

Abstract

Behind every site is an unseen history. Before us, countless people have lived their lives through an ever evolving environment. This research examines how a process of uncovering site specific architectural and cultural histories using virtual reality can facilitate for the development of a design intervention that builds upon former histories of the site.

This has been done through a process of digitally unveiling traces of historic architectures, using notions of palimpsest and pentimento.

Palimpsest and pentimento are terms from art and literary studies which are concerned with the physical traces of historic processes left on parchment and canvas, the reworking and adding to a new piece that reflects what was before. Palimpsest as an architectural theory is somewhat related to ideas of historicism in 1980s postmodernist architecture.

This research was undertaken initially through conventional historical research using archival plans and photographs of former buildings on the site. These were obtained from sources such as the Wellington City Council and National Library of New Zealand in order to accurately determine what has previously existed. This history was then visually represented in three-dimensional digital models and overlaid onto a model of the site. By digitally rebuilding each built intervention, users can occupy each phase separately or simultaneously in a virtual reality environment. This full scaled model enables an accurate visualisation of how the historic architecture really existed. Ideas such as scale, phenomenology, depth, form, and detail can be represented in virtual reality in a way that allows a greater understanding than simple flat images and plans.

This process then leads to a way of developing an architecture based off what made the previous buildings successful. Once Again using virtual reality, this time as a design tool, to root the new building in to its historical context, creating a deeper architectural experience.

Developing this process of using the history of a site as a tool for generating a new architecture allows for a greater meaning of the site, and for a deeper meaning to the architecture.

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Objective

The objective of this project was to develop a process of designing a building by exploring the known spatial, architectural and cultural histories of a site in order to create a contemporary architecture, sympathetic to and inspired by site specific history.

Manifesting previous histories in an apparent way through new technologies, so as to allow a greater understanding of what has been before, and use this knowledge to create a new architecture using old architectural theories.

Research Question

The primary question considered in this research is to do with how best to manifest the architectural and cultural histories of the site, how to allow for the best way of understanding these histories, and how to develop a design intervention that builds upon the former histories of the site in a meaningful way.

Can a process of uncovering site specific architectural and cultural history using VR visualisation allow the development of a design intervention that builds upon the former histories of the site in a meaningful way?

Introduction and Theoretical Framework

Palimpsest and Pentimenti

As a way of representing layers of uncovered history, notions of palimpsest and pentimenti were used as a way of creating "physical" traces.

A palimpsest is a physical item. Conventionally, it is the term for a manuscript or similar writing surface on which other layers of writing have been superimposed over time. As parchment was prohibitively expensive in historic times, this reuse was often done as a matter of necessity, and as such the layers on the parchment tend to have little relation to each other.

The word palimpsest is derived from two Greek words via Latin. *Palin*, meaning again, and *psēstos* meaning rubbed smooth. A palimpsest is now more commonly understood as something reused or altered that still bears visible traces of its previous histories.

A pentimento (plural, pentimenti) is similar to a palimpsest in that it is a trace of a prior layer, yet there are a few key differences. Pentimenti are traces beneath layers of paint on a canvas, showing where the artist changed their mind on the composition or on a detail of the painting. This is often mistakenly confused to be simply an artists underdrawing or the reuse of a canvas for a different painting. However, the key point of pentimenti is that it reveals where the artist changed their mind. Coming from the Italian word for repentance, it shows where the artist improved upon the composition or a detail; building upon the former layer to create a more appropriate new form.

Palimpsest in Architecture

Palimpsest as a theory was first postulated in architectural discourse in the early 1980s by landscape architect André Corboz in *"The Land as Palimpsest".*

"The land, so heavily charged with traces and with past readings, seems very similar to a palimpsest." (Corboz 33)

In this, Corboz compares landscapes with a palimpsest in how the land is used over and over again by successive generations for different uses.

Since this, palimpsest has been used as both a theory and a tool by numerous other architects such as Peter Eisenman, Herzog and De Mourn, Carlo Scarpa, David Chipperfield, and even locally, such as by Wraight + Associates. While some of these architects explicitly reference palimpsest as a design theory or tool, others do not.

Pentimenti as an architectural theory is not something that is commonly used. However, very similar ideas of reworking upon previous layers, effectively equivalent to how pentimenti is used in this project, have been done before. Examples where ideas resembling this same theory are used without overt reference to palimpsest or pentimenti itself, include the 2012 Serpentine Pavilion by Herzog and De Meuron, with a local example also including Waitangi Park in Wellington, New Zealand, by Wraight + Associates.

For their 2012 project of a temporary pavilion at the Serpentine Gallery, Herzog and De Meuron referenced the foundations of previous Serpentine Pavilions, and incorporated the building footprints into the design. Cutting down into the earth, Herzog and De Meuron used the formerly "physical" traces of previous designs as a strategy for establishing the form of the future architecture (Hobson, sect. 3).

Although there does not appear to be any overt references to palimpsest or pentimenti in any accompanying literature, Herzog and De Meuron employ similar techniques to the ones suggested in this thesis.

The traces of the pavilions that formerly occupied the site no longer existed, and the site was treated as a palimpsest, layering the plans of the previous architectures on top of each other. Reworking of these traces into a new form as Herzog and De Meuron have done, is very similar to the process suggested in this research. The limitation of this precedent is that the project is simply a pavilion, and therefore the architecture is less functional than the design proposed in this research. Additionally, due to the nature of the Serpentine Gallery's pavilion programme, there is little relation between each design. In this research the process was used for a site where the history of the buildings share somewhat common uses. The relation between the form and function of the building are somewhat more similar than a pavilion, where an interesting form is paramount.

