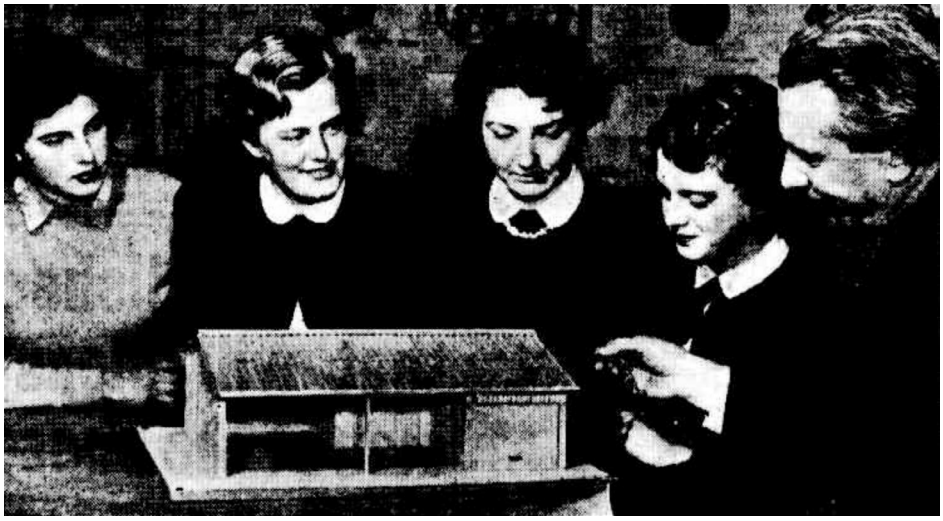


Figure 6: Austrian emigre architect Fritz Janeba, who had worked with modernist "pioneer" Peter Behrens before leaving Europe for Australia, revises design work of students Dorothy Webber, Gwynneth Brown, Nell Cussen and Janice McLean at the University of Melbourne, where he taught from the late 1940s to the early 1960s. Source: "Woman's Parade: a Lady with a Plan's as Good as any Man!," *The Age*, 29 October 1953, 9.

21. Philip Goad, "The Modern House in Melbourne 1945-1975," (PhD thesis, University of Melbourne, 1992), 3/86.

22. The University of Melbourne, *Handbook: Faculty of Architecture 1938* (Melbourne: Melbourne University Press, 1938), 39. The University of Melbourne, *Faculty Handbook, Architecture: Regulations, Details of Subjects and Information for Students 1948* (Melbourne: Melbourne University Press, 1948), 1-3.

23. Melbourne Technical College, *Prospectus 1948* (Melbourne: A. H. Massina & Co. Pty. Ltd., 1948), 78-79.

Teaching bodies in Melbourne's architecture schools were significantly transformed, now featuring emigre lecturers who had worked with great modernist masters or graduated from leading European technical institutes (Figure 6). Brian Lewis, The Age Chair of Architecture and responsible for Diploma and Bachelor courses at Melbourne University, directly encouraged "the full embrace of a techno-scientific approach."[21] Inspired by the ETH School of Architecture, Lewis aimed to make the integration of design and construction subjects the foundation of his atelier courses; but the new technical "flavour" was not limited to design studios. Melbourne University's handbooks record a profound reorganisation within the Bachelor of Architecture between 1938 and 1948: technical subjects mushroomed and a new curriculum ramification allowed for ulterior incursions in scientific disciplines.[22] Late 1940s Diploma curricula at MTC contained noteworthy numbers of technical subjects as well.[23] These were all precious opportunities for architecture students to get in contact with exciting structural themes, as finely demonstrated by Peter McIntyre's acknowledgment of the influence on his work played by the lectures delivered by young engineer Norman Mussen at Melbourne University.

24. Turnbull, *Enterprise in Structure and Form*, 110.

25. The University of Melbourne, *Faculty Handbook, Architecture: Regulations, Details of Subjects and Information for Students 1949,* (Melbourne: Melbourne University Press, 1949), 24, 27.

