



THE UNIVERSITY *of* EDINBURGH

THE IMAGES OF SUSTAINABLE ARCHITECTURE

A REFURBISHMENT CASE STUDY

THREE RENOVATION PROPOSALS FOR AN ENVIRONMENTAL
EDUCATION CENTRE LOCATED IN BRIDGEND FARMHOUSE,
EDINBURGH

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MSc Advanced Sustainable Design

Advanced Sustainable Design Dissertation (ARCH11042)

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ESALA | Edinburgh College of Art | The University of Edinburgh | 2012-2013

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"Study nature, love nature, stay close to nature. It will never fail you."
Frank Lloyd Wright

FOREWORD

I would like to thank all the people who contributed in any way to the work described in this thesis.

First and foremost, I would like to express my sincere gratitude to my thesis supervisor, Professor Lisa Moffitt, for her guidance, useful comments, kind assistance and engagement during the process of researching and writing this dissertation. Her attention to detail and hard work have set an example.

I would like to show my great appreciation for Professor John Brennan, for his instructive teaching about sustainable architecture and his kind guidance during the whole year. I am grateful that he has introduced me to many interesting projects, amongst which, the Bridgend Farmhouse project.

I would like to thank Professor Dimitris Theodossopoulos for the valuable consultation in which he has shared some of his vast knowledge about conservation and renovation. I am also grateful for the many documents which he has sent me, which I have read with great interest.

Additionally, I would like to thank all the professors and professionals that have instructed and guided me during this year in Edinburgh.

I would like to thank the volunteers of the Farmhouse Renovation Group that have assisted me during my work: their chairman Mr. Will Golding, Mr. Jamie Ross and Mr. Chris Macefield. I appreciate their friendly support and the feedback that they have offered.

I am also grateful to the former inhabitants of the Bridgend Farmhouse, Mr. Harry and Mrs. Doris Darling, for the extensive conversation we had, in which they have provided me with so much valuable information that could not be found in any book.

Furthermore, I would like to thank my classmates and friends for their friendship and company throughout the year and during my daily work.

Last but not least, I would like to express my gratitude towards my parents, for their unconditional support and encouragement during the full curriculum of my studies in architecture.

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ABSTRACT

In a time where a myriad of approaches for and expressions of sustainable design exist, it has become difficult to see the wood for the trees. Especially when it comes to renovation, there is no clear consensus on how it could or should be approached. Many projects end up as a patchwork instead of resulting from consistent and informed decisions.

The assertion of this thesis is that sustainable renovation is about more than adding insulation and solar panels to improve quantitative energy efficiency. Research is done about how to achieve a more meaningful project. The thesis tries to establish a framework that can make the decision process in sustainable renovation more informed and purposeful.

First, the distinct theories about aesthetics, visibility and outlook are defined, in order to understand current sustainable architecture better. The theories are based upon the work of contemporary critics and researchers, such as Guy and Farmer, Hagan, and Williamson, Radford and Bennetts. From these theories, an objective scale of *seamlessness* was derived. This results into a first set of three parameters: very seamless (S1), medium seamless (S2) and not seamless (S3).

Second, several key theories from the 19th and 20th century about historic renovation are explained, amongst which the contributions by Viollet-le-Duc, William Morris, Alois Riegl, and Cesare Brandi. It is indicated that renovation projects are more complex than new projects as there are existing cultural, social and historical values that have to be preserved in order for the project to succeed. The *approaches towards renovation* discussed result into a second set of three parameters: returning to an earlier state (R1), keeping the present state (R2) and moving on to a next stage (R3).

The thesis concludes with a case study: the Bridgend Farmhouse in Craigmillar, Edinburgh. Although it is not a listed building, the farmhouse is a historic icon for the local community and people have formed a community action group in order to restore this building as an education centre for sustainable lifestyles. The values explained in the dissertation are certainly present. Instead of proposing just one design for the renovation, three proposals which expose the direct results of choosing three combinations from the parameter sets are suggested: a 'conserving' proposal (S1 + R1), a 'modulating' proposal (S2 + R2) and a '[sign]ificant' proposal (S3 + R3). This leads to a larger insight into the physical effects of each of the theories. It can serve as a valuable tool in the upcoming decision making process by the community group, and for other sustainable renovation projects in the future.

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CHAPTER 1: INTRODUCTION

1.1 Sustainability as a process

Sustainable architecture can be seen as the new paradigm of architecture. It can be considered the new grand narrative, what Jean-François Lyotard called *'les grands récits'* (Lyotard, 1979), in the history of architectural thought. Over time, the environmental agenda will probably become an inherent part of architecture and will become common day practice: in that case, the term 'sustainable architecture' will have become a pleonasm. Robert Stern suggests: "In 10 years we're not going to talk about sustainability anymore, because it's going to be built into the core processes of architecture." (2010, cited in Conniff, 2010) Like in any of the great movements in the timeline of architecture (Figure 1), architectural practice will take up the most valuable lessons learnt and hold on to the important progressions that have been made, but it will drop the more superficial characteristics. Important knowledge is kept but the often more extreme ideas and aspects don't survive. Hagan affirms that hard modernism and deconstruction have gone out of style (2001). This thesis suggests that environmentalism should not be seen as a narrative that will go out of style, and that sustainable architecture must find a way to become an inherent part of architecture rather than a stereotype or a trend.

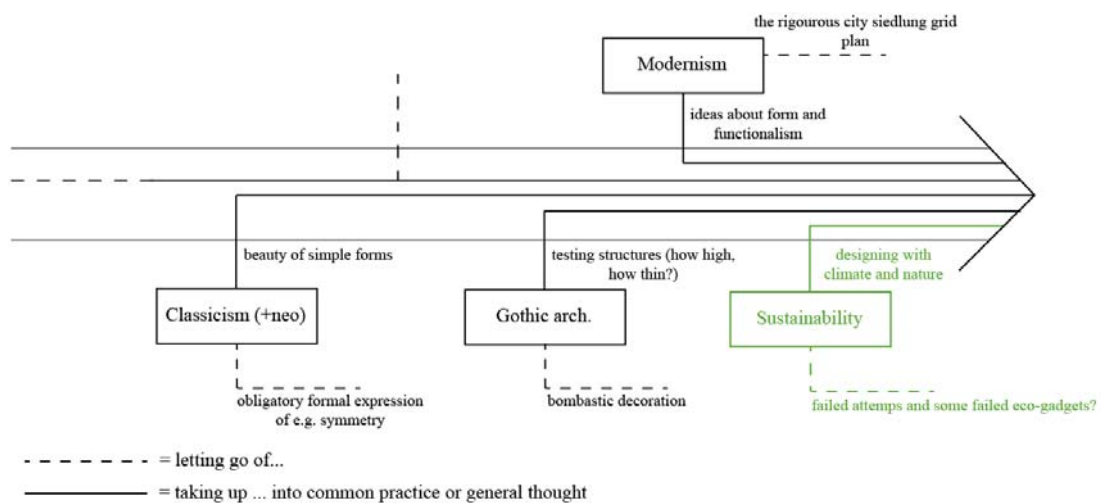


Figure 1: A simplified process of architectural thought, showing some of the great movements (by author)

However, the process is not always continuous and straightforward: sometimes some of the knowledge was lost at one point and taken back up later in history. For example, 'designing with climate' (Olgyay, 1963) and nature was already present in architecture since the start, as old vernacular buildings are often very climate-intelligent, and got partially lost with the

introduction of HVAC, when some very climate-ignoring buildings arose. This research encourages taking up those former strategies so that they can contribute in our current body of knowledge about sustainable design.

