



WHAT IF? WHAT NEXT?

SPECULATIONS ON HISTORY'S FUTURES

SESSION 3B

COUNTERING THE CANON/S

**Activism and Agency in Architectural History:
Migrancy, Gender Diversity, Class**

TO CITE THIS PAPER | **Meherzad B. Shroff and Julian Worrall.**
“Building Upon: A Designer’s Approach to Adaptive Reuse.” In
*Proceedings of the Society of Architectural Historians Australia and
New Zealand: 37, What If? What Next? Speculations on History’s
Futures*, edited by Kate Hislop and Hannah Lewi, 500-514. Perth:
SAHANZ, 2021. Accepted for publication December 11, 2020.

PROCEEDINGS OF THE SOCIETY OF ARCHITECTURAL HISTORIANS AUSTRALIA AND NEW ZEALAND (SAHANZ) VOLUME 37

Convened by The University of Western Australia School of Design,
Perth, 18-25 November, 2020

Edited by Kate Hislop and Hannah Lewi

Published in Perth, Western Australia, by SAHANZ, 2021

ISBN: 978-0-646-83725-3

Copyright of this volume belongs to SAHANZ; authors retain the
copyright of the content of their individual papers. All efforts have
been undertaken to ensure the authors have secured appropriate
permissions to reproduce the images illustrating individual
contributions. Interested parties may contact the editors.

BUILDING UPON: A DESIGNER'S APPROACH TO ADAPTIVE REUSE

Meherzad B. Shroff | University of Adelaide
Julian Worrall | University of Tasmania

With heritage policy stressing cultural significance extending in many cases beyond the material reality of an existing building towards intangible heritage, this paper seeks to put forward an alternative approach to those that emphasise a stable understanding of existing buildings as material artefact. The propositions described in this paper aim to promote new conceptual tolerances for creating architecture from existing buildings via a design research modality.

This paper sets out a speculative, design-oriented approach and methodology to mediating the relationship between intangible heritage qualities possessed by existing buildings and their agency towards the creation of new form for adaptive reuse. It describes the creation of mnemonic and metaphoric devices to mobilise and tease out these qualities via acts of oblique questioning and imaginative interpretation.

The specific case employed to mobilise this inquiry is the Union House building at the University of Adelaide, designed in 1969-1975 by Dickson & Platten. The re-reading and focus on a single building provides a consistent base as a starting point, allowing a clear mapping of a suite of design strategies, akin to a "theme and variations" approach found in musical composition.

The consistent premise is for a building realised in-situ through a new 2500m² volume and selective demolition of the existing Union House. Re-readings of the existing building are conducted in search for distinctive points of departure emanating from the host building. Through various techniques, the generated propositions aim for "conceptual fidelity" to the host while articulating an expanded field of architectural qualities sourced in its existing condition.

Introduction

The term *adaptive reuse* has gained momentum in the last fifty years, emerging as an alternative process to demolition of built fabric. Adaptive reuse is a process of alteration, mediating between preservation, renovation and demolition.¹

It is worth noting that what is now termed adaptive reuse is not a new process and the re-purposing of buildings has been happening for thousands of years. In contemporary settings, adaptive reuse is generally regarded as a positive process, promoting sustainability by preserving the embodied energy held materials, curtailing urban sprawl, and allowing cities to densify, offering benefits in economic, social and environmental terms.

From a cultural and aesthetic perspective, the reuse of historic buildings allows for the associated intangible fabric of time, history, and experience to be maintained and enhanced within a contemporary sensibility. Adaptive reuse enables the story of architecture to continue, told through new architectural intentions via new form.

Within this cultural perspective, a number of questions of theoretical and practical concern are confronted:

- How can architects interpret heritage buildings to elicit poetic representations of time, space, and event within the process of adaptive reuse?
- How can intangible heritage be mobilized within a design-oriented process to expose new potentials for the creation of new architectural form within heritage practice?
- How can a designer engage deeply with an existing building allowing them to dwell, remember, preserve and expose alternative and latent histories for the design of architecture?

This paper seeks to demonstrate how the ordinary everyday histories and memories of a heritage place can be reconstructed, recollected and remembered from a state of 'amnesia' by architects who wish to design new architectural form which engages history as a generator, beyond conventional hermetic material-focused heritage practices of adaptive reuse.