An ulterior confirmation of the relevance or tertiary institutions for the "rapprôchement" is the fact that *Cross-Section*, the well-known bulletin which displayed the work of structurally experimental Melbourne architects and expressed "admiration for the structures of engineers," was a product of the Department of Architecture and Building at Melbourne University (Figures 7-8).[24] Hence, it should come as no surprise that around this time the same school also started adopting the written works of great modernist architects and theorists as recommended textbooks, from Giedion's *Space, Time and Architecture* to Le Corbusier's Vers Une Architecture.[25] Advocating the adoption of

an "Esthétique de l'Ingénieur" in its first page, Jeanneret's seminal text seemed to perfectly capture the world architecture students would be welcomed into at the crowded Nissen huts of the University's Mildura Branch.[26]

26. Edouard Jeanneret, *Vers Une Architecture* (Paris: Les Editions G. Cres et C., 1924), VII.

Figure 7: A full Cross-Section page dedicated to images of exciting construction sites, including those of the Olympic Pool and of the Hosies' Hotel. *Cross-Section*, no. 3 (January 1955).

Figure 8: *Cross-Section* recorded the extraordinary process that led to the construction of the Academy of Science dome in Canberra, highlighting the role played by engineers Bill Irwin and Arthur James Francis. *Cross-Section*, no. 59 (September 1957): 1.

The Ascension of the "Engineer-Consultant"

The conciliation also stemmed from a transformed perception of the role of engineers within design processes. The overcoming of empirical building science and the need to scientifically calculate structures had resulted in the practice of involving structural engineers from the initial stages of the design process ("the earlier the better"[27]) and in the necessity to establish a dialogue with them.[28] This often multiplied the possibilities for structural designers (who gradually abandoned the role of "engineer-contractors" to embrace that of "engineer-consultants") to provide input on projects. Forms of collaboration, ranging from stable partnerships to occasional outside consultancy, became a "fixed pattern" within design processes at the dawn of the twentieth century. However, a true "turning point in the history of construction," with engineering and architecture finding a convergence, took place in the post-war period.[29] At times, Picon writes, architecture's symbolic and aesthetic discourses walk a "technical path" - and one can easily argue that the 1950s and 1960s were such a time.[30] The global post-war attraction to unconventional structures (of which non-linear concrete shapes were but one of the many kinds) meant that collaborations between architects and engineers could produce unprecedented

27. Saint, *Architect and Engineer,* 489-490.

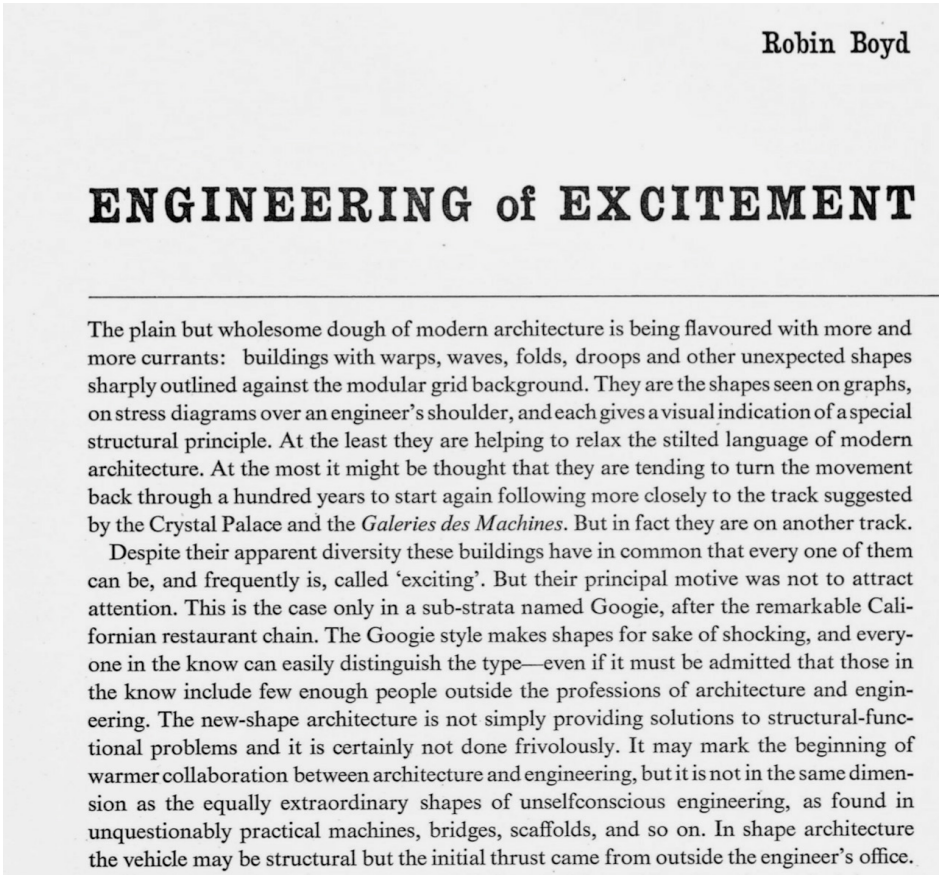
28. Ibid., 229.