1.2 Title clarification

The title of this thesis, ‘the *images* of sustainability’ focuses on the dual meaning of the word image. On one hand it refers to how something (in this case, the sustainability of a building) is visually represented, on the other hand it refers to the mental impression or the popular conception people have about something. It originates from the Latin word ‘*imago*’, meaning both appearance and idea. The two meanings cover two main topics discussed in the work, which are the aesthetic representation of sustainable architecture and the importance of what people think of a building and how they feel about a building in order to make it function well. The word was also used in the famous work ‘*The Image of the City*’ by Kevin Lynch (1960), in the context of images and mental maps that people have of cities.

1.3 Motivation for the research

The research about sustainable renovation was initially motivated by three key concerns. The first concern is very general: from a lifecycle perspective, it is much better in most cases to renovate than to demolish and rebuild. Second, a problem concerning spatial planning in the UK was highlighted by the following quote: “[...] *needs to remove the big disincentive to refurbish empty properties and developing brownfield sites by lowering VAT from 20% to 5%. [...] This would liberate more than half a million homes and make some progress towards addressing the housing shortage without ruining our rural landscapes.*” (Lack, 2013, p.28) Apparently, not enough buildings are being renovated and too many landscapes are continuing to be filled with new developments. There is a dire need for good and thoughtful renovation work in the UK specifically in the years to come.

Third, this thesis would be an opportunity to research theoretical strategies for combining sustainability and renovation and their aesthetics and visibilities. There is an opportunity to define new strategies as a remedy for thoughtless patchworks and an image of sustainable architecture and renovation that is often being critiqued. Afterwards, these strategies could be applied in practice now and in the future.

1.4 Scope of the research, methodology and research limitations

The research aims to find a coherent theoretical and methodological framework and a holistic categorization system for sustainable renovation. Therefore, the dissertation will be mainly theoretical, although it will conclude with a practical case study.

Theories from both the sustainable movement and historical renovation theorists will be examined in order to try to find useful links between existing knowledge than can enrich the sustainable renovation process.

Chapter 2 will focus on theories underlying the current expressions of sustainable architecture. What are the approaches used? Why do certain expressions of sustainable architecture have a bad image? What is the effect on the outlook of the building? The chapter will present a relevant literature review and selection about the formal expression of architecture and its relationship to sustainability. The most important references include the contemporary books *'Taking Shape'* (Hagan, 2001), *'Understanding sustainable architecture'* (Williamson, Radford and Bennetts, 2003), *'Aesthetics of sustainable architecture'* (Lee, 2011) and *'The shape of green'* (Hosey, 2012).

A method for assessing the visual representation of sustainable architecture that can be used for sustainable renovation will be sought.

Chapter 3 will zoom in on the expression of sustainable renovation. Fundamental theories about historical conservation and renovation from the 19th and 20th century and their effects on the outlooks of buildings, will be distinguished. They will include the points of view of Eugène Viollet-le-Duc, William Morris, Alois Riegl and Cesare Brandi. The most important reference for this was *'A history of architectural conservation'* (Jokilehto, 1986). There are a lot of historical, social and cultural aspects to be taken into account in renovation projects, as is described in these theories and can be derived from the phenomenological discourse about places of Christian Norberg-Schulz (*'Genius loci: towards a phenomenology of architecture'*, 1980). How can they be respected sustainable renovation? The doctoral thesis *'Towards Sustainable Renovation'* (Botta, 2005) is one of the key resources of information. The chapter will aim to distinguish the basic categories in these traditions and theories that are still relevant to sustainable renovation today.

Chapter 4 will then try to combine the relevant parameters that were extracted from chapter 2 and chapter 3 and apply them in a design in practice. It will concern the traditional Scottish Bridgend Farmhouse in Craigmillar, Edinburgh. The research for this chapter included a

study of practical guidelines, books and legislations about renovating traditional Scottish architecture and an interview with a professor specialized in historic buildings (Theodossopoulos, 2013). It also included a more specific review of information provided by the committee members of the Bridgend Farmhouse renovation group, research about the community, several building and site visits, research for old maps and pictures of the building, and an extensive interview with the former inhabitants. These various approaches were necessary to gain an expertise as complete as possible about the historical and current state of the building.

With this information as a basis and starting point, three renovation proposals will be presented. Each proposal represents a different combination of theoretical parameters; they will link methodology and design outcome. These proposals will then be discussed and their qualities compared. As they serve as theoretical reflections, they are presented as conceptual designs only.

1.5 Contribution

The thesis aims to provide clear insights and make links across existing discourses that will be useful for the necessary sustainable renovation projects in the years to come. Specifically, the thesis strives to be a helpful link in the process of facilitating the Bridgend Farmhouse renovation. An attempt is made to show the renovation action group the aspects which they have to make clear decisions about when choosing the actual renovation plan and design in the future, by defining clear strategies and applying them on the design proposals. In this way, the thesis can be a useful tool, so that the group will be able to make a more informed and conscious decision.

CHAPTER 2: SUSTAINABLE ARCHITECTURE, AESTHETICS, IMAGES AND SEAMLESSNESS

2.1 Sustainable architecture and aesthetics: are they irreconcilable?

When we think of architecture from the modern movement, we think of plain white surfaces, large windows, open spaces and cuboid forms; when we think of deconstructivism, we think of ‘broken’ shapes and complex spaces. But when we think of sustainable architecture, a myriad of completely different looking forms and alternative visual expressions comes to mind. There are many manifestations of sustainable architecture. The photos in Figure 2 are all labelled as sustainable, but they all have very different outlooks. The reasons why this is the case, and the main theories which influence these designs, will be explained. This chapter will bring together the vocabulary and main discourses about the rather immeasurable part of sustainable architecture. This does not concern U-values but reflects how these buildings look like, how people feel about them, and which place they have in the history of architecture.

The research will start from criticisms that have been expressed towards sustainable design, mostly about its aesthetics. This will illustrate the complexity of good sustainable design, and bring up relevant issues. Should sustainability be visually expressed? In which ways can it be expressed? How do sustainable features and aesthetics relate to each other?



Figure 2(a-h): Alternative visual expressions of sustainable architecture
a) Commerzbank Tower, Frankfurt, Germany by Norman Foster; b) Fusionopolis, Singapore by Ken Yeang; c) Passive house nearby Paris by Krawitz architecture; d) West-African vernacular architecture; e) Hobbit House, Wales by Simon Dale; f) Dyssekilde ecovillage, Denmark; g) Lighthouse zero-emission home UK by Sheppard Robson; h) Eden project, Cornwall by Nicholas Grimshaw

Contrasting opinions exist among researchers and architects on whether or not sustainable design and aesthetics can coincide in a building design. Many believe that they can't and see green design and great design as two different aspirations. In 2009, architect Peter Eisenman said the following: “*‘Green’ and sustainability have nothing to do with architecture. [...] Some of the worst buildings I have seen are done by sustainable architects.*” (cited in Conniff, 2010; Hosey, 2012, p.2), and “*Some of the worst buildings I have seen have Gold, Silver or Platinum LEED certificates... and they are awful, architecturally. They are depressing...*” (cited in Jauslin, 2011, p.109). There is scepticism whether aesthetics can exist in sustainable design. It has a damaged image.

The criticism can be very harsh: “*Sustainable architecture justifies itself by claiming to be pursuing a higher truth [...] and justifies the production of [...] ugly buildings [...] to the creation of spaces and forms that are not particularly good for either the inhabitants or their surroundings.*” (Betsky, 2010, cited in Hosey, 2012, p.3)

These buildings are probably built by architects who see sustainability merely as a matter of quantitative benchmarks, who believe that U-values and CO₂-emissions have become the primary issue. Many believe that this ‘green agenda’ of buildings is ugly when visible and as a result it should be covered up and hidden.