The aim of this paper is to demonstrate a *critical adaptive reuse* practice. To achieve this task, a speculative design research project (drawn from the author's current PhD research), takes a single building and develops a series of alternative propositions for its adaptive reuse. This single test site provides a consistent base as a starting point, allowing for a clear mapping of a suite of design strategies, akin to a "theme and variations" approach found in musical composition.

Re-readings of the existing building are conducted in search for distinctive points of departure emanating from the host building. Here the new architecture serves as a 'conceptual condenser,' with the consistent premise of creating a built extension with addition of 2500m² of new volume. An architecture and design school has been chosen as the speculative design brief to reanimate the existing building out of a state of obsolescence.

Ground

The building that forms the base or *ground* of this inquiry is the Union House Building complex at the University of Adelaide (Fig. 1).

The Union House complex was the physical base for the student union and formed the social hub of the campus. The building was designed in close collaboration with the university client representative Ralph Middenway and was designed to accommodate the needs of a growing student population. The building included a variety of programs common to such facilities during that era.²



Figure 1. View to Union House from across the University footbridge over the River Torrens.

In 2002 this group of buildings was added to the State Heritage Register of South Australia. The listing was justified for the building's demonstration aesthetic architectural qualities under Criteria E³ (tectonic qualities), and its cultural significance to student life, under Criteria G⁴ (historic qualities).

Union House Building was a two-stage redevelopment (1969-1975) designed by notable Adelaide architecture firm, Dickson and Platten. The lead designer on this building was Robert Dickson (1926-2014), in collaboration with Newell Platten (1928-present). The positive critical reception by historians have positioned it as one of the most significant buildings in the firm's oeuvre. Goad and Lewi's *Australian Modern* judged it to be "a prime example of Australian regional rationalism."⁵ (Fig. 2).



Figure 2. Union House as seen from the Library Steps designed by Dickson and Platten.

The Union House building is part of an older precinct of structures, which includes The Lady Symon Building and War Memorial Cloisters (1926-1927), and The George Murray Building (1936-1938). These earlier buildings were designed by the Adelaide architecture firm Woods

Bagot and Laybourne-Smith Irwin, who were the university architects. These earlier buildings were designed in a Neo-Georgian revival style with Tuscan overtones. This set of buildings, particularly the Cloisters, have become a celebrated and widely publicised symbol of the university, along with the Barr Smith Library and Bonython Hall, also designed by the same architects.

Recently the Hughes Plaza at the university was redeveloped into a 'student learning hub'. This new multipurpose space shifted the social heart of the campus away from the Union House complex. With the dissolution of the student union, changing ideas around educational spaces and twenty years of maintenance neglect has seen this group of buildings fall into obsolescence.

Method

The design process for each design iteration consists of three main phases: (1) collection; (2) interpretation; and (3) translation (Fig. 3).

The *collection* phase begins with the question of how do we bring history into practice, or how can *history become the generator* (paraphrasing Le Corbusier's epigrammatic call for the plan to be the generator of architecture)? The approach taken here to this premise is one of asking *oblique questions*, a process of asking questions to seeking conjectures towards existing buildings to generate creative departure points. The questions seek to act as a catalyst for opening up fixed perspectives on architectural heritage and preservation (thus generating new tolerances), and aid in close readings and understandings of an existing building, contributing to the development a design response.

The questions are categorised to develop approaches towards architecture which can be classified as *materialist*⁶, *historiographical*⁷ or *phenomenological*.⁸ These oblique questions work in close relation to various categories of data collection, classified as follows: (1) material *artefact*; (2) recorded *archive*; (3) the designer's subjectivity or *self*. This first phase results in a *collection* of a mass of raw data. This can include stories, archival photography, reports, diagrams, drawings, timelines, maps, and memories, to name a few.

The second phase, *interpretation*, curates or maps information gathered during the collection stage. Here actions include the ordering of fragments of information, looking for patterns and considering how this data might be used. The information is gathered and sorted and filtered seeking creative departure points. The interpretation phase results in a *mnemonic artefact*, a form that results from the use of a series of artistic and design tools. These new artefacts contain core principles or 'essences' which act as a bridge to visualizing intangible heritage and act as potential hypothesis in response to the oblique questioning.

In the third phase, *translation*, the created mnemonic artefacts are mobilized towards the creation of new architectural form with the introduction of a design brief. Informed by the designer's intuition, this stage consists of a series of architectural procedures, utilising analogue and digital workflows to overcome translation roadblocks towards the production of an architectural proposition.