29. Marko Pogacnik, "The Esthetics of Impersonal," in *La Concezione Strutturale: Ingegneria e Architettura in Italia negli Anni Cinquanta e Sessanta,* eds. Paolo Desideri et al. (Torino: Umberto Allemandi & C., 2013), 33.

30. Antoine Picon, "Industrialisation of the Building: a Technical and Political Project," in Understanding and Conserving. I*ndustrialised and Prefabricated Architecture*, eds. Franz Graf and Yvan Delemontey (Lausanne: PPUR, 2012), 26.

results. In a meeting point between aesthetics and technology, there was the feeling that the new curves drawn by engineers, scientists and machines could project the world into the Space Age. Australia was not immune to this fascination, and the country's "flirtation with concrete shell structures (...) was a brief and exultant explosion of experiment, as architects and engineers collaborated, as Boyd would have it, in an 'engineering of excitement'" (Figure 9).[31]

31. Philip Goad, "Shells, Spires and a Dome," in *Modern Times: The Untold Story of Modernism in Australia*, eds. Ann Stephen, Philip Goad, and Andrew McNamara (Carlton: Miegunyah Press, 2008), 143.



Robin Boyd

ENGINEERING of EXCITEMENT

The plain but wholesome dough of modern architecture is being flavoured with more and more currants: buildings with warps, waves, folds, droops and other unexpected shapes sharply outlined against the modular grid background. They are the shapes seen on graphs, on stress diagrams over an engineer's shoulder, and each gives a visual indication of a special structural principle. At the least they are helping to relax the stilted language of modern architecture. At the most it might be thought that they are tending to turn the movement back through a hundred years to start again following more closely to the track suggested by the Crystal Palace and the *Galeries des Machines*. But in fact they are on another track.

Despite their apparent diversity these buildings have in common that every one of them can be, and frequently is, called 'exciting'. But their principal motive was not to attract attention. This is the case only in a sub-strata named Googie, after the remarkable Californian restaurant chain. The Googie style makes shapes for sake of shocking, and everyone in the know can easily distinguish the type—even if it must be admitted that those in the know include few enough people outside the professions of architecture and engineering. The new-shape architecture is not simply providing solutions to structural-functional problems and it is certainly not done frivolously. It may mark the beginning of warmer collaboration between architecture and engineering, but it is not in the same dimension as the equally extraordinary shapes of unselfconscious engineering, as found in unquestionably practical machines, bridges, scaffolds, and so on. In shape architecture the vehicle may be structural but the initial thrust came from outside the engineer's office.

Figure 9: The first lines of Boyd's "Engineering of Excitement" hinted at the fundamental role played by the discipline of structural engineering within post-war modern architecture. Source: Robin Boyd, "The Engineering of Excitement," *The Architectural Review* 124, no. 742 (November 1958): 295.