These views raise a lot of questions. Should the environmental agenda of a building always be visible? If so, is it always ugly? Should this be covered up or should it remain recognisable as ‘green’?

Kenneth Frampton is a critic with a different opinion from Eisenman and Betsky. He declares that there is actually too much focus on aesthetics, especially in the current architectural academia (Frampton, 2011). He believes that the emphasis on individual creativity is detrimental to the full engagement with the issues of sustainability. The resulting buildings are aesthetically pleasing but are missing more sustainable potentials. He believes that environmental responsiveness and culturally stimulating buildings are *not* two different irreconcilable aims and that they should be both pursued in new designs.

The author of the book ‘The shape of green’ (Hosey, 2012), acknowledges that the sustainability and aesthetics often haven't amalgamated well: “*The ugly truth about sustainable design is that much of it is ugly. [...]* Even the most ambitious sustainable design

can be unattractive because attractiveness isn't considered essential to sustainability." (p.2) However he believes that it doesn't have to be this way: *"It will change. Striking examples of eco-design have appeared."* (p.5) According to him, they can and should be integrated together.

He encourages architects to balance them, and to be as intelligent about shape, patterns and colours (and their effect on people) as we are about mathematical benchmarks such as U-values.

The German architect Anna Heringer seems to agree with Hosey: *"For me, sustainability is a synonym for beauty: a building that is harmonious in its design, structure, technique and use of materials, as well as with the location, the environment, the user, the socio-cultural context. This, for me, is what defines its sustainable and aesthetic value."* (2011, p.9) For her, beauty is an inherent part of sustainability and they are fundamentally connected.

This is a common principle for many architects in the eco-design movement who are seeking to overcome shallow green design. They are trying to make buildings that are good for us and which we will care about, or as Hosey calls it: *"If it is not beautiful, it is not sustainable. [...] How long will something last if it fails to excite the spirit and stir the imagination."* (2012, p.7) They are trying to approach green design as a timeless quality with positive associations and not as a 'fashion' trend or style. Rafael Vinoly and Cesar Pelli agree with this approach: *"Sustainability has, or should have, no relationship to style"*, resp. *"Sustainability does not necessarily photograph"* (Hosey, 2012, p.5). Keith Bothwell regrets the unnecessary aesthetic and personal prejudices which compromise passively conditioned architecture and which often lead to failure of projects.

Some argue that sustainability and nature and climate have only become a part of architecture because it has become a necessity. Jauslin says that it was externally imposed because of this necessity and that this might explain why architects like Koolhaas, Eisenman and Pritz believe that sustainable architecture isn't beautiful (yet).

This view might contradict Marc-Antoine Laugier's 'Primitive Hut' (Figure 3), by which Laugier meant to say that the basic rules for constructions and the principles of architecture have been based on nature since the very beginning for making a shelter (Laugier, 1755).



Figure 3: The Primitive Hut (Laugier, 1755)

This section has illustrated that there are a lot of different opinions about how sustainability has been expressed up to this day and how it became a part of our discourse. This problem probably sources from the many different approaches that exist – there is not one ‘correct way’ of sustainable design that can be taught in architecture school.

2.2 The images of sustainable architecture: many images for one narrative

Sustainable architecture appears in many different forms and styles and at the moment these can be classified in different ways. This section will discuss the categorisations that have been made by Guy and Farmer (2001) on one hand and those made by Williamson, Radford and Bennetts (2003) on the other hand.

The classification of sustainable architecture that has been made by Guy and Farmer consists of six different ‘logics’. These authors define a ‘logic’ as “*a specific ensemble of ideas, concepts and categorisations that are produced, reproduced and transformed in a particular set of practices through which meaning is given to social and physical realities*” (2001, p.141). In other words, they have tried to distinguish six different approaches that result into different expressions of sustainable architecture. These approaches are summarized in Table 1 and a general description of them is given in Appendix A. In the following paragraphs, only their relevant visual outcomes will be discussed.

Table 1: The competing logics of sustainable architecture (Guy and Farmer, 2001)

Logic	Image of Space	Source of Environmental Knowledge	Building Image	Technologies	Idealized Concept of Place
Eco-technic	global context macrophysical	techno-rational scientific	commercial modern future oriented	integrated energy efficient high-tech intelligent	Integration of global environmental concerns into conventional building design strategies. Urban vision of the compact and dense city.
Eco-centric	fragile macrobiotic	systemic ecology metaphysical holism	polluter parasitic consumer	autonomous renewable recycled intermediate	Harmony with nature through decentralized, autonomous buildings with limited ecological footprints. Ensuring the stability, integrity and 'flourishing' of global and local diversity.
Eco-aesthetic	alienating anthropocentric	sensual postmodern science	iconic architectural New Age	pragmatic new non-linear organic	Universally reconstructed in the light of new ecologically knowledge and transforming our consciousness of nature.
Eco-cultural	cultural context regional	phenomenology cultural ecology	authentic harmonious typological	local low-tech commonplace vernacular	Learning to 'dwell' through buildings adapted to local and bioregional physical and cultural characteristics.
Eco-medical	polluted hazardous	medical clinical ecology	healthy living caring	passive nontoxic natural tactile	A natural and tactile environment which ensures the health, well-being and quality of life for individuals.
Eco-social	social context hierarchical	sociology social ecology	democratic home individual	flexible participatory appropriate locally managed	Reconciliation of individual and community in socially cohesive manner through decentralized 'organic', non-hierarchical and participatory communities.

The *eco-technic* logic relies on high-tech methods such as intelligent façades, dynamic structures and BMS controlled louvres. Externally, these buildings often have a high level of visibility: they usually display the newest technologies and material developments (Figure 4).



Figure 4: An intelligent façade (left) and perforated shading panels (right)

The *eco-centric* logic is expressed in a completely different way. Natural and minimally processed materials such as earth, timber and straw are mostly used. These are supplemented with reused and recycled materials only. Their degree of visibility depends highly on the context. In a context of buildings with many modern materials, the eco-centric building will be highly noticeable.



Figure 5: 'Earthship' resulting from the eco-centric logic

According to the *eco-aesthetic* logic, individual creativity, aesthetics and appropriate architectural forms prevail. These forms are created by computer modelling. Novel materials are used. 'Organi-tech' architecture and 'cosmic' forms can be categorized as eco-aesthetic (Figure 6). The curved lines are the eye-catchers of these designs.



Figure 6: Bridge designed by Future Systems (left) and Education City Convention Centre Qatar design by Arata Isozaki (right)

The *eco-cultural* logic is linked to regionalism and therefore it uses regional building styles, shapes and local building materials. The visibility of the sustainable goals can range from slightly to highly visible (Figure 7).



Figure 7: Design by Glenn Murcutt

For the *eco-medical* logic, creating a healthy indoor environment is the most important goal. The well-being of the users has to be assured and the materials, colours and shapes have to be chosen accordingly. Traditional building materials and earth colours might be visible aspects when they are applied (Figure 8). However, the visual difference between e.g. a potentially hazardous paint and a natural paint is often indistinguishable. This means that an eco-medical strategy might not be noticed by people.



Figure 8: The interior of a building made without any unhealthy materials

According to the definition of the *eco-social* logic, sustainable architecture is mainly about the process of participation and not the outcome. This results into self-built or community-built construction methods. The process by which the buildings were constructed and how many people were involved cannot be seen once the buildings are finished (Figure 9). This means that they cannot be distinguished as eco-social sustainable architecture: there is a low visibility.