It is essential that a *clear conceptual line* is sustained throughout the *interpretation* and *translation* phases. This is necessary to maintain fidelity to the qualities of history and memory being carried along within the process of design and combat reduction and combat literalism within the design process.

Design Research

The overall PhD design inquiry advances nine design iterations. For reasons of space in this paper, only three are expanded upon here. One design from each of the oblique questioning data collection categories has been covered.



Figure 3. Process Diagram.

Design 4: Oral Histories.

Oblique Question:

- Where does the building exist outside itself?

Collecting Stories

This design began with a deep dive into archival material surrounding Union House. This task led to a review of the student-produced university newspaper, *On Dit*. After reviewing all the magazine issues between 1960 to 1980, one name recurred across multiple issues of the periodical. This was Ralph Middenway, the principal representative of the university who worked closely with Robert Dickson during the design process of Union House.⁹

A meeting was arranged with Middenway at his home in Hobart, Tasmania. During the meeting he recounted his time as the university union warden and many anecdotal stories of the colourful characters he worked with. He painted an animated picture of Union House, a picture which now feels lost in time, preserved only in oral histories (Fig. 4).



Figure 4. Ralph Middenway

These stories prompted the designer to consider the function of a building, and how the past users of a place could reclaim and possess agency in the process of adaptive reuse when the functional logic of the plan is the first aspect to be discarded.

Designing with the memory of the past users here allowed the original design ethos to be carried forward, honoring the plan and original intentions of the architects who designed this building according to modernist principles, such as ‘the plan as generator’. The oral histories of the previous users of Union House become the point of departure for this design and one *hypothesis* in response to the question: “Where does the building exist outside itself?”

Finding Form

Utilizing various techniques of anthropomorphism and conceptual art, a series of *mnemonic artefacts* were created taking the form of tectonic sculptures (Fig. 5). Many sculptures employ *objet trouvé* (found objects) and a type of performative functionalism – taking the form of abstracted tools used by the previous users. Elements of the past users are embodied into sculptures through the use of icons and symbols.



Figure 5. Tectonic Sculptures

The techniques of casting narrative or history used by John Hedjuk, and in particular his *Victims* project, inspired a way to interpret these oral histories into architecture.¹⁰ With the focus here on using everyday ordinary histories for the design of new form, the reference to the *Victims* project is used as a guide to a kind of method of interpretation, rather than engage in a reflection on grand historical trauma or the role of architectural agency in addressing such themes.

Assembling Architecture

Moving into the translation phase, after some thought the tectonic sculptures were placed in their original location they occupied within the building – a type of conceptual homecoming (Fig. 6). Aiming to design an extension rather than interstitial interventions for this iteration, these tectonic sculptures were deconstructed, aligned to the west side of the existing building and were placed within a new volume.

Seeking continuity with an unrealized extension designed by Dickson in 1990, this new volume was created with the same pitch of roof and with matching the setbacks to the buildings on the site, an endeavor which Dickson focused on achieving as well in the original design of the building. These displaced sculptural elements arranged in this volume were recast as elements of architecture. Through a process which the author calls *palimpsest iterative digital modelling*, the design reached completion.¹¹

Form as Conceptual Monument

The new form in this design research acts as a conceptual monument to the previous uses of a building now in a state of obsolescence. The everyday users of the building are visualized as sculptures and then deconstructed to form an extension. The original design of Union House was dictated by the functional aspects of its plan, designed inside out. The past users who inhabited Dickson’s plan are here transcribed into a new plan of a building extension.

This iteration exhibits a conceptual fidelity to the past, testing the limits of creative interpretation within the process of adaptive reuse. This design seeks to demonstrate a method of overcoming the entropy of function within the process of adaptive reuse and visualizes it into architectural form with a social dimension of cultural significance connected to a heritage building (Fig. 7).