Engineers could "bring to fruition what the architect conceived"; at the same time, new technologies and radical structural concepts "*obliged* the architect to consult early on, and to heed the engineer's judgement."[32] A feeling of this type was expressed in 1952 by Melbourne-based architect Ray Berg, who called for the "harnessing" of specialisation to be a "potent force" for architects in an age when buildings had become so complicated that it would be "impossible for any one man to conceive a building in its entirety."[33] Berg's statements echoed earlier reflections by Walter Bunning, who had highlighted how architects had ceased being "the original artistic souls" to become "practical men" in response to the rapid developments of construction practices. Architects, Bunning argued, could not be perfect in every aspect of the profession, so engineers would play a large part in all contemporary building - and it was to "them" that architects owed the greater part of their progress.[34]

32. Saint, *Architect and Engineer,* 367.

33. "A Three Sided Debate: Are We at the Beginning, Peak or End of an Architectural Era?," *Architecture and Arts*, no. 1 (July 1952): 10.

34. Walter Bunning, "The Future of Architecture: Changes as a Result of War," *Architecture* 29, no. 3 (March 1940): 48.

History has shown us how leading designers within partnerships can

be either architects or engineers and how, as a substantial result of the "rapprôchement," professional boundaries can be evanescent. Nevertheless, on a general level it was not uncommon in the second half of the twentieth century for engineers to "play second fiddle" to architects, at times suggesting the image of the engineer as a professional whose job was to transform an "artist-architect's" visions into reality. Saint has argued that design partnerships seldom have been "affairs of equals" since most architectural jobs "come to architects first," setting the tenor of these collaborations in advance.[35] Picon has suggested that it might have been the twentieth century-professionalisation, diversification and growing numbers of engineers which gradually transformed them "into a massive labour force" and eroded their prestige of "engineer-artists."[36] Arguably, these aspects also affected the historiographical fortune of their profession.

35. Saint, *Architect and Engineer*, 491.

36. Antoine Picon, "Engineers and Engineering History: Problems and Perspectives," *History and Technology* 20, no. 4 (December 2004): 427.

Media Representation of the "Nexus" between Architecture and Engineering

One might propound that the "rapprôchement" had two principal manifestations: the transformation of the architect, who became a professional with greater technical skills, and the increase in the number of collaborations between architects and engineers. Whenever Melbourne's innovative architectural practices were advised by the best structural consultants of the period, the "emphasis on *firmitas*" was apparent and led to exciting outcomes. Although some significant Victorian engineers were acknowledged as true co-protagonists by the architects they worked with, these collaborations have often faded from memory through how the period has been studied. The recognition of the convergence of the disciplines of architecture and structural design in post-war Victoria has not been paralleled by an extensive study of engineers' careers and contributions. Scholarship has privileged the architect as the primary subject in the creation of the structurally innovative buildings of the 1950s. The engineer is only occasionally acknoweldged, and cast in a support role. Such an approach leads to a partial understanding of this professional alignment and constitutes a simplification of the typically concerted nature of design processes. Researching how the "rapprôchement" and the contributions made by engineers were portrayed within post-war media represents an interesting direction to facilitate the reconstruction of these important design collaborations. The pages of post-war architectural periodicals contain some of the most interesting evidence of the conciliation. Reviews published within journals such as Architecture in Australia or Peter Burns' Melbourne-based *Architecture and Arts* generally recognised consultants and contractors involved in architecture projects. Analysing the issues of these (and other) periodicals, one will notice Bill Irwin's and John Connell's recurring presence as the engineers for Melbourne's structurally innovative large buildings of the late 1950s, Frank Dixon's work as Yuncken Freeman's main engineer for projects where structural expression became a central design theme, and the striking industrial structures designed by the firm Mussen, Mackay & Potter.[37] It is within these journals that one can also find meaningful pieces of writing which directly reflected on "the melding of architecture and engineering." These include, for example, Berg's previously mentioned arguments for the "harnessing of specialisation,"

37. The final chapter of my Master's thesis is structured as a series of individual case studies on the early careers of meaningful Victorian post-war engineers and includes bibliographical references of this type for each of them. See: Francesco Maranelli, "A History of Melbourne Modern 1945-1956: Engineering the Great Post-war "Structural-Functional Idea," (Masters's thesis, Università luav di Venezia, 2021), 143-234.