Figure 9: Buildings created with the self-build Segal construction method

The logics that are most likely to induce the criticisms mentioned in section 2.1, are the eco-centric and the eco-technic logic. The eco-centric logic might be reproached for being inappropriate or useless in developed contexts and countries. Many see them as caricatures and houses in which nobody would actually want to live. The lack of meeting current expectations for aesthetics and comfort can be criticized.

Buildings associated to the eco-technic logic are criticized when their focus is on meeting benchmarks and quantitative assessment schemes only. Their shapes then risk to be restricted to dull and industrial looking cuboids. On the other hand, the eco-technic category contains some of the most applauded projects as well, when aesthetics, benchmarks and functionality do seem to be combined in the design.

The eco-aesthetic and the eco-cultural logics are the ones that see sustainable design and aesthetics as a harmonious whole. The eco-aesthetic logic has a lower risk of being criticized as the shapes are in the centre of the attention of the designers and the forms are often thoughtful. The eco-medial and the eco-social logic are the ones with the most invisible sustainable agenda: their effects can often not be seen.

Williamson, Radford and Bennetts (2003) reduce these six logics to what they see as the only three main contrasting ‘images’ of sustainability: the natural, the cultural and the technical image (Table 2). They relate them to the six logics as represented in Table 3. A general synopsis of the images is given in Appendix B. The following paragraphs will only discuss the physical results of these images.

Table 2: Three images of architectural sustainability (Williamson, Radford and Bennetts, 2003)

Image	Dominant concerns	Dominant horizon	Symbolism/aesthetics	Approach
Natural	Environmental place, ecosystems, health, balance	local	‘Touching the earth lightly’ with forms echoing nature	Study local natural systems; emphasize sensitivity and humility in relation to nature.
Cultural	Cultural place, people, genius loci, difference cultural sensitivity	local	Highly contextual with forms, materials and construction methods echoing the local vernacular	Study local culture and building; emphasize local involvement and local expertise.
Technical	Technologies, global environmental impacts, cost-benefit analysis, risk management	global	Leading edge contemporary international systems	Study science, economics and technology; emphasize transnational expertise.

Table 3: Comparing the images and logics

Image (Williamson, Radford and Bennetts)	Associated logics (Guy and Farmer)
Natural	Eco-centric Eco-medical Eco-aesthetic
Cultural	Eco-cultural Eco-social
Technical	Eco-technic

The *natural image* is the most closely related to nature and the resulting buildings are integrated in the landscape. The designs are highly affected by sun paths and local microclimate and often result into soft and organic curves. Natural finishes are used. This can result into intelligent and healthy buildings but here is a danger when the shapes are only defined by environmental issues and the functionality of the spaces is neglected. In that case, the buildings will not be appreciated by the users and sustainable architecture might be regarded as unpractical.

Ralph Knowles pleads for the solar envelope zoning method, which can be classified in the category of the natural image. This method results in buildings with natural forms that are completely adapted to the sun's trajectory, as buildings have been to a certain degree for a long time in history (2011). They are in dialogue with nature. Examples of his work can be seen in Figure 10. The degree to which this solar zoning is visible, is very high in these figures, but much of the rationale of his design could be used in a more subtle way of expression too when making a holistic design.

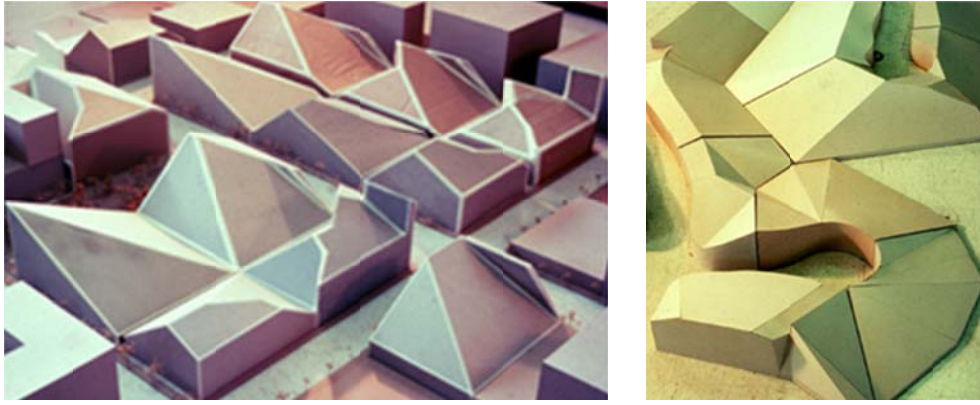


Figure 10: Solar zoning by Ralph Knowles

The *cultural image* results into buildings which are inspired by local traditions and which use local materials. It can be a good way to successfully integrate new buildings in an existing community. The limitation of the cultural image is that there might be a restraint on what is accommodated: typologies such as office buildings can prove to be very difficult. Not all local materials might be able to serve as appropriate and resilient structures. Moreover, many people will prefer a material that is certified as safe and healthy over a material that is the most local. There is also an aesthetical ‘boundary’ as only certain materials and colours will be used. This can be seen both as a positive because of its visual uniformity, or as a negative aspect as there will be less differentiation and creativity of combining materials.

The aesthetic representation of the *technical image* shows technical proficiency by using the materials of contemporary architecture such as glass (double skins), stainless steel and cladding panels in alloys or aluminium. Geothermal systems and heat recovery are not visible, there is an intelligent computer control of lighting and heating and cooling function via timers and movement detectors.

Architecture in the scope of the technical image is sometimes reproached to be only ‘semi-environmental’ architecture. Susannah Hagan explains that what looks very green is not always very green. As an example she refers to the building design in Figure 11 by Emilio Ambasz: “*The energy embodied in a mountain of high performance glass would probably outweigh any environmental benefit the winter garden might bestow, [...] the visible overwhelms the operational, [it is] imagery rather than energy efficiency.*” (2001, p.162)

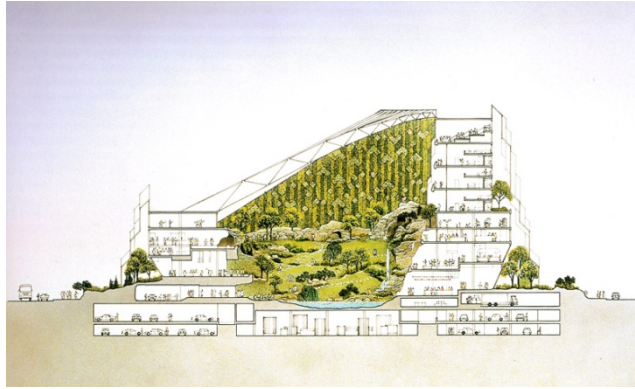


Figure 11: Nichii Obihiro Department Store, Japan, by Emilio Ambasz and Associates

The technical image is also related to using advanced simulation and calculation methods and to the design of more efficient products. Simulation techniques can have positive aspects, such as testing specific climates, and negative aspects, for example forgetting microclimate, landscaping and view and just going for the best numbers. Idem for the product design: useful improvement in efficiency versus unnecessary excesses in consumerism can be counterposed.

The three images are caricatures for most architects in reality. They often use a combination of these images in their projects. Williamson, Radford and Bennetts provide an example: a building can have mud walls (cultural image), a curvilinear form derived from sun path (natural image) and solar panels on a steel tower (technological image) at the same time.

2.3 Eco-gadgets versus eco-minimalism

Apart from the logics and the images, there is another main distinction that is being made in the strategies for a sustainable building: the notion of eco-gadgets (or eco-bling) versus eco-minimalism. Liddell (2013) has made his own division of what he believes to be merchandising products (which do not really make the building more sustainable, are inefficient, and of which the benefits are outweighed by cost and LCA), versus products and strategies that really do have a positive impact. His classification and the main reasons for this can be found in Appendix C. Most of the eco-minimalism strategies are passive approaches and he believes that they should be the antidote to eco-gadgets. Things he classifies as eco-bling are mostly related to the technical image but also strategies from the natural (e.g. natural materials) and the cultural (e.g. local materials) appear.