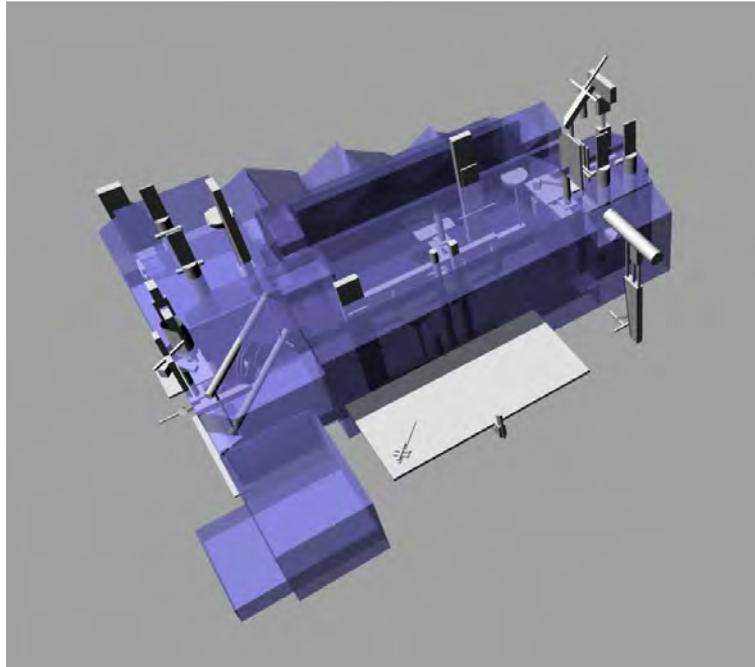


Figure 6. Tectonic sculptures placed in the location that they occupied originally within the building.

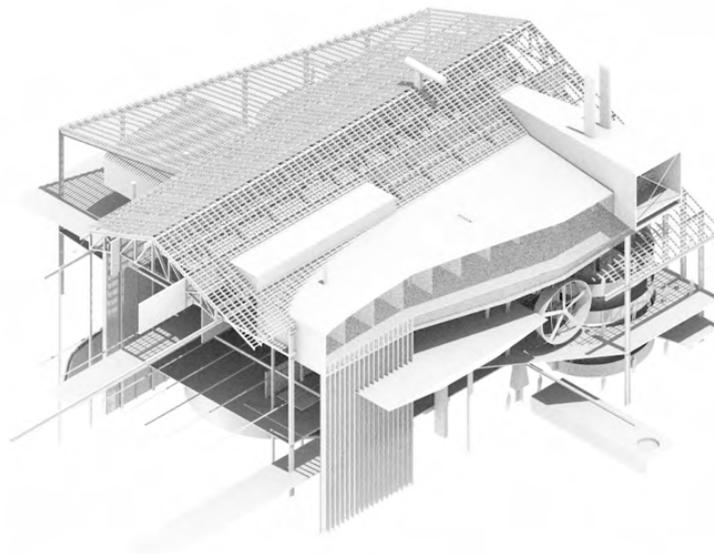


Figure 7. Conceptual monument building to the previous uses of a building.

Design 7: Past Forms

Oblique Questions:

- What was here before this building?
- How would you restore the idea of place?

Resurrection Methods

Restoring a building previously demolished is one technique utilised by architects in activating previous states of place. Architects bring back past forms through varying degrees of restoration.¹² These approaches display and unfurl an historical image of time and act as a time

machine on site. The practice of restoration can be divided into a materially focussed orientation and a conceptually focussed orientation¹³. Miles Glendinning summarizes Viollet-le-Duc's position towards the latter:

A 'monument' might exist not as an object or as material substance but as an abstract ideal at one remove from historic 'reality', whose modern 'recreation' (or, rather, creation for the first time, in its new form) might, in its greater purity, answer the demands of the nation more effectively than 'authentic' old substance.¹⁴

The question posed here is how can a conceptually focussed practice of restoration create new architectural form drawing both on a building's ideals and its historical realities.

Virtual Space

Before any restoration can occur, the previous state of place must be recollected. After some archival detective work¹⁵ eventually all the relevant drawings and archival photography were sourced and used to reconstruct every spatial configuration of the site in 3D space. These digital models act as a simulation of a lost reality. After the collection of information and the reconstruction of previous build stages in virtual space, the interpretation stage of this iteration could begin. (Fig. 8)