Mussen's essays on the "beauty of numbers"[38] and Roy Simpson's call for a "seamless nexus" and "closest sympathy" between architecture and engineering - for the sake of economy, efficiency and good design.[39]

Since its very early days under Boyd's direction, Cross-Section highlighted the contributions to architecture made by Melbourne consultants, as well as by engineers in other States (the exciting works of Sydney's great Peter Miller were rarely left unnoticed). The first issue meaningfully adopted the title "architect-engineer" to describe Dixon and presented an anecdote on the structural design of his Balwyn house;[40] the third issue reported how Mussen discussed important themes of design, construction and economy at an architecture congress in January 1953.[41] Mussen's best works were recorded by the bulletin, which eventually paid homage to the engineer in 1967, few months after his passing, describing him as "one of those rare men who was not only capable of awakening an awareness of structure in the students he sometimes taught, but also an inspiring speaker on the whole field of architecture."[42] Many of Melbourne's best buildings, the editors added, were all the better for having Mussen as structural consultant.

28, 1945

TICES

The Herald

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CABLE NEWS FROM AUSTRALIAN ASSOCIATED PRESS

SPECIAL HERALD CABLE SERVICE IN LONDON, NEW YORK AND OTHER WORLD CENTRES

Melbourne, Thurs., June 28, 1945

SHUFFLES ON MIGRATION

IN sharp contrast to its jealous party control of subjects in which Labor is genuinely interested, the Government decided that migration was a matter on which an all-party Parliamentary committee could work. But the vagueness which surrounds this proposal, together with the lack of information given by the Government about its talks on migration with Britain, have justified the Opposition's caution in accepting the proposal of a joint committee.

The ball now being tossed back to him, the Acting Prime Minister (Mr Chifley) proposes to pass it to Mr Forde. It is true that Mr Forde discussed migration with the Dominions Secretary while at San Francisco. But it is also true that Mr Forde had opportunities to discuss it months ago in London, and to clear the ground sufficiently for at least a general statement of policy.

While there can be no movement of migrants from Europe

Why Homes Are Too Costly

By NORMAN MUSSEN, Consulting Engineer, of Melbourne.

It is essential that houses be built immediately and in great numbers — we all know that. But it is equally essential that they be large enough, and sufficiently well equipped, for a family to live in decently and yet be within the means of the owner-occupier.

THE amount the low wage and salary earner can afford for his home is about £1000. If he pass it off at the rate of £1 per week the home will be his in 30 years (putting interest at 3 per cent).

But today a home sufficiently large and sufficiently well equipped for a family to live in decently would cost nearly double this amount.

This is the present position. With the existing methods and conditions of the building industry and with the present rest of equipment we cannot build suitable homes for low wage and salary earners that are within their means.

Realising this position, some of our authorities show an untappy tendency to reduce the size and quality of their houses. This in my opinion would not be neces-

job, has to put another bricklayer out of work.

Let us, therefore, as a community, commit ourselves to this: that we guarantee permanent employment to every wage earner other than those declared by some impartial court to be habitual loafers or trouble makers, subject to these conditions.

- Strikes must be outlawed;
- A full day's work must be given by each wage earner;
- Disputes between labor and management shall be settled by some properly constituted and impartial court, whose findings shall be binding on both parties.

The second factor in our too-high building costs is the ridiculously high price of labor-saving devices and fittings. Here we must press for a little good old-fashioned competition.

In particular, we must bitterly oppose anything in the nature of

DON

Hopes

PATTON . . . Mayor only.