However, the process used by Herzog and De Meuron is a successful one that can be adapted to work in this project.

A local precedent that uses a similar idea of revealing site history in a subtle way, is Waitangi Park by Wraight + Associates, located in Te Aro, Wellington. In the park, historic elements such as Waitangi Stream, which was previously underground, and a graving dock, outlined in the park by a lowered garden with walls clad in corten steel, evoking images of ship building or hull cleaning, which are both activities undertaken in a graving dock (Waitangi Park | Wā par. 6). This element is effective as it only adds to the overall design, while subtly referencing the history of the site in a meaningful yet useful way. The technique used in this way is more akin to how palimpsest has traditionally been used in architectural practice. Where this differs from a project such as the Herzog and De Meuron pavilion is in how the historic layers have been used.

Where Wraight + Associates reference particular features and transport them into a contemporary setting, such as the graving dock turned into a landscape feature, Herzog and De Meuron reference features more abstractly, *transforming* them into a contemporary architecture. Which reference is more apparent to a user of each architecture is debatable. Wraight + Associates example is more apparent as a feature while the historic reference may be less obvious, whereas the Herzog and De Meuron example is perhaps more abstract as a form, and thus more obvious as a reference.

Elements of Palimpsest

"Palimpsest in Architecture, Six Personal Observations", by Robbert Verheij is a useful piece of text that discusses and aims to define palimpsest in architecture. This text discusses the idea of palimpsest in architecture as a way of introducing "deeper, spatial, soft, poetic and philosophical values" (16) to architecture by analysing a series of different buildings. While Verheij himself admits that the analysed buildings tend to have some degree of archaeological or monumental value, he goes on to emphasise that he believes a concept of palimpsest can be used in new buildings, saying;

"It is not about creating a palimpsestuous aesthetic but to recognize its philosophy: a sensitive attitude towards dealing with the past, present and future. The palimpsest is about a delicate layering of the different stages of being through time: both as material and immaterial." (Verheij 163)

This is an important point to consider when discussing palimpsest. Palimpsest is similar to ideas such as collage, so by emphasising "*it is not about creating a palimpsestuous aesthetic*" (163), Verheij is talking about

other aspects of palimpsest, rather than any collage-like appearance.

Described simply, these elements are:

Place, elements that are "inscribed" within the buildings fabric through time. (34)

Reuse, architecture as a remaking. (58)

Memory, imprint of old, stimulating memory. (38)

Traces, where the distinction between old and new becomes blurred. (100)

Materiality, materials that age well, suggest depth, are local or historic. (120)

Dialogue, the moment when two or more elements meet. (140)

These are discussed in depth with examples of how each element is related to an architecture. A key difference between this project and his research, is that Verheij tends to assume more physicality of the historic features than was available on this site used in this research. This research is in effect trying to create a palimpsestuous architecture, where some of the elements defined are impossible, due to the lack of physicality. This research is not to do with archeology or historic conservation, as the history is not present in any physical sense, hence *virtual palimpsest and pentimenti*. The key focus to this project is the exploration of architectural and cultural histories as a driver of a new design, rather than an exercise in preservation or rebuilding.

This therefore means that some of these elements as they are defined by Verheij are irrelevant, and some of them are exceedingly important to consider.

Some of the elements that are most relevant include traces, memory and dialogue.

Traces and memory are similar, and somewhat hard to define. With a lack of any physical remains, the historic architecture exists completely as a memory, and thus the traces are obtained and understood digitally. Both memory and traces are more intangible than this however. As it is used in this project, the ideas of trace and memory are used to highlight the significant details of both the architectural and cultural histories.

Dialogue is an exceedingly important element in this project due to the lack of physical remains. By using the

palimpsest of the whole site, the history being worked with is very in depth, and therefore the dialogue is not only between the new and the old, but the new, the old, the older and the oldest. This history is layered very richly, and as such the dialogue between the different architectures had to be a key focus.

Some of the elements as they were intended are less relevant, although they can be used in a less literal sense. The ideas of place or reuse, for example, can not be taken literally as there are no physical items that can be recycled or imprinted upon. In this project however, using the traces of the architectural history in a digital realm could be considered reuse in a less literal term.

In addition to the elements identified, another feature of palimpsest in architecture that could be suggested is the idea of curiosity. This is not an element explicitly identified by Verheij, yet after studying a number of buildings, and designing a building through this process, it is apparent that they all share this trait.

Curiosity is defined as a strong desire to know or learn something, and it is believed that this is something suggested by a palimpsestuous architecture. In a piece of architecture such as the Herzog and De Meuron Serpentine Pavilion, the way palimpsest and pentimenti manifested in the buildings form suggests more to the design. Due to the unconventional form and details, it suggests to occupants of the building that there is something deeper to the architecture; that the architect made the decision for a reason. This leaves an imprint on the buildings occupants.

"...overlapping traces from successive periods, each trace modifying and being modified by the new additions, to produce something like a collage of time. It is the depth in an old city that is so intriguing. The remains uncovered imply the layers still hidden" (Lynch 171).

By building upon the history of the site, this same history is evident in the design, creating a richness to the architecture in a meaningful way.



Fig. 1: Process Overview

Overview of Process

The method used in this project was undertaken in three main phases, phase 1: historic research, phase 2: research analysis, and phase 3; design research.