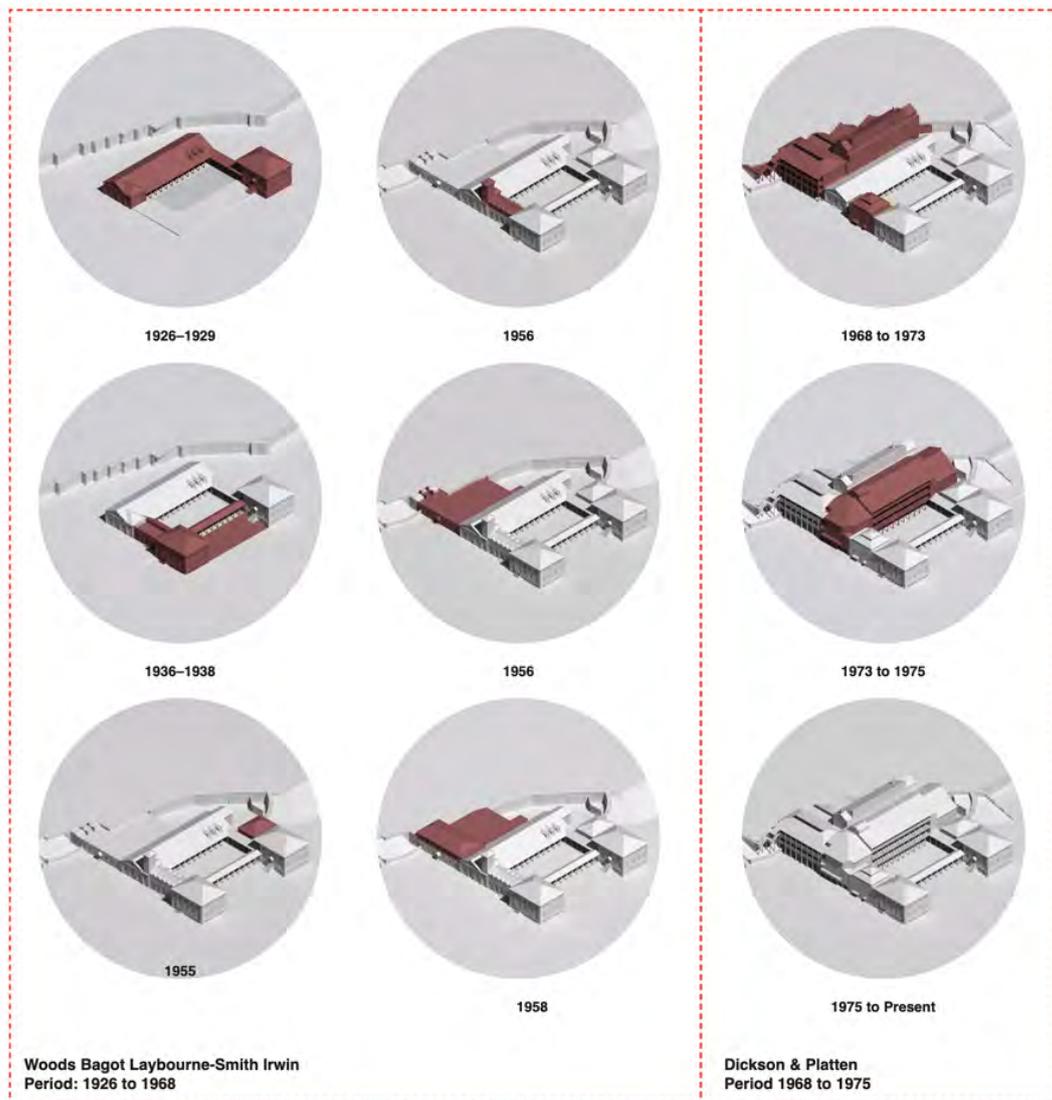


Figure 8. 3D Modelled Stages of Development.

Shadows of Time

The idea of restoration can be further unpacked as the restating of something removed. Here architecture was removed, in this case via the process of demolition – the destruction and removal of built fabric. A property and effect of demolition is that it removes built fabric from revelation in light. This interpretation of the process of demolition and its behavior towards light and shadow was inspired by Louis Kahn and Le Corbusier’s well-known pronouncements on light and architecture¹⁶.

Interpretation of these concepts of light led to the production of renders depicting shadow and light, to see how the previous states on the site were articulated by sunlight, bringing the demolished fabric back into light. What was fascinating about this idea was how shadows capture presences and absence and how they constitute traces of tectonic form in time. This led to the idea to generate and resurrect new forms stemming from the shadows of demolished buildings.

Finding Form

Developing this idea further, an attempt was made to render shadows at the moment of demolition and to capture their *umbra* – the fully shaded inner region of a shadow cast by an opaque object. The aim was to produce frozen transitional surrogates of the temporal shadows of built elements undergoing demolition, which occur and linger for just a few moments before elements collapse to the ground.

The restored fabric was disassembled and exploded in 3D space to achieve this concept. This created a dynamic field of scattered elements casting complex figure-ground shadow *umbras*. With these more complex shadow renders, form was extracted that exhibited an architectural logic. What emerges was a series of mnemonic artefacts the author named “Shadow Forms” (Fig. 9).