Eco-gadgets are the most recognizable objects, but not necessarily the most sustainable. In this way, they might project a false or dishonest image of sustainability. Liddell chooses much less visible and more integrated approaches over visible elements in the debate of sustainability as a visual style.

However, it might be a bit short-sighted to simply dispose of these technologies. The most important thing is to be sensible about what is appropriate for a certain location and building and what is not. For now, we need some of the eco-gadgets to keep certain levels of comfort which we are used to (choosing the least damaging of the existing technologies), and many technologies are evolving to become more and more efficient over time. If it is possible to make a design that meets appropriate levels of comfort and that doesn't need these technologies, this should be the preferred option in order not to be wasteful. A distinction should also be made between cheap eco-gadgets, using recycled materials, and expensive eco-gadgets, often using valuable finite materials. Cheap eco-gadgets (e.g. home-made rainwater harvesting tank for watering the garden) can often be a good addition to the house.

2.4 Vernacular architecture

After paragraphs 2.2 and 2.3, there is another main topic that requires more focus and cannot be left out in the debate about visibility and images: the discussion whether sustainable architecture equals (mimicking) vernacular architecture or not.

Some architects believe that local vernacular architecture should be the leading inspiration for sustainable design, as was described briefly before in the cultural logics and images.

In 'The sustainable indigenous vernacular: interrogating a myth' (AlSayyad and Arboleda, 2011), and 'The Vernacular, the Iconic and the Fake' (Bharne, 2011), the authors are very critical about using vernacular architecture as the reference point for sustainable architecture. They explain that it is a myth that vernacular architecture is sustainable per se. A romantic view of the vernacular and celebration of its iconicity may limit a true engagement with sustainability and may result into repeating instead of pursuing innovations towards sustainability. Just like eco-gadgets, they might be a false representation of sustainability. AlSayyad and Arboleda encourage using natural and local building materials but warn for an appreciation of the superficial appearances of vernacular architecture rather than actual sustainable qualities.

A good example is the study of wind catchers that Susan Roaf has done in Iran (2013). In all the villages these wind catchers were different, according to the local microclimate (e.g. shadow of a mountain). In one city however, Yazd, they were taller than in all the other places. She first thought that this could be rationalized by a microclimatic reason as well. In a further stage of her research however she learned that, in reality, they were the tallest because of the wealth that came to Yazd because of the Opium trade. They were made this high to show off the prosperity of the families, although they also have the environmental benefit of higher wind speeds. This shows that there is not always a climatic rationale behind every form in vernacular architecture, and so it shows that copying these forms does not result in sustainable buildings automatically.

Sometimes the name ‘vernacular architecture’ is used incorrectly. Some call Renzo Piano’s work ‘Jean-Marie Tjibaou Cultural Center’ on the island of New Caledonia vernacular (Figure 12). However, this building is *inspired by* the traditional huts and villages, but the materials used are modern and not indigenous; in this way it can project a false image. When the materials are shipped over a long distance they are unsustainable from an LCA-perspective, although they might perform better. Renzo Piano’s approach honours the cultural heritage by its form rather than by its materials.



Figure 12: Jean-Marie Tjibaou Cultural Centre by Renzo Piano

2.5 Sustainable architecture as a tool for communication and persuasion

In the previous sections, visibility and aesthetics of sustainable design were discussed in the framework of their appreciation, honesty and functionality.

Buildings could roughly be divided into 4 categories:

- 1) being sustainable and showing it in one of many ways (honest image),

2) being sustainable and hiding it (image that aesthetics prevail or that sustainability is ugly),
3) not being sustainable but looking green (dishonest image),
4) not being sustainable and not looking green (common image);
and from the previous sections we could derive that there is a discussion about choosing option 1 or 2 as the best method to incorporate sustainability in design.

In this section, the discussion on how sustainable architecture should look like will be related to the issues of language, communication and persuasion.

To some people, the marrow of the matter is not only for the building to be sustainable and to stay sustainable, but also to look sustainable as a method or *tool* to convince people to be sustainable.

According to the linguistic theory of Ferdinand de Saussure and its application as structuralism in architecture (Roland Barthes and Umberto Eco), buildings can convey a message.

In the case of sustainable architecture, the message could be that the building is sustainable. How clear does the connection between ‘signifiant’ (signifier) and ‘signifié’ (signified) have to be? Is the connection lost when covering up the sustainable features? What exactly should the building express?

Many architects believe that sustainable architecture can signify that the inhabitants and users have to have a green lifestyle to fit with the building as well. In this case, the denotation, i.e. the literal main meaning, ‘*this is a sustainable building*’, could have the connotations, i.e. the associated subjective meaning, ‘*apparently, this is how we should build now*’, ‘*other buildings should be sustainable too*’ or ‘*I have to live in a sustainable way*’. In the case of a sustainable building that is well designed the connotation can hopefully become ‘*green architecture is not ugly (anymore)*’ for those who criticised this aspect before.

There are different ways in which the building can communicate that it has a green design. Eco-minimalistic design can express this subtly because of the features of the building itself, whilst eco-gadgets will rather function as ‘billboards’ that let people know that the building underneath, despite of its regular outlook, tries to achieve certain benchmarks (a comparison with the famous sketch from ‘Learning from Las Vegas’ can be seen in Figure 13). Or does the whole building design need to be an obvious icon to draw people’s attention to environmental concerns?

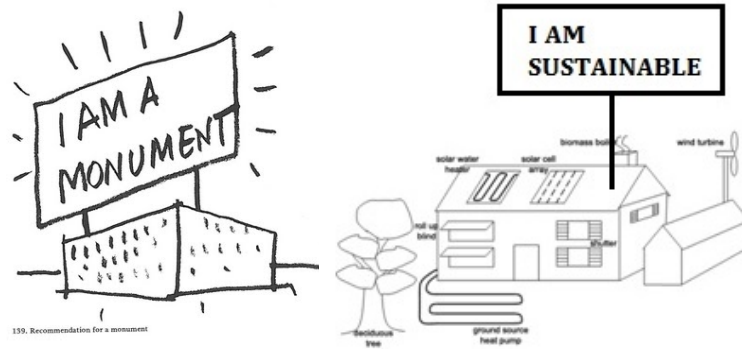


Figure 13: Sketch from 'Learning from Las Vegas' (left) and comparable sketch (right)

Baird's opinion is that buildings should express their environmental functions: *"The architectural expression of these features becomes a significant part of the aesthetics and character of the building, [...] the aesthetic qualities of the building are justified and rationalized because they are expressions of its environmental functions and the conditions of its production as in nature."* (Williamson, Radford and Bennetts, 2003, p.26) Form follows function, also when it comes to sustainable features, just like in modernism. In postmodern architecture forms are justified on grounds of coding and meaning). This might mean that, when it comes to the justification of form, visible sustainable architecture follows the modernist principle and invisible sustainable architecture follows the postmodern principle.

Kant believed that the experience of beauty arose from *"the sense that a given object fits a given purpose"* (Lee, 2011, p.11). This purpose can be the green ideology.

Lee agrees with this statement: *"A built form should inform and express the principles of its programmatic, structural, material and spatial qualities. And an aesthetic is supposed to emerge from, as well as be embodied in, the order that ties them together as an indivisible whole. Therefore, in short, if a building or an environment is designed and built to be sustainable, it should inform how it was conceived and situated, and what makes it be so under what kind of conditions. And in the presence of such a work, it should be perceivable and/or understandable that it serves and fits such purpose."* (2011, p.11) Williamson, Radford and Bennetts warn against superficial symbolisation. The sustainable expression has to be a *genuine* expression and not a counterfeit: *"Where is the boundary between a legitimate symbol of sustainability, and the proliferation of eco-gadgets as a feature of green-wash?"* (2003, p.27) This corresponds with an honest image.