Phase 1 began by identifying the architectural and cultural history of a site. This was done through conventional research, by obtaining plans from the Wellington City Council, and cross referencing this with historic photographs obtained from a variety of sources, such as the National Library of New Zealand and the Wellington City Council Archives. Cultural heritage was identified through a range of photographs, contemporary and modern texts.

Using this information, each building was rebuilt digitally in Rhinoceros 3D as per the original plans. These models were then imported into the gaming engine Unity in its entirety, onto the site. This allowed each layer to be occupied in virtual reality both separately and simultaneously to allow users to walk around the former buildings and understand what has been before.

This allows the user a greater understanding of what it was like experiencing the historic architecture, and enables relevant information to be extracted.

For phase 2, each layer of historic architecture was then merged together into an aggregate architecture,



Fig. 2: Tools and Strategies Used

highlighting the differences and similarities in the architecture.

Using VR, aspects of the physical and experimental architecture are then extracted and represented digitally, creating digital spolia. These architectural traces were then used as palimpsest and pentimenti as an inspiration for a new architecture as the third phase.

By doing this, what has been used on the site before can be critically analysed for its suitability for today and the future. Retracing the lines of what has been before and using the history as a guide.

Phase 1: Historic Research

Site History Context

The site chosen to demonstrate this process is a local site in central Te Aro, Wellington, New Zealand. Situated in a prominent position on the corner of Cuba Street, Manners Street and Dixon Street, all notable streets in both historic and contemporary Wellington. This site was chosen as it is a prominent site in the streetscape, yet is debatably known more for its previous buildings than the one that exists today.

Before European settlement, the area was inhabited by Te Ātiawa Māori, an iwi originally from Taranaki, from around 1824. At this time, Te Aro was a low swampy area, primarily covered in native vegetation such as flax and raupō (Menzies 3). Te Aro stream, an important source of water in the early history of the area ran through or adjacent to the chosen site. Because of this, Te Aro pā was located adjacent to the site, around the intersection of Manners Street and Taranaki Street today. During these times Māori used the stream for uses such as fishing and cleaning.

It can be assumed that there were little to no *physical/ architectural* traces on the site at this time. This is due to the fact that it was used in 1839, when two Wesleyan missionaries hosted the first Christian service in Wellington at this site. Additionally, it still appears unoccupied in photos from 1857.

A Wesleyan Church has existed nearby to this site, since the 1840s on Manners Street, to the present day church located on Taranaki Street which was opened in 1880.

The site as it exists today was first divided in the 1840 plan of Wellington, designating the site as Market Reserve 8, owned by the Wellington City Council. The intended use for the site at this time was to be a market place.

By 1865, what is assumed to be the first building was built on the site, Market Hall. This was a fairly simple building, rectangular with castellations and a clock tower. Five years after this in 1870, the first Royal Oak Hotel was built beside Market Hall on the same site.

Tragically, both of these buildings burnt down, along with many other buildings in the 1879 Opera House Fire. The year after this, in 1880, the second Royal Oak hotel was built. This too burnt down in 1898.

The building that existed longest on the site, and is the most well known of the buildings on this site was the third Royal Oak hotel, which was built in 1899. The building went through many alterations in its time, most notably in the 1930s and 1960s, when the interiors were redone. Notable changes to the architecture include the removal of some decorative parapets following the 1942 Wairarapa earthquake, and the replacement of the portico with a verandah in 1946.

Culturally, this hotel was recognised as the "best hotel in the colony" (Hewstone 46) in its early years, and inversely as somewhat sordid and disreputable in its later years. Overall, this building was held in a high regard for large amounts of its existence due to its architecture and prominent site. It was demolished in 1981.

In 1982, the hotel was replaced with The Oaks Shopping Mall, a somewhat ambitious retail centre by Warren and Mahoney Architects. This was well regarded at its time, winning awards (Warren & Mahoney Architects 61) and being referred to in the book, The Elegant Shed by David Mitchell as *"the most pleasing arcade in the country, extraordinarily gracious"* (71).

As of now, the building has been altered and neglected, allowing it to fall in to disrepair. The building is widely regarded as being dilapidated and of little remaining architectural merit. The site was identified for its potential for development in the 2040 City Council Plan.

Historic Research

The history of the site was identified through comprehensive conventional research. Sources include books, archival newspapers, historic photographs and resource consents.

The most valuable source of information was photographs obtained primarily from the National Library of New Zealand. Other sources of photographs include the Wellington City Council archives, the Wellington City Library, and books.

Generally the site had buildings that were well recognised, yet were not significant culturally in the same way as a church or civic type of building such as a town hall. As such, many of the historic photographs used in this research are photographs from events, general streetscape photographs, wider view photos zoomed in, or photographs of nearby buildings. While this is indicative of the prominence of the site in the city, it tended to result in photographs from similar angles.

This meant that particular parts of each of the architecture were more *known* than others. For example, the prominent corner on the intersection of Cuba Street and Manners Street has meant that a significant percentage of photographs are from this angle. Similarly, the Cuba Street facade is often represented, whereas the Dixon Street facade is rarely shown anywhere, resulting in a disproportionate level of focus on particular areas.

3D Modelling

Models of each of the buildings were constructed in digital software, primarily Rhinoceros 3D.

This was done initially by recreating the plan in 2 dimensions, where possible digitally drawing over scale plans, and following measurements annotated on the historic plans. Where plans were incomplete, facades were recreated from photographs, recreated to scale with known measurements.

For buildings such as the 1865 Market Hall and 1870 Royal Oak hotel, the only information obtained was a dimensioned footprint on a site plan, two photographs, and in the case of the hotel, only long distance photographs. However, other buildings such as the 1899 Royal Oak Hotel and the 1982 Oaks Shopping Mall had far more detailed sets of drawings available, and therefore enabled much more accurate models.