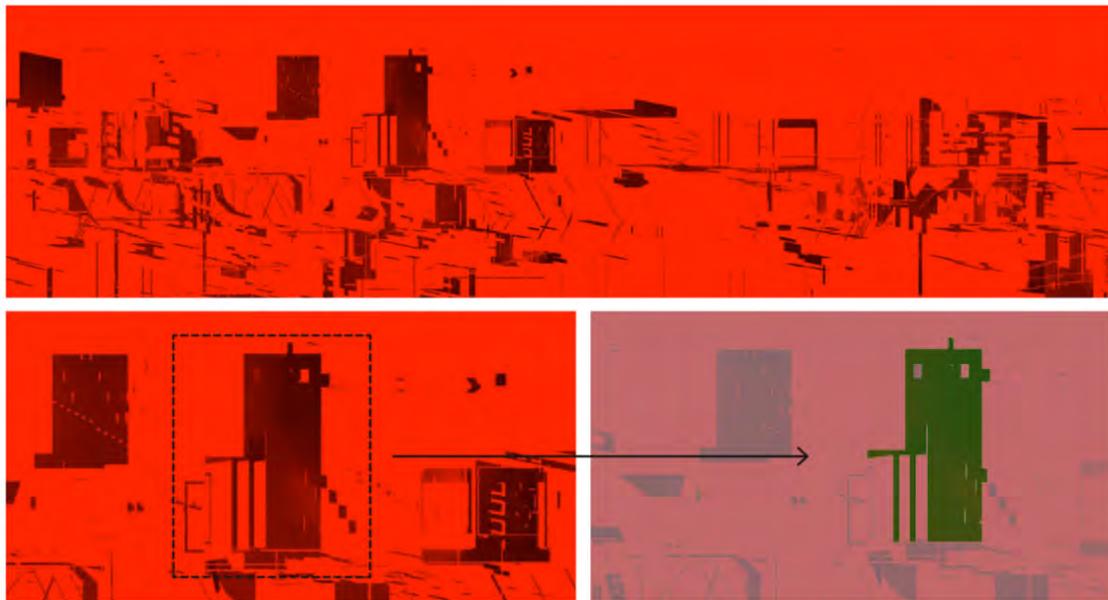


Figure 9. Shadow umbras from a representation of demolished built fabric.

These traced out forms begin to demonstrate a condensation of formal and volumetric qualities being restored. These 2D figure-grounds, were then projected in 3D and architectural form was produced in the translation stage.

This process of searching for the right forms in light (or in this case shadow) took inspiration from a process performed by Dickson throughout his career. On tracing paper, he would draw over his

elevations in soft pencil to see the shadows the built elements would cast and modify his elevations accordingly. In the process of sifting and looking for architecture, the designer's approach here aims to re-interpret this process performed by Dickson.

Restoring Ideas

Looking for the ideals connected to place we find the ideal of 'harmony' and 'continuity' appearing in the work of the previous architects on site. Although Walter Bagot¹⁷ was an advocate for harmony within place, ultimately his work represents a form of European colonialism. The architecture of Bagot was then referred by Dickson, who sought the harmony and continuity with how Bagot interpreted place.

Considering his practice and writings of architecture, Bagot was driven by how his buildings could address the canon - the beauty and logic of classical form and how it resolved the climatic and functional aspects of a project. In contrast, Dickson was driven by function, and plan was his generator. His relationship with history was materially focused.

This iteration seeks to build on these two foundations, by once again looking back at itself. In this case the harmony and continuity are conceptual via generative architectural practices. This iteration seeks continuity by drawing from the 'amnesia' of place. The aim of this design was not to restore the lost form as verbatim on site, but to rethink and interpret how new form could emerge from a pool of demolished every day ordinary university buildings, aiming to seek a conceptual fidelity to past places.



Figure 10. Conceptual harmony and continuity via generative architectural practices.

Design 9: Spatial Practice

Oblique Questions:

- Who was the original architect?
- What was original architect's spatial practice?
- What was the aspiration for the building held by the original architect?

Recasting

How would you *channel* an architect's spatial practice for the creation of new form? Such oblique questions are the starting point for this iteration (this design is still in progress). Answers to these questions are obscured further if the original architect has passed away. One way forward is to

adopt a 'method acting' approach towards the previous architect's spatial practice. Actors engage in this psychological process which involves a long period of rigorous preparation, involving immersion into the character's habits, personality, and influences. Architects could also engage in this process moving towards a method acting approach to design. The aim and outcome of this type of process would seek to create seek an architecture which is uncanny in process and output.