These views are again opposed to the ones mentioned in the beginning of the chapter, which believed that sustainable architecture should be concealed.

According to Glen Hill (Hill, 2011), the early radical environmental architecture of the 1960's and 1970's was more focused on changing people's lifestyles rather than on aesthetics, while nowadays it is mostly interested in maintaining an unsustainable way of living and an aesthetic economy. He warns against too great dependency on technologically sustainable practices. Instead he believes in a poetic sustainable architecture that should be revealing and responding to the unsustainable commodification process. Using Guy and Farmer's logics, he could be classified as anti-eco-technic and pro eco-social logics as he believes that some wider issues in the society should be tackled.

Sauerbruch and Hutton (2011) agree that sustainable architecture should be able to change lifestyles and to show that less consumption does not equal less quality. This architecture should respond to normal people. They call this a positive architectural language that signifies a new beginning in relation to the environment which will advocate creating spaces that communicate with people on an intuitive level by employing space, surface and light in an intelligent way.

Trying to change people's lifestyle has never really fully left the environmental discourse. Especially in eco-villages and eco-districts in cities, the city planning is very much focused on changing people's transport and waste habits, and showing that these changes are not a utopia or only for 'deep green' people. Scandinavian projects in particular, such as Hammerby Sjøstad in Sweden and Brøset in Norway are making large efforts by encouraging user participation and facilitating new habits. The motto is that everybody can contribute their part. BedZED is a good example from the UK. Masterplan-scaled projects will continue to try to encourage people and break the still rather distinct separation between people who see themselves as environmentalists and those who don't. The future new or upgraded sustainable neighbourhoods can aim to show more subtle ways to raise awareness without having to use stereotypes and inappropriate eco-gadgets.

2.6 Holistic approaches and seamlessness: first set of parameters

Although there are so many contrasting views on how sustainable architecture should be perceived, it is possible to try to define some general guidelines. These guidelines advocate no fixed formal design; neither do they choose one image above another one. However, they should consider the criticisms mentioned before. These could be the elements of sustainable design that will survive and will be taken up in the process illustrated in Figure 1.

The guidelines should result into a design that meets the minimum requirement: *“If you think you can’t make the world a better place with your work, at least make sure you don’t make it worse”*, as formulated by Herman Hertzberger (1991, p.174).

Guideline 1: Use a holistic approach; aesthetics, functions, context, landscape, (micro-) climate, comfort and LCA are all important and should work well together in one design.

Guideline 2: Do not see a building as a separate entity.

Guideline 3: Do not use unnecessary expensive eco-gadgets.

Guideline 4: Never copy any building method without understanding it (no fake vernacular).

Guideline 5: Do not make the buildings caricatures.

Guideline 6: Be smart about the design: be aware of the effects of spaces, shapes, colours and materials on people, just like in non-sustainable design.

Guideline 7: Do not see sustainability as a restriction in the design process.

Guideline 8: Try to establish timeless qualities; do not just design for the present situation.

Guideline 9: Take up a more humble role as an architect when necessary.

These are further explained in Appendix D.

These general guidelines can also be accompanied with a general scale to talk about the outlook and aesthetics of a building, independent from the theory or starting point used. This general scale will be *seamlessness*. Seamlessness can be used to talk about how seamless the parts of a building fit with each other, how seamless the building is integrated in a given context and how seamless it fits a given purpose. Combined, this forms the seamlessness of a building as a whole. It cannot only be applied to new projects but also to renovation projects, which is why they are so important in this thesis.

Seamlessness is regarded as the most objective term because a technical image may be considered seamless in an industrial area while a natural image is rather considered seamless in a rural area and community. There is no good vs. bad connotation, as in certain cases differentiation might be sought while seamlessness may be wanted in others.

As a conclusion, the researches, approaches, logics and images used in this chapter can now be related to each other as can be seen in Figure 14. There are many connections the key theories. An application of the vocabulary on an existing building situation can be found in Appendix E and some extra annotations can be found in Appendix F.

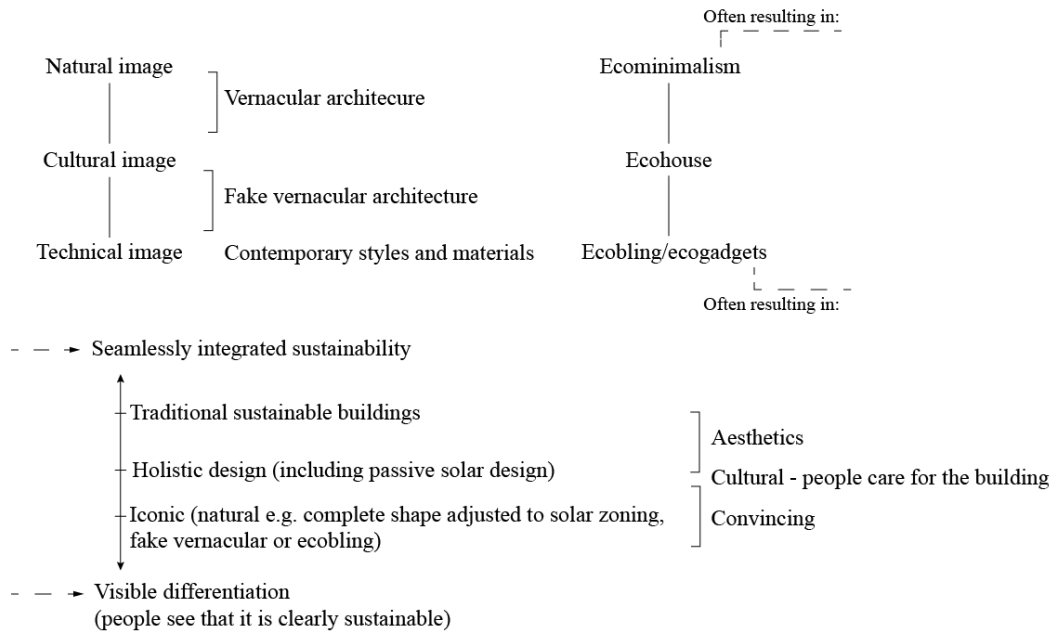


Figure 14: Linking the chapter's concepts

FIRST SET OF PARAMETERS

The three parameters that are chosen to talk about the visual expression of a sustainable design in an objective way further in this thesis will be three *degrees of seamlessness*:

S1): Very seamless approach: nature, landscape, the building and building systems look like one totality (often corresponding with the natural image, using natural materials and an eco-minimalistic approach).

S2): Medium seamless approach: the building is clearly differentiated from its surroundings; there is a balance between minimalism and gadgets which is sensible for the particular project.

S3): Least seamless approach: the building is differentiated from its surroundings and it is supposed to be. This approach has the most eco-gadgets and uses some unnatural materials as well (partially corresponding with the eco-technic logic or technical image).

The parameters will be used in chapter 4 and applied to a case study design.

CHAPTER 3: SUSTAINABLE ARCHITECTURE AND RENOVATION

3.1 The approaches towards renovation through time

The research that was presented in chapter 2 was mainly focused on the sustainable images of new buildings. However, the situation in the present and in the years to come is that the number of buildings that will have to be adapted is larger than the number of buildings that will have to be built. Eighty-five percent of the building stock that we will have in 2050 already exists (Gonzalez-Longo, 2013). This means that we will have to find a way to incorporate sustainability in building refurbishment and renovation.