While steps were taken to ensure faithful reconstructions, some assumptions had to be made. In instances where no photos were found, such as the east facade of Market Hall, it had to be assumed that the west facade was similar, and thus it was duplicated without the doorway. Contrasting this, with buildings such as the Oaks Shopping Mall, more detail was available than was needed to build a sufficient model. For example, the types of bolts used for fixings.

The problem that arises with both of these cases is that the models can therefore be misleading to the user of the VR system, and assumptions made could influence the design of a new architecture. This issue was mitigated in this project as the research, modelling, and subsequent utilisation of the models was all done by the same person.

Should this process be replicated by a team of people, or on a more complex site, assumptions such as these could be difficult to keep organised Although this project focused primarily on using the system as a tool for generating a new architecture, to recognise the potential of the tool as a heritage conservation tool, this issue would need to be critically addressed.

The ethics of reconstructions for this reason is a key issue in similar fields of study, for example archaeology. In the book *The Cultural Life of Images: Visual Representation in Archaeology*, by Brian Molyneaux, the risk of misleading reconstructions is heavily discussed, and methods of more effectively representing uncertainties are discussed (26). Similar research reiterates this issue saying, "[assumptions] may give a viewer the impression that this is exactly how it did look, even though a large portion may be artistic interpretation" (Zuc et al. 7). As such, some methods that were used in this research include leaving unknown parts blank, or simplifying parts of the digital model.

Phase 2: Research Analysis

Aggregate Architecture and Virtual Reality as a Cognition Tool

Once all the models of each architecture were digitally constructed, they were then aggregated together in a digital model of the site, before being imported into a virtual reality system. The benefits of virtual reality, augmented reality, and mixed reality are being widely explored in architecture. Virtual reality (VR) is a computer generated simulated environment that can be experienced through a variety of ways, such as head mounted display (HMD) or simply on a screen in a first person or third person perspective. Some of the ways VR is used in architecture include for easy design mockups, as a communication tool to clients and designers, as a design tool itself, and many more.

This research uses VR in two different ways, these are as a cognition tool and as a design tool. At this stage the VR system is used as a cognition tool, functioning effectively as a 1:1 scale model that can be walked around and through.

The aggregate architecture was created by combining all the models as a way of easily highlighting similarities and differences in the various architectures. Doing so in VR allowed each model to be experienced either separately or





simultaneously. By aggregating these models on the site the dialogue between the different architectures became immediately apparent. For example, some of the similarities that were evident on this site include the regular window rhythms, or the emphasis the architecture provides on the Cuba street facade and the corner or Cuba and Manners Streets. Similarly, the differences in the architecture are highlighted, such as the use of vertical elements in some buildings contrasting with the horizontality in others.



While it is possible many of these insights could have been interpreted simply from seperate models alone, or even the primary plans or photographs, the noteworthy aspect of using the VR system with the aggregate architecture technique is in how immediately apparent it is to comprehend the dialogue between each layer. For example, the history of the site led to boundaries being slightly changed, and as such, the corners of the buildings do not always line up with the corners of the site. Again, if this process was used on other more complex sites, aggregating the architectures is also an effective way to locate historical architectures within a site.

Additionally, some things were far better understood through the VR system which would have been harder to comprehend using only plans and photographs. Some things that were not perceived until the introduction of virtual reality in this project include fully recognising the oversized scale of the early buildings, and experience of compression and release in the newer building. Returning to the primary sources with prior knowledge from the system revealed that these observations were already somewhat apparent, however this goes to prove that there is knowledge to be gained through using this method.

Moreover, this could prove to be an important part of the process on other projects, perhaps where models are made by a team and not the system user, or with less familiar styles of architecture.

Once the models are obtained, it is a relatively simple procedure to view the models in virtual reality, and the unparalleled insights in to things such as scale and dialogue, that can be immediately understood makes this phase very effective.

Although augmented and mixed realities were explored, virtual reality was decided upon for this research due to the site conditions. With its inner city location and a building still existing, the site was better suited for recreation in virtual reality, as the overlaying of the virtual buildings would make it hard to digitally remove the existing context.

Originally it was the intent to include the nearby architectural context as three-dimensional models in the VR system, either manually modelled or with simple forms such as extruded footprints obtained elsewhere. This was not progressed in this research as it was deemed overly labour intensive for an individual. However, also for this reason, virtual reality was used due to the site conditions meaning that contemporary architectural context would also need to replace current day context. As such, virtual reality was the obvious choice for this site. Alternatively, if this process was used in a site that was cleared, remote, or with little to no historic change to the architectural context, augmented or mixed reality may be the preferred option, allowing the system to exist easily within the landscape.

Virtual reality was also selected due to its potential in creating an extremely immersive environment. In this research, the three-dimensional models were detailed enough to give a good representation of what existed, yet they were not comprehensive. To create a perfect example of what truly existed is incredibly resource intensive, and may be near impossible.

A recent paper presented at a 2018 conference for The Society of Architectural Historians Australia and New Zealand (SAHANZ) discusses the legitimacy of a similar idea, how *"immersive digital experiences of space help us to recapture 'authentic' experiences of history and place"* (De Kruiff 113). This paper refers to the recreation of a temporary pavilion from the 1937 Paris World Expo in virtual reality. The key learning of the paper is aiming to develop the *"first step to move beyond virtual reconstructions for the purpose of architectural documentation or information delivery into embodied* experience for holistic understanding of a building's experience and embodied discovery" (123).