This iteration seeks to interrogate how the process of method acting could be applied within architecture and preservation in order to embody the original architect, building a new addition to their original building.

Preparation

The architect to be embodied in this iteration is Robert Dickson. His spatial practice was chosen over the other previous architects who had worked on the site because of the reasons of information collection and the author's access to primary and secondary sources.¹⁸ Preparation towards embodying Dickson involved three methods.

1. Interviews to learn working methods were conducted with people who knew Dickson professionally and personally. The idea here was that sometimes others know people better than themselves. These interviews were conducted with a line of questioning which aimed to learn about Dickson's personality and design practice.¹⁹ (Fig. 11).
2. The books and journals mentioned in his autobiographical monograph were borrowed and read. This overwhelming task was done to absorb the architectural design imagery over the course of his career. (Fig. 12).
3. Travel was another avenue for preparation.²⁰ The designer retraced Dickson's youthful journey across Italy. Here he visited as many of the places mentioned in his own monograph as possible. This trip also included a meeting with the daughter of Bruno Morassutti, Dickson's former employer in Milan. This process was done to absorb the architectural design imagery and phenomenological presence of Italy. (Fig. 13).



Figure 11. Meeting Newell Platten at his book launch.



Figure 12. Borrowing every issue of *Architecture Review*.

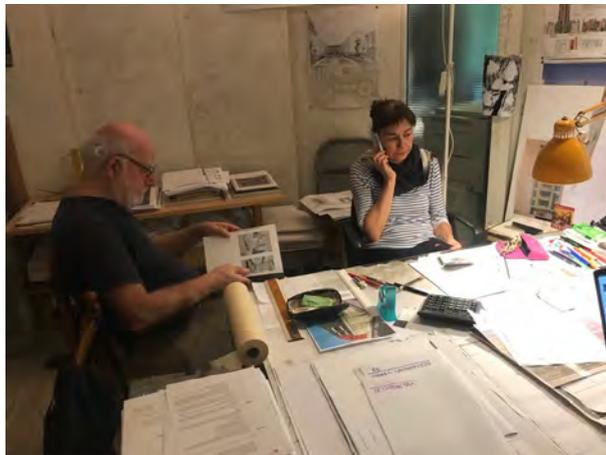


Figure 13. Meeting Bruno Morassutti's daughter in Milan.

Action!

All these fragments of information build up a web of tools and tactics (acting props) which can be applied during the design process (performance). With all the research about Dickson at hand it is now time to channel it into the design of new form. This performance is about to begin...

Conclusion

This work presented here is the property of an individual designer, who seeks a process to engage everyday ordinary histories in practice.

Reviewing the aims of the research described in this paper, one possible critique could be that the work might be regarded as 'hermetic' due to its design research modality. Reverse engineering the design research in this paper towards yields three possible responses to this critique.

We are aware that design can appear to be a closed process, personal in nature and ad-hoc. However, considering the work as hermetic would be a misreading. On the contrary, we would argue that much of adaptive reuse in contemporary practice is hermetic in relation to intangible heritage. This paper, by contrast, intends to render explicit the designer's method, exposing implicit and intuitive methods of design.

Another way to view the contribution of the work is not through its process but through its design output. Here the output of the process is what matters rather than the process itself. Of course, this leads to the conundrum of what is considered a good output versus one that is bad, and who

gets to decide. The contribution from this perspective possibly can only be answered in time or in retrospect through dialogue and critique.

If we set aside the designer's method and the value of the design output as avenues for a contribution, we find the work also proposes a mode of reading and observing the existing built environment.

Umberto Eco developed the concept of the 'open work' in his writing about interpretation of art. Applied here to architecture, existing buildings are 'closed' entities when they function, but as a building approaches obsolescence and then undergoes adaptive reuse, the building transfers to an open work of sorts, requiring a new ending.

Every performance exploits the composition, but it does not exhaust it. Every performance makes the work an actuality, but is itself only complementary to all other performances of the work.²¹

Conceptual tools like 'oblique questioning' aim to open new ways of seeing existing buildings and their original authorial intentions.

The contribution of this work sits somewhere in between these three different responses to the question of the hermetic, seeking to advance a form of 'critical adaptive reuse'. In sum, this inquiry presents a critique towards adaptive reuse and the limitations of its current methods for dealing with intangible heritage.