This chapter will discuss the main aspects that should be considered and the different ways in which sustainable renovation can be approached.

First it is important to understand that renovation, even without the notion of sustainability, is a complex matter which has led to many different points of view and discussion through time. Many profound reflections about the matter were expressed in the 19th and 20th century.

One of the main dissensions is to choose whether a historic building has to be frozen in time and kept exactly like it was or whether it should further evolve and be altered through time.

John Knight agrees with the former vision and defends this in his work ‘A Good Doctor’: *“Conservation should not endow a building with an appearance that it may never have had. So how do we, who are charged with the care of the built heritage, go about getting it right, or at least trying to? [...] Too many historic buildings have been shamefully dealt with because too many architects have been allowed to sweep away what is there, or bring about fundamental change in order to impose their own ideas and conceptions.”* (1992, cited in Great Britain, 1995, p.69)

This view corresponds well with the very conservative approach of the influential Austrian art historian Alois Riegl (1858-1905). He was in favour of minimal intervention. Historic fabric was deemed sacrosanct so change or interference had to be avoided (Jokilehto, 1986; Theodossopoulos 2013). He supported limiting restorations to what was strictly necessary for the preservation of the object.

Cesare Brandi (1906-1988), and other theorists of the ‘restauro critico’ movement (1950-1960) in Italy such as Renato Bonelli and Roberto Pane, believed that some changes could be allowed, as long as the architect made an intelligent critical decision about what was

valuable and what wasn't (Jokilehto, 1986). A good reading of the building and a technical and historical understanding was required and then it was up to the architect. The problem lies in the fact that not every architect made the right decision and in this way some important features did disappear in historically important buildings. This is why Italy returned to a more conservative approach.

Buildings with a very strict renovation often serve as museum pieces, while the adapted buildings often have a modern function (other than a museum).

Letting the building further evolve often requires the addition of modern services and building extensions. These building extensions could be in the same style as the original building, copying its methods, shapes and materials, but the general consensus in renovation theory now is that this extension has to be clearly differentiated by using modern materials (often glass and steel) in order to be honest and not 'fake'.

The second main discussion is about which point in time should be chosen as the ideal 'restoring point'. Some believe that the building has to return to one certain stage in time, representing just one style. This is often the original or most glorious state. Later alterations would have to be removed. Viollet-le-Duc (1814-1879), who further developed the 'romantic restoration' ideas established in the Italian Renaissance, believed that the significance of a building was not so much related to continuity and stratification in time but rather to a particular moment or period in history, especially that of the first architectural concept (Jokilehto, 1986). Stylistic unity was preferred over more authentic but stylistic unrelated forms.

Others theorists and designers believed that every addition from any style until the present should be conserved. They believe that returning to this one uniform state would be fake.

This is the opinion that William Morris (1834-1896), founding father of the 'Society for the Protection of Ancient Buildings' (SPAB), defended. He believed that buildings had a documentary value and that every stage or alteration ever done had to be shown (e.g. patches of brickwork). This could lead to indiscriminate results (Theodossopoulos, 2013). The outlook of the building is not seamless.

The difference between the opinions of Viollet-le-Duc and William Morris can also be related to what Riegl defined as the sometimes contradicting 'historical' value and 'age' value. The latter concerned the value of a building that shows the test of time.

Figure 15 shows an example of a building that displays many styles; the castle was built in the 16th century, but has been altered until the 21st century: the Flemish-traditional building style has elements from late-gothic, renaissance and neo-gothic and contemporary architecture.



Figure 15: Castle of Arenberg in Belgium, front view (left) and side view (right)

The overall consensus nowadays is that the architect has to do a critical historical evaluation of the work about its aesthetic, historical, and landscaping values; and prevent a patchwork design that distorts the overall coherency of the building. Repairs can be done in a more sympathetic way (Theodossopoulos, 2013). Original ideas might have been more important than what has happened later, so the critical eye has to decide: is it worth it or not to keep an alteration?

The theories described in this section will influence the second set of parameters that will be defined in this chapter.

3.2 Sustainable renovation and the importance of historical and socio-cultural values and the landscape: second set of parameters

The connection between sustainability and outlook becomes even more complex when it is applied in renovation. One of the reasons for the complexity is that renovation often favours a static state (a 'snapshot') while sustainability refers to a dynamic process and an architecture that is resilient and can adapt when changes occur. There is often a tension between the visibility of history versus the visibility of sustainability. An example of this is the renovation of an exterior wall in the UK: the most straightforward way to upgrade its energy efficiency would involve adding external insulation, but then the historical façade would be covered up.

Depending on which aspect is given priority, Botta distinguishes three types of renovation in her work (2005):

1) Careful renovation

Historical and documentary values and visibility prevail in careful renovation. Restoring (a version of) the original building is the key issue. Awareness and knowledge of the building, as well as identifying conditions and qualities are necessary.

2) Environmental renovation

For environmental renovation, meeting energy efficiency standards and other quantitative environmental benchmarks is prioritized. Sustainability is the most visible in this category.

3) Sustainable renovation

Sustainable renovation tries to balance the best of both: goals both of careful renovation and environmentally friendly renovation are regarded as necessary components of sustainable development. This corresponds to the idea of sustainable renovation in this thesis. Identifying key conditions and unique qualities and values are necessary for a project to truly succeed. Sustainable renovation can therefore be linked to the theory of phenomenology. It was mentioned earlier as a part of the cultural image; and it is against the domination of technology (technical image): every technical intervention would have to be properly justified.

The phenomenological approach implies that buildings and places play a significant role in people's life. Space is seen not only as a physical reality but also as the result of objective and subjective aspects and people's relationship to the environment.

Edward Husserl, who is considered the founding father of the philosophical school of phenomenology, described the 'lived space' as a product of interaction between a place and

man's perceptions. Accordingly, Heidegger states that people are essentially related to the world in which they live, and he declared the individual experience the basis for the relationship between people and places. These individual experiences create positive links and patterns and meanings would be identified. When man had this relationship with the place, he would 'dwell': "*Man dwells when he [...] experiences the environment as meaningful.*" (Norberg-Schulz, 1980, p.5) The Norwegian architect Christian Norberg-Schulz built further upon these theories: "*The spaces where life occurs are places; [...] a place is a space which has a different character. [...] Architecture means to visualize the 'genius loci', and the task of the architect is to create meaningful places, whereby he helps man to dwell.*" (1980, p.5) The 'genius loci' is the spirit of the place and can be interpreted as its unique character.

Phenomenology thus tells us that it is important to preserve the positive links and elements that form the character of the place, otherwise the meaningful relationships and connections between people and a place will be destroyed. This can be applied to sustainable renovation: sustainability then implies protecting the environments and places that we know from within and their meanings. One should intervene without destroying the existing cultural, social and historical values, meanings and memories and with respect to the users and the surrounding context and landscape.

This is where the distinct difference with the previous chapter lies: it is not possible to start from a 'tabula rasa'; here there are materialistic and non-materialistic aspects to start from and to work with. The architect has to be well-informed of the values (and their scale) that are to be kept and prioritise these over his/her own individual stylistic expression. An example of the application of this theory is the 'Ekporten' project in Sweden where much effort was done to keep the initial social connections intact during and after the renovation works (Botta, 2005).

When everybody takes care of his own environment, this can accumulate to a global environment that is taken care of. When people understand that unsustainable lifestyles will sooner or later affect their own environments too, they might be more likely to change them. Understanding the necessity of sustainable renovation might induce understanding the necessity of passive house standards for new buildings.

There are some important documents and organizations of the 20th century that have officially stated the importance of architectural, cultural and social values. They include:

- The Athens Charter for the Restoration of Historic Monuments in 1931
- UNESCO since 1945 (understanding culture and heritage)
- The Venice Charter in 1964 (with the important addition of considering '*not only great works of art but also more modest works of the past*' (Botta, 2005))
- The Burra Charter in 1979
- DECOMOMO since 1988 (for 20th century heritage)

In the English Heritage publication 'Energy Efficiency and Historic Buildings', the importance of preserving the character of a place and building is stressed as well. They mention four types of values that are to be considered: evidential value, historical value, aesthetic value and communal value (see Appendix G). Part L of the building regulations, 'Conservation of fuel and energy', also acknowledges that historic buildings should not be expected to meet the building standards for new buildings if this results into the loss of significant features or character. Historical valuable elements prevail over eco-gadgets. A reflection on some documents and schemes that are more shifted towards environmental renovation can be found in Appendix H.

It has become clear that when talking about sustainable renovation, there are many more aspects to be taken into account than only formality, functionality and eco-gadgets, which seemed to dominate the discussion about new-build architecture in chapter 2. It cannot be reduced to a series of environmental actions and does not imply simply transferring technologies used for new buildings onto existing buildings.

Therefore, a second set of parameters is introduced to incorporate the theories mentioned in sections 3.1 and 3.2.

SECOND SET OF PARAMETERS

The three parameters or basic categories that are chosen in this thesis as three different intents for renovation are as follows:

R1): Returning to an earlier state: the building should be restored into its original and most glorious state, even if parts of this earlier state have disappeared. This approach is the most related to Viollet-le-Duc's.

The former character of the place is kept in the most literal and visible way and sustainable intervention cannot involve elements that counterwork this.

R2): Keeping the present state: this parameter proposes not restoring everything that used to be there, neither removing what is there now. This refers back to Morris and Riegl. Sustainable intervention cannot involve removing or adding too many things.

R3): Moving on to a next stage: a building should not be frozen in time, it should evolve. Old parts that have become useless can be removed and sensible additions can be made. This corresponds with the opinion of the 'restauro critico' movement. Only the important characteristics of the place are kept and new experiences and meanings can be inserted. Sustainable changes, additions and extensions can be embedded.

Until now, this thesis has presented vocabulary and theories about aesthetics, seamlessness, renovation strategies and values. They have led to the creation of two sets of parameters.

These will be combined and applied on a case study of a renovation in Chapter 4.

CHAPTER 4: RENOVATION PROPOSALS FOR BRIDGEND FARMHOUSE

4.1 Background, history, values and current state of the project

The project that will be used as a case study in this thesis is the Bridgend Farmhouse (Figure 17) with its steadings. It is located in the Craigmillar area of Edinburgh and lies directly next to the Bridgend community allotments (Figure 16). A group of volunteers from the local community have formed the Bridgend Inspiring Growth Farmhouse Renovation Group because they would like to see the farmhouse being renovated. Earlier in 2013 they have received a funding of £11,000 to carry out a feasibility study and make a business plan.



Figure 16: Location of the project



Figure 17: Current condition of the Bridgend Farmhouse

The building is very appropriate as a case study in this thesis because of two reasons. First, there is an incentive to renovate it in a sustainable way and to use it as an environmental education centre. The renovated building would serve as a community building that

encourages sustainable lifestyles. Some suggestions about how the building could show sustainability are summarized in Appendix I. Second, the traditional farmhouse has a historical significance, although it is not listed (Appendix J). It is situated on the edge of the historical Craigmillar Castle park lands and it is believed that it was the site of a chapel built by James V (The city of Edinburgh Council, 2011). More information about the history and historical maps can be found in Appendix K. From these maps one can see that the farmhouse has been present for a very long time. The building clearly has the cultural, social and historic values described in chapter 3 as well as the beautiful surroundings of the park as a context.

Since the last inhabitants left the farmhouse in 2000, it has been a target of vandalism and has fallen into disrepair. However, the values of the building clearly remain an important factor in the community and an incentive to renovate, which is proven by the engagement of the members of the renovation group.

Apart from research about the history and context of the building, site inspections were also necessary to understand the current state of the building and thus the starting point of the renovation. The photos of the site visits and comments on them can be found in Appendix L, and newly made floor plans in Appendix M. The main conclusion is that the exterior walls and most of the roof structure are still usable while many interior elements are deteriorated.

The Bridgend farmhouse has, to a certain degree, always been a sustainable building on many levels. One of the first things one can notice when looking at its façades, is that the house is clearly orientated towards the south. The northeast façade has got only half of the amount of windows that the southwest façade has. The bedrooms upstairs have no windows to the north in order to keep the cold out but they gain warmth from the southern sun. Second, the building's external walls consist of 60 cm of stone. This large thermal mass would protect from cold in winter and from overheating in summer. Third, old farmhouses such as this one were made from very local materials; the stones were usually resourced at nearby quarries.

The current image of the building is that of a formerly productive farm that has lost its glory and has experienced better times in the past. It is a reminiscent image. The goal of the renovation would be to make it functional and useful again, as a building that cooperates with its surroundings and that is a place to rest and learn about sustainability. Its place in the

community and environment would be restored and the building would have the image of having a strong local identity, and of being an open and friendly place that can set an example about sustainability.

Currently, the volunteers of the renovation group are considering three different options for the scale of the programmatic functions. Every consecutive option involves more organisations and people. The options can be summarized as described in Appendix N.

4.2 A previous proposal: critical review



Figure 18: A previously made design proposal

In 2009, a design proposal was suggested for the farmhouse by Cooper Cromar (Figure 18). The site would be converted into a major health and well-being centre (Cooper Cromar, 2009). In this design proposal, the farmhouse loses its identity; it is not the centre of the site anymore. The farmhouse is 'lost' in the excess of new additions that take over the site, and can barely be seen. The new buildings are not in balance or seamless with the part that existed already. Moreover, the harmony with and openness to the landscape are also disturbed as the inner court is fully enclosed. The overambitious building is not appropriate for the place and the community. These criticisms imply that the design is disrespectful towards the cultural and natural image and the character of the place. The project was unsuccessful in securing funding to move forward, largely because it failed to engage with the community (CaskieCo, 2013).

In the following sections, new design proposals for the farmhouse will be presented. They will be based on the theories and strategies explored in Chapters 2 and 3 and will aim to be more appropriate.

4.3 Constrained aspects and basic renovation upgrading works

Before presenting the new design proposals in detail in 4.4, some common ambitions, features and constraints that will be present in each of the proposals should be explained.

These guidelines are based on social, cultural and historical values that are considered to be respected after the contextual research and a critical choice by the author. Elements from the cultural image and based on its phenomenology will therefore be present in every approach.

The guidelines can be summarized as follows:

- The farmhouse has to continue to be the centre and the icon of the site, so no obtrusive additions or extensions will be used. In this way, the character and ‘focus point’ are respected.
- The north and south façades of the house remain fully intact and visually unchanged, as they form the identity of the building. They are the most visible features and have to remain recognisable for the community. This cancels out external insulation in any of the proposals.
- The balanced relationship between the buildings and the landscape should not be disturbed. The farmhouse wouldn’t be half as beautiful without its surrounding landscape, with which it co-exists. The landscape and the farmhouse give meaning to each other. This is respectful towards the natural image.
- Simple, modest forms are to be used, so that scale and shapes are seamless.

Some practical guidelines for the renovation of Scottish historic buildings in general can be found in Appendix O. One of the most important guidelines to keep in mind is that healthy, breathable, natural materials with a low LCA-impact should be chosen and potentially hazardous products and paints should be avoided.

4.4 Combining the parameter sets: design application by three renovation proposals

In this section, three design proposals for