Figure 10: Engineer Norman Henry Mussen actively participated in post-war "reconstruction" debates and had his opinions frequently published on Victorian newspapers and journals, suggesting that his contribution to Melbourne architecture transcended his professional profile of "consulting engineer." Source: Norman Mussen, "Why Homes Are Too Costly," *The Herald,* 28 June 1945, 4.

Victorian newspapers often reveal further details on engineers' involvement in the production of the built environment which enrich our understanding of their role. In their pages we learn of Cyril Hudspeth's participation in a post-war prefabrication scheme which specifically aimed at cutting cost of house production,[43] of Dixon's early work as a consultant for a series of "unconventional" post-war churches in Victoria designed by Alan Robertson and the CONARG collective,[44] and of Mussen's contribution to Robert Warren and bus manufacturers Ansair Pty. Ltd.'s 1963 curious industrialised dwelling project.[45] Mussen's case is of particular interest. The engineer, a skilled communicator himself,

38. "A Three Sided Debate," 9-17. Norman Mussen, "There are Only Numbers," *Architecture and Arts*, no. 1 (July 1952): 23.

39. Roy Simpson, as quoted in "Some Recent Buildings of Importance by Yuncken, Freeman Bros., Griffiths and Simpson, Architects, Melbourne," *Architecture and Arts*, no. 30 (February 1956): 22.

40. *Cross-Section*, no. 1 (November 1952): 2.

41. *Cross-Section*, no. 3 (January 1953): 1.

42. *Cross-Section*, no. 176 (June 1967): 3.

43. "House Costs Cut: Assembly Line System in Dandenong Factory," *The Herald*, 31 July 1953, 9.

44. "Functional Plan for Coburg Church," *Advocate*, 4 November 1954, 12. "Church for Holidays," *The Herald*, 22 September 1953, 3. *Plywood and Plywood Products* 1, no. 6 (November 1959): 24.

45. "Architect and Manager Confer," *Canberra Times*, 6 September 1963, 25.

was widely involved in post-war reconstruction debates. As early as 1940 he wrote an article advocating the use of reinforced concrete for structural frames instead of steel, which was a more expensive solution and should have been reserved for munitions industries.[46] Mussen had already presented the theme in a 1937 lecture delivered at the RVIA's Students' Society,[47] and frequently handled reinforced concrete in his early Melbourne works.[48] After the war, Mussen used newspapers to discuss building issues, such as the importance of lifting building height limits, the correct siting of houses and the challenges of price and quality of construction work – not without enraging more than one contractor (Figure 10).[49] In a *Small Homes Section* piece, "leading Melbourne consulting engineer" Mussen wrote about Australia's subpar building regulations.[50] Even later on, as he moved to Canberra, newspapers kept recording his opinions on the construction industry. In 1954 he suggested that Australia's building industry wasted 20% of its annual expenditure: reducing construction costs was now to be seen as "a moral act of benefit to Australia" for both builders and clients.5151 In Mussen's case, newspaper "representations" are also useful sources of biographical information: his numerous achievements as a tennis and bridge player, his lively social life in Melbourne, his graduation and his love for mathematics were all at some point documented by the local press.[52]

Although these constitute sources of great importance, it must be highlighted that both newspaper and journal pieces reviewing major post-war projects usually gave greater emphasis to the role played by architects; engineers were often depicted as marginal consultants, or their names did not appear – hence possibly feeding simplistic narratives that identify buildings as the products of architects' work only. Even *Cross-Section*, paradoxically, tended to acknowledge builders more consistently than engineers.


THE AGE, TUESDAY, DECEMBER 30, 1952

SUCCESS FOR ORIGINALITY

OLYMPIC POOLS BEST IN THE WORLD

MELBOURNE will be proud of its Olympic Pools. The design which won the Australia-wide architectural competition will be discussed all over the world.

It will be a unique and exciting building which will probably arouse more interest here than any building since the Manchester Unity's Gothicky tower changed the expression on the city's face.