The research develops the virtual reality experience to a far higher level of detail and immersion than this project, and even still questions its own limitations saying, *"Without emulated smells of 1937 Paris air, the feel of the marble floor, and the touch of a breeze, how realistic can any emulation of the Paris World Exposition be?"* (116).

Digital Spolia and Virtual Reality as a Design Tool

After identifying relevant information of physical traces of the architecture, it became an issue of how best to represent these aspects. The technique that was employed for this was an idea of digital spolia.

Traditionally, spolia is where repurposed building materials, typically stone, was used for new constructions elsewhere. Derived from the Latin word for *spoils*, as in *spoils of war*, spolia typically refers to ancient or medieval examples. However, spolia does not necessarily need to refer to ancient or destructively obtained materials, and spolia can be used as a term for something recycled from one architecture to another.

The term coined here, digital spolia is therefore used in a similar way. Digital spolia is the term introduced here for key architectural elements extracted from each of the layers of architecture, repurposing them into pentimenti of the architecture from the site. Digital spolia is effectively the traces of each architecture that was deemed significant from the learnings gained from the virtual reality experience of the aggregate.



Fig. 5: Digital Spolia

The main spolia that were initially extracted included physical and more abstract entities. Things such as window placements, ornamentation, and building footprints made up the original physical traces whereas more abstract qualities such as entries, internal/external spaces, and ideas of hierarchy were represented as digital spolia. Abstracting this idea further, this digital spolia transformed into the traces of previous architectures on the site, resembling the lines of palimpsest or pentimenti.

Using these traces, a new three dimensional model was created. In this model, an array of lines were arranged showing the shape and form, as well as highlighting important details of each of the historic buildings. These lines are presented without any hierarchy, providing a wealth of information.





This model was then combined with the aggregate in virtual reality to allow for greater exploration and understanding of the model, and of the architecture of the site. This model allowed for manipulation of layers, allowing the user to easily compare the different buildings to each other, and highlight what details were extracted for the digital spolia and pentimenti. Here, virtual reality is used as a cognition tool once more; using virtual reality to view models, comprehend models, extract from the models, and once again understand from the adapted pentimenti model. In this next phase however, virtual reality was used as a design tool.

Virtual reality can be an effective design tool for similar reasons as to why it was used as a cognition tool. The ability for easy 1:1 scale visualisation of ideas allowing for experimentation and comprehension of design interventions is unparalleled.

At this stage however, initial design interventions were attempted, to limited success, as the designs still felt like a somewhat superficial inclusion of historic elements. However, lessons learned by these attempts proved to be invaluable to the later designs.

Initial attempts aimed to use the newly created pentimenti to generate a design. How this was less successful, was in how it over emphasised the two dimensional plans, which dominated the design. While it was always the intent that the pentimenti would play a significant role in the design, the central point of pentimenti itself is in fact the reworking of an idea, not poorly rehashing the original concept.



Fig. 7: Early Design Attempts

Other design attempts involved imposed *rules* working the different models in different ways; for example, additive and subtractive techniques to establish the first concept, before developing the design more. As with the previous attempts, these early experiments felt somewhat superficial and did not result in a particularly attractive design.

Phase 3: Design Research



Recreating the Experience





With early attempts feeling superficial, more thought and research was done in how best to develop the information obtained into a coherent architecture. This is another area where virtual reality as a design tool was particularly effective.

By placing less emphasis on the physical traces and more on the intangible memory of the architecture, a significant result was developed. This was done by referring back to the research of the buildings and VR system, and identifying not only physical traces of architecture, but nodes of cultural significance that existed within the buildings. Using these nodes as intangible volumes of space, meaning could be assigned areas that were more phenomenological than physical.

Following this, teachings from Space Popular Architects on their lessons for architects on designing in virtual

Fig. 8: Experiences Recreated

reality, a method of 'designing backwards' was used. Space Popular teach an "inside out" approach to designing with virtual reality, *"designing an experience first, then constructing architecture to deliver it"* (Lesmes and Hellberg, "Human Behaviour" 10).

In a similar way, this process was used to bring the cultural and architectural history into the VR system, to be developed into a new design; by allowing the experiences of the historic architectures to inform, and then reconstruct as new.

The VR system was used once more as a cognition tool, here used again to identify the experiences of the historic architecture within the pentimenti; the difference here providing less emphasis on the walls making the room, but more as walls embracing space for grandeur and comfort, for optimism, or for opportunity.

Identifying what the experience was in the original buildings, distilling the notion of what the experience was, and how it was created, led to a clearer way to develop the history into an actually meaningful architecture without simply rebuilding walls in the same place.

Subsequently, virtual reality was then used as a design tool, identifying where the architecture could be

constructed to deliver the intended experience, reworking the physical traces like pentimenti.



Fig. 10: Pentimenti and Experiences Recreated

A New Layer to the Palimpsest

As a result, reworking the experiences alongside the pentimenti allowed for a far more organic design process. Naturally, the experience of a building 150 years ago need not be completely relevant for a design for the present day, however the principle of an aspect can be. The essence of what a design embodied can be abstracted into an applicable design for today. The architecture in this project was worked to a developed concept design.

The pentimenti extracted from the digital spolia of the aggregate architecture formed an underdrawing for the physical architecture, while the nodes of former experiences led to the new experiences of the architecture.