Endnotes

¹ Scott, Fred. *On Altering Architecture*. (London: Routledge, 2008),11.

² The functions include: a student union bookshop, two refectories (cafeterias), kitchens, a bakery, games rooms, university union offices, student club offices, bank, record store, art studios + darkroom, squash courts, gallery event space, forum shaped theatre, function rooms and a 16mm film cinema.

³ "(E) it demonstrates a high degree of creative, aesthetic or technical accomplishment or is an outstanding representative of particular construction techniques or design characteristics"; or

⁴ "(G) it has a special association with the life or work of a person or organisation or an event of historical importance".

⁵ Goad, Philip, and Hannah Lewi. 2019. *Australia Modern: Architecture, Landscape & Design 1925- 1975*. (Melbourne: Thames & Hudson), 258.

⁶ The first category of questions focusses on the built artefact itself, and how its form and aesthetic qualities can be understood, aiming to give the edifice itself a form of agency. This aligns with a *materialist* approach to architecture.

⁷ The second category of questions seeks to open up the archive surrounding a building as a source of design inspiration. This could include the archive of the architect who designed the building, or the archives of the client or other parties connected to the building. This aligns with a *historiographical* approach to architecture.

⁸ The third category of questions seeks empower the designer to make use of their own experience and memory, becoming an additional actor within the temporality of the building. With its basis in an experiencing subjectivity, this category can be understood as aligned with a *phenomenological* approach to architecture.

⁹ He was employed by the University as Warden, taking care of student-related affairs and management of the University Union. Middenway was the closest person connected to the project, involved in the whole process from design to construction.

¹⁰ This was a competition entry for the rethinking of memorial park which was on the site of the former Gestapo headquarters adjoining a section of the Berlin Wall. This place was also the site of a torture chamber employed during World War 2.

¹¹ The designer's intuition is used in carefully composing and translating the mnemonic artifacts into architectural form. The viewport of Rhino 3D is the picture / cinematographic frame used in this process.

¹² Historical pastiche can be high if aesthetic considerations are not considered critically. Pastiche can create a superficial environment where the timeline of history never happened.

¹³ Critical demonstrations of this include the turret at the Wexner Center for the Arts by Peter Eisenman and the mesh sculptures by Edoardo Tresoldi.

¹⁴ Glendinning, Miles. *The Conservation Movement: A History of Architectural Preservation: Antiquity to Modernity*. (Abingdon, Oxon: Routledge, 2013), 77.

¹⁵ This involved visiting numerous archives at the University of Adelaide, The State Library of South Australia and the archives held at the Architecture Museum at the University of South Australia.

¹⁶ “I sense Light as the giver of all presences, and material as spent Light. What is made by Light casts a shadow, and the shadow belongs to Light.” (Louis Kahn) and “Architecture is the masterful, correct, and magnificent play of volumes brought together in light.” (Le Corbusier).

¹⁷ Lead architect for The Lady Symon Building and War Memorial Cloisters (1926-1927); and The George Murray Building (1936-1938) and the original student union buildings.

¹⁸ This design iteration, although the concluding one, has been steadily advanced in the background of the others. The immersion into the life of another designer is not straightforward. It was built upon progressively over the course of the thesis. A hypothesis connected to this process is that conducting this process of preparation under these categories is easier to achieve with an older postwar architect like Dickson than a contemporary architect, because the pool of influence and inspiration to track is smaller. This is unlike the contemporary architect, due to the internet has a wider pool of possibility influences. Removing the internet from the equation leaves a limited historical data set.

¹⁹ Key interviews include: Newell Platten, long term firm partner; Nigel Dickson, his son who is also an architect living in Sydney; Pam Phillips, Dickson’s Partner at the end of his life; Matthew Hardy, Dickson’s longest employee living in London; Rachel Hurst, Dickson employee and subsequent historian on his farm’s architectural influence and Ralph Middenway, the university client from the union house redevelopment and eventual close friend.

²⁰ Between 1955 and 1957, Dickson travelled to the United Kingdom and Italy.²⁰ His time in Italy was especially influential towards the development of his outlook on design and his tectonic sensibilities. In London, Dickson worked for Maxwell Fry and Jane Drew, where he also encountered Denys Lasdun, before moving to Milan to work in the design studio of Angelo Mangiarotti and Bruno Morassutti.

²¹ Eco, Umberto. *The Open Work*, ed. Anna Cancogni (Cambridge: Harvard University Press, 1989), 15.