IT will be one of the largest postwar buildings, costing £350,000 and seating 6000 overlooking the big twin swimming and diving pools. But size will not be the chief interest. This will be a building with enough strength of character to provoke general discussion purely on its architectural quality.

It will be the work of the young team which won the contest: John and Phyllis Murphy; Peter Mc- big buildings naturally tend to play safe, which has made progress painfully slow.

Architectural competition, the time honored device for giving young designers a chance to show their ideas, was the rule for big buildings last century, but has been out of favor lately.

The pools competition is one which really had the desired result. It has uncovered imaginative local talent capable of proving to the world that Australia is still advancing, after all.

In a way this is a personal triumph for Mr. Eric Hughes, president of the

By ROBIN BOYD,
One of the assessors of the Olympic Pool Design competition.

EXCURSION INTO THE UNUSUAL

CONGRATULATIONS FOR THE WINNERS.—Mr. John Murphy, Mr. Peter McIntyre, Mr. W. Irwin, Mr. Kevin Borland, Mrs. Phyllis Murphy and Mr. A. W. Coles. In the background is the winning design.

the basic elements self-supporting by taking the spread upper ends of the seating floors and tying them together by means of the roof.

This meant, of course, special design within the beams and roof trusses to withstand the unaccustomed forces that were set up.

★

BUT the most spectacular effect, which

LETTERS

P.M.G. Chief & Telephones

SIR. — THE DIRECTOR-GENERAL of Posts and Telegraphs (Mr. G. T. Chippindall) is reported as saying ("The Age," 20/12) that he found Australian local telephone and phonogram services compare favorably with those in Great Britain.

It is apparent that Mr. Chippindall did not use a public 'phone box in Britain, or he would have noted that there are slots for shillings, sixpences and pennies, so that payment for other than local calls can be made.

In Britain trunk calls and phonograms can be put through from any public call office, at any time. Where in Australia can this service be had?

N.B. (Kew).

NEW DISHES REVIVE OLD FAVORITES

Successful Industry on Romantic Island

TRISTAN da Cunha crayfish is making its appearance on the brightly colored menus of the famous Southern

Figure 11: Boyd, as one might imagine, explicitly acknowledged engineer William Lyle Irwin as part of the Olympic Pool competition's winning team even in his newspaper articles. Source: "Olympic Pools Best in the World," *The Age*, 30 December 1952, 2.

46. Norman Mussen, "Defence Works," *The Argus*, 8 February 1941, 6.

47. "Students' Section," J*ournal of the Royal Victorian Institute of Architects* 35, no. 4 (September 1937): 171-172.

48. Including, for example, the spires of St. Patrick's Cathedral, the Century Building, the Russell Street Police Headquarters and the Rivoli Theatre.

49. Norman Mussen, "Height of City Buildings," *The Age*, 20 January 1945, 2. Norman Mussen, "This Much is Free," *The Age*, 1 May 1951, 5. Norman Mussen, "Why Homes Are Too Costly," *The Herald*, 28 June 1945, 4.

50. "Poor Building Regulations Restrict Housing," *The Age*, 2 February 1949, 4.

51. "£50m. Wasted in Building Industry Yearly," *Canberra Times*, 21 January 1954, 2.

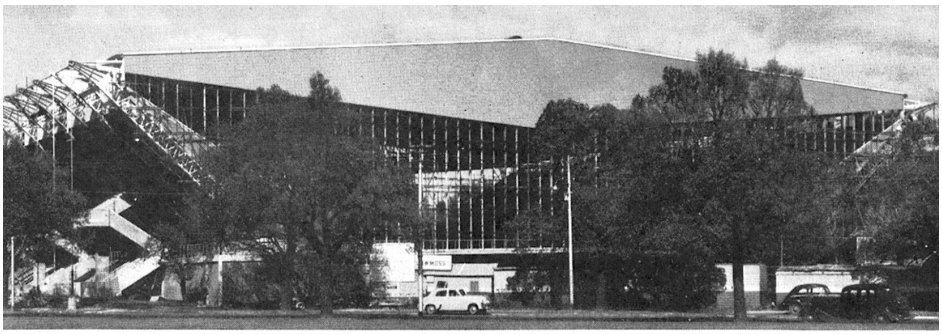
52. I have included an extensive collection of newspaper articles on Mussen's youth and early works in my thesis. See: Maranelli, "A History of Melbourne Modern 1945-1956," 226-228.