This resulted in a natural feeling design process, where design decisions were informed through the process. For example, designing a prominent corner and Cuba street entry was an obvious choice, as evident in the historic architecture, and as such these were designed to reference former traces. Details such as the exaggerated scale, depth of window reveals, and rhythmic placement of elements such as windows and columns. Returning to elements of what makes a palimpsestuous architecture as suggested by Verheij (162), the architecture uses some of these principles. It could be argued that all six principles; place, reuse, memory, traces, materiality and dialogue, are all evident in this design. While the idea of place refers to the idea of elements inscribed within the buildings fabric through time, reworking the pentimenti for the physical architecture incorporates the changes time had on the original building, therefore inscribing time into the whole design. Memory is similarly incorporated in to the building through the recreation of past experiences.

Other ideas such as dialogue and reuse were incorporated more abstractly, with the idea of using digital history as the driver of a design process being similar to the idea of reuse, and the combined history of the aggregate architecture meaning the dialogue was worked in to the whole process.

Ideas such as materiality were introduced in this building in a slightly different, yet still valuable way. The suggestion was originally to use materials such as brick or stone that would show age and time, however, in this design materials that suggested depth in other ways were used.

For example, translucent glass over walls and window openings were used to suggest depth in different places,

and the dialogue between different layers. Similarly, the idea of layering facades through details such as aluminium louvres, and glossy facades suggests the inclusion of more depth to the appearance of the building, inside and outside.

This combined idea of reworked experiences creates a depth to the phenomenological architecture, while the visual depth and detail to the building suggests more to the architecture; palimpsestuous both in appearance and experience. These all speak to the other idea of palimpsest in this research, curiosity.









Findings and Discussion

Upon reflection, this research establishes an effective way of designing a piece of architecture that references the sites history in a meaningful way. The tools and techniques used in this research produced a compelling result which high potential for further research.

This process is valuable as it is allows for the history of a site to manifest in a new architecture. Historic architecture is important in a city due to depth it adds, and the feelings it evokes in its users. When some of this historic architecture is lost, residents of a city can feel a tremendous sense of loss.

"This sense of loss, of the past and of the heritage of things that were familiar, it's intimidating because you're not quite sure where to start. ...It's as if you've been made a stranger in your own home town."

- Tippett (Hometown Boomtown)

Where historic architecture is at risk of being lost through economic, social, or natural risks, this process of reworking the past through notions of palimpsest may be an effective way of designing in key site; for example, sites in Christchurch where heritage buildings were destroyed by earthquakes. In Wellington, large amounts of historic architecture was lost in the 1980s construction boom and the remaining architecture is increasingly at risk, especially from the threat of earthquakes. As such, this process of recapturing the history as generator of a new design could prove to be a valuable tool.

One particular aspect of this process that could be improved upon to better create a streamlined, effective process, is in the initial modelling. Currently, it can be a particularly time consuming endeavour due to a number of inefficiencies that could be mitigated. The main parts of the process that could be streamlined without diminishing the quality of the research is in the initial modelling of the historic architectures, and the interface between using the VR system and creating the new architecture. Manually building a detailed three dimensional model from incomplete information was undoubtedly the most laborious part of the research. Although a great deal of understanding was gained from personally plotting every surface in every model, less time in this phase of the process could have benefitted the overall process. In future work on this process, more efficient ways of constructing these initial models could be explored. One

such example could be through using photogrammetry, which is a process of fabricating a model from a collection of photographs taken from different angles which can automatically build a three-dimensional digital model. This is something that was considered early on in the research but was not utilised. This was due to the decision to have a consistent modelling technique in all models, and photogrammetry really only best suited to buildings which still exist. Therefore, in the case of buildings with limited photographs, the models would have needed to be manually constructed regardless. Perhaps the most realistic option for streamlining this phase would be outsourcing the "manual labour" required to a more skilled modeller. This however would result in a lesser understanding of the historic architectures. As it was, in this research less detail was included in models than would have been preferred, with some models being incomplete in certain areas.

However, if this model building was outsourced or similarly generated to a very high level of detail, then the pentimenti and VR phases of the process could be more heavily utilised, potentially compensating for the lack of understanding otherwise obtained from manually modelling. Other ways this research could be further developed or expanded upon could include automatic generation or identification of aspects of the process. Similar to photogrammetry, artificial intelligence could be used to construct models based off input data such as plans and photographs. As this technology is still in its infancy, this route was not explored in this research. Artificial intelligence also has the potential to be used to identify significant parts of a buildings design, automatically extracting the digital spolia and pentimenti. This would further streamline the process, allowing it to be used more widely.

Additional work on developing the virtual reality system as a standalone heritage preservation tool could also be explored. In order to do this, more emphasis would need to be placed on the accuracy of the models. What would make the system incredibly useful, would be if threedimensional models were stored by archives and libraries, in the same way plans and photographs currently are. Additionally, if councils were to store future building information models (BIM), an archive of three-dimensional models of the entire cities history could be kept. If this was the case, it would result in this process being extremely viable, as a large part of the process would already be complete. The limitations in this are the same as those identified above, although with new buildings BIM models being archived, and key historic buildings models being constructed, it is believed this could be highly possible. One issue that could arise from this is the storage and management of digital models. While photographs and plans are able to be stored fairly easily, three-dimensional digital media formats may require more upkeep as software changes. This is a wider issue than can be addressed in the scope of this research.

As well as historic conservation, a virtual reality system of the architectural history of a city could have the potential for an extremely wide range of uses, such as tourism, movie making, game design, and undoubtedly many more.

One aspect of the process that could be improved upon in the future is through the disconnect of the interface between the virtual reality system and in designing the building. Although many of the design decisions were made in virtual reality with a head mounted display, actually constructing the digital models of the new design were done without an HMD. This was primarily due to limitations in software and personal ability. Currently, modelling software in virtual reality is in its infancy, and as such this was outside of the scope of this research. Should this process be repeated sometime in the near future, it is expected that it would be possible to do all design inside the VR system. This would likely be beneficial to the design, although the biggest benefit would likely be in streamlining this process.

Although the method of using virtual pentimenti as a physical trace had a generally favourable outcome, one key limitation exists in this and potential future projects. This limitation is to do with the boundaries of the site, thus disregarding potentially relevant information.

This limitation manifested in this project in a few ways. Due to the widening of streets since the original site was established in 1840, parts of some of the historic buildings traces were outside of the modern day boundary. This limitation was overcome in this instance as it was possible to incorporate these peculiarities into the design, such as with the first floor balconies.

However, other important aspects of the site where physical traces were not within its physical boundaries can have significant impacts on the sites cultural history. For example, Te Aro Pā is a significant part of the sites history, yet since there were no physical traces on the site, it was hard to incorporate into the design. Attempts were made by establishing an open, landscaped area on the north east corner of the site with space for congregation and market stalls, trying to relate to the scattered layout and use of the kāinga. However, this is more of an abstract interpretation and does not address the lack of physical traces, so may be felt as more of a token gesture. With a more developed design intervention, this could be addressed further.

If the design process was to be repeated, more emphasis on recreating experiences from the initial concept designs should be explored. The idea of identifying and recreating experiences was not introduced until some formal design attempts had already begun. With more of a focus on replicating phenomenological experiences from the beginning, it would be interesting to see how the design could develop differently.

Conclusion

In conclusion, the value of this research stems from its exploration of history as a driver of design, testing theories of palimpsest and pentimenti in architecture, investigation of virtual reality as a cognition tool and as a design tool, and using ideas of working "backwards" from an experience.

The process developed in this research revisits existing architectural theories of palimpsest and expands upon them using new technologies such as virtual reality, introducing strategies such as aggregate architecture, digital spolia. The process then works to develop a new design, recreating experiences from history into a new architecture, again using virtual reality as a tool for designing inside out to create a deeper piece of architecture.

The treatment of historic research in this thesis leads effectively to the development of a process for understanding and utilising valuable information to design a new building. History as design inspiration is an idea that has been utilised effectively in architecture before, and this process introduces a series of techniques for using virtual reality as a way to do so in a meaningful way. Furthermore, the ability to experience historic architecture in virtual reality was similarly a fascinating exercise that allowed for greater understanding of the buildings, as well as creating potential of the system itself as standalone outcome, perhaps as a form of historic conservation or other such tool.

Palimpsest as a theory is an idea that has existed as a way of creating a deeper architecture through representing historic ideas of a site in a new architecture since the 1980s. However, this research expands on more recent ideas of palimpsest through three-dimensional computer modelling. Furthermore, coupling ideas of palimpsest with pentimenti allowed for greater use of the raw information, as the reworking of the base lines was a key theory in this research. Additionally, employing notions of palimpsest and pentimenti digitally allowed for an effective way of extracting information employing new concepts such as aggregate architecture and digital spolia. These concepts allowed for a way of utilising the information obtained from digitally representing the palimpsest of the site. This meant that the process revisited an established theory that fell out of favour and reworked it with new technology.

The method of identifying an experience of a history in virtual reality, that is the designing "backwards" to recreate the experience, was similarly a compelling exercise which

could prove to be an effective way of utilising new design techniques in the future of the architecture profession, with a range of new tools and technologies.

Overall, this thesis worked in developing a process of designing an architecture which represents history in meaningful way, through a reworking of established architectural theories, using new technologies.

Bibliography

Corboz, André. "The Land as Palimpsest." *Diogenes*, vol. 31, no. 121, Mar. 1983, pp. 12–34. *SAGE Journals*, doi: 10.1177/039219218303112102

De Kruiff, Alison et al. "Learning from Lost Architecture: Immersive Experience and Cultural Experience as a New Historiography" *Historiographies of Technology & Architecture, Victoria University of Wellington, 4-7 July 2018,* Edited by Merwood-Salisbury, Joanna, Dudding, Michael and McDonald, Christopher, SAHANZ, 2018, 113-126, *SAHANZ* <u>https://www.sahanz.net/wp-content/uploads/SAHANZ18_Proceedings-2-red.pdf</u>

Derrida, Jacques, and Eisenman, Peter, et al. *Chora L Works:* Jacques Derrida and Peter Eisenman. Edited by Jeffrey Kipnis, First Edition edition, The Monacelli Press, 1997.

Eisenman, Peter, et al. *Reconstruction, Deconstruction: Peter Eisenman versus Leon Krier: My Ideology Is Better than Yours*. Acad. Ed., 1989.

El Antably, Ahmed. "Experiencing the Past: The Virtual (Re)Construction of Places." ProQuest Dissertations Publishing, 1 Jan. 2011. tewaharoa.victoria.ac.nz, http://search.proquest.com/docview/928449428/?pq-origsite=primo.

Frampton, K. *"Towards a Critical Regionalism: Six Points for an Architecture of Resistance."* The Anti-Aesthetic: Essays on Postmodern Culture, edited by Hal Foster, New Press, pp. 17–34. *Talis Aspire*, http://www.ebook3000.com/The-Anti-aesthetic--Essays-on-postmodern-culture_43257.html.

Hewstone, John, et al. The Hotel That Sam Built. [Nelson, N.Z.]: J. Hewstone, 2008. Trove, https://trove.nla.gov.au/version/43684336.

Hobson, Ben. "Serpentine Gallery Pavilion 2012 by Herzog & de Meuron." *Dezeen*, 14 Feb. 2016, <u>https://www.dezeen.com/2016/02/14/</u>video-interview-serpentine-gallery-pavilion-2012-herzog-de-meuron-ai-weiwei-excavation-movie/.

Hometown Boomtown. Directed and produced by Reid, John, Plumb Productions, 1983

Kalay, Yehuda, et al. New Heritage: New Media and Cultural Heritage. Routledge, 2007.

Karasozen, Rana. "Experience of Post-Modern Historicist Architecture in Turkey." *Procedia Engineering*, vol. 161, Jan. 2016, pp. 1763–67. *ScienceDirect*, doi:10.1016/j.proeng.2016.08.773.

Lesmes, Lara, and Hellberg, Fredrik, "Tools for Architecture - Human Behaviour." *Issuu*, https://issuu.com/spacepopular/docs/ aa_inter_1_full_brief_spreads. Accessed 20 Sept. 2018.

Lesmes, Lara, and Hellberg, Fredrik, "Tools for Architecture - Visceral Interfaces." *Issuu*, <u>https://issuu.com/spacepopular/docs/</u> <u>aa inter 1 full brief booklet</u>. Accessed 21 Sept. 2018.

Lynch, Kevin. What Time Is This Place? MIT Press, 1972.

Marot, Sebastien. Sub-Urbanism and the Art of Memory / Sebastien Marot. Architectural Association, 2003. Roberts, Bryony. Tabula Plena: Forms of Urban Preservation / Edited by Bryony Roberts. Lars Müller Publishers, 2016.

Menzies, Erin, "Progress v Preservation: a history of Te Aro, Wellington," *New Zealand Transport Agency,* accessed March 30 2015, <u>http://www.nzta.govt.nz/assets/projects/wicb/resources/pdf/Te-Aro-History.pdf</u>

Mitchell, David. The Elegant Shed: New Zealand Architecture since 1945 / David Mitchell and Gillian Chaplin. Oxford University Press, 1984.

Molyneaux, Brian, and Theoretical Archaeology Group (England). *The Cultural Life of Images: Visual Representation in Archaeology.* London; New York: Routledge, 1997. *Trove*, <u>https://trove.nla.gov.au/version/43499572</u>.

Moneo, José Rafael, et al. Wexner Center for the Visual Arts, the Ohio State University: A Building / Designed by Eisenman/Trott Architects; with Critical Essays by Rafael Moneo and Anthony Vidler, and Introductions by Edward H. Jennings ... [et Al.]. Rizzoli, 1989.

Prieto, J. de la Fuente, et al. "Augmented Reality in Architecture: Rebuilding Archeological Heritage." *The International Archives of Photogrammetry, Remote Sensing and Spatial Information Sciences*; Gottingen, vol. XLII-2/W3, Copernicus GmbH, 2017, pp. 311–15. *ProQuest*, doi:http://dx.doi.org/10.5194/isprs-archives-XLII-2-W3-311-2017.

Rossi, Aldo, and Peter Eisenman. *The Architecture of the City.* Translated by Diane Ghirardo and Joan Ockman, Reprint edition, The MIT Press, 1984.

Rowe, Colin, and Fred Koetter. Collage City. First Edition edition, The MIT Press, 1984.

"The Palimpsest: A Collective Memory Recorded through VR." *Designboom* | *Architecture* & *Design Magazine*, 21 Nov. 2016, <u>https://www.designboom.com/architecture/the-palimpsest-interactive-architecture-lab-ucl-virtual-reality-11-21-2016/.</u>

Venturi, Robert. *Complexity and Contradiction in Architecture / Robert Venturi; with an Introduction by Vincent Scully.* 2nd ed., Architectural Press, 1977.

Waitangi Park | WĀ. http://www.waal.co.nz/our-projects/urban/waitangi-park/. Accessed 3 Mar. 2019.

Walsh, John March 30-, et al. *Last, Loneliest, Loveliest: 14th International Architecture Exhibition La Biennale Di Venezia /* Edited by John Walsh; Contributors: Mike Austin, Bill McKay, David Mitchell, Tony van Raat. *New Zealand Institute of Architects*, 2014. natlib-primo.com, http://venice.nzia.co.nz/media-resources/.

Wards, Ian, and New Zealand Historical Publications Branch. *The Shadow of the Land : A Study of British Policy and Racial Conflict in New Zealand 1832-1852.* Wellington, N.Z.: A.R. Shearer, Government Printer, for the Historical Publications Branch, Department of Internal Affairs, 1968. *Trove*, <u>https://trove.nla.gov.au/version/45597066</u>.

Warren & Mahoney Architects. Warren & Mahoney Architects, 1958-1989. The Architects, 1989.

Wergles, Nathalie, and Andreas Muhar. "The Role of Computer Visualization in the Communication of Urban Design—A Comparison of Viewer Responses to Visualizations versus on-Site Visits." *Landscape and Urban Planning*, vol. 91, no. 4, July 2009, pp. 171–82. *ScienceDirect*, doi:10.1016/j.landurbplan.2008.12.010.

Zuk, T., et al. Visualizing Temporal Uncertainty in 3D Virtual Reconstructions. p. 8.

Verheij, Robbert, "Palimpsest in Architecture, Six Personal Observations" Graduation thesis, Faculty of Architecture, Delft University of Technology, 2015