53. Peter McIntyre, personal communication with the author, 1 April, 2021.

54. *Cross-Section*, no. 41 (March 1956): 2. *Cross-Section*, no. 13 (November 1953): 3. *Cross-Section*, no. 30 (April 1955): 3.

55. "Olympic Pool, Melbourne," Architecture and Arts, no. 6 (June 1956): 25. "Peter and Dione McIntyre's House at Kew, Melbourne," Architecture and Arts, no. 6 (June 1956): 27. "Architect's Own House at Kew, Melbourne," *Architecture in Australia* 46, no. 1 (January/March 1957): 34.

To find a clear example of this, one should look no further than to how Irwin's contributions were represented. This is particularly significant since Boyd went as far as to "advertise" Irwin's importance for Melbourne post-war architecture on the *AR* and since Irwin's contribution constitutes a rare case where commentators of this historical episode have unequivocally acknowledged the role played by an engineer. Being able to conceive and handle "unconventional" alternative structural solutions, Irwin was at times the only Victorian engineer who could make what experimental architects formulated technically achievable (Figure 11).[53] A survey of Irwin's drawings and project records highlights the exceptional amount of relevant structures the engineer contributed to after his proverbial participation in the Olympic Pool competition alongside Borland, McIntyre and the Murphys. But his name was not necessarily mentioned every time one of those structures was reviewed by magazines or newspapers. In *Cross-Section*, Irwin's participation in many iconic designs, including the McIntyres' River House or Beulah Hospital, was not acknowledged.[54] A similar lack of recognition can be found in *Architecture and Arts and Architecture in Australia* articles on the River House and Olympic Pool projects, with his name being mis-spelled or omitted altogether (Figure 12).[55]



OLYMPIC POOL, MELBOURNE

Architect: Borland, Murphy & McIntyre

Engineer: W. L. Erwin

Fundamentally the structural problem is to support and provide a roof over the sloping seating. The seating is supported by sloping girders at 18 ft. centres. The girder can be supported by a vertical reaction from below in the conventional manner.

The vertical ties are anchored into the columns of the ancillary concrete structures below. The dead load on each anchoring column is considerably greater than the maximum tension in each tie.

The final structure, therefore, consists of two components—the seating and the roof. The resulting form is the minimum volume.

Figure 12: Irwin, shown proudly inspecting the construction of the Olympic Pool in the first illustration of this paper, had his name mis-spelled ("Erwin") in a review of the same project by the Melbourne-based magazine *Architecture and Arts*. Source: "Olympic Pool, Melbourne," *Architecture and Arts*, no. 6 (June 1956): 25.

Conclusion

Given the general lack of historiographical material on the lives and careers of post-war engineers, newspapers and architecture periodicals might be a valuable option to fill some gaps, but one must be aware of their frequent "imperfection." Thus, locating the current position of post-war engineers' material archives would be a fundamental operation, although this frequently represents a challenge in itself.

As a study methodology, the "reconstruction" of engineers' biographies is not solely aimed at giving historiographical recognition to an often undocumented professional category. An ideal "section" through the career of a structural consultant will reveal an intertwining of secret threads, a sequence of recurring collaborations on projects and a portrait of the architectural circle the engineer worked with. It also contributes to shape richer, non-simplistic histories of the built environment which may better reflect the complexity of the processes that drive the production of architecture and the construction of cities. These operations can be of particular relevance for episodes characterised by an "emphasis on *firmitas*" and a marked professional "rapprôchement" - such as the one presented here.

Author's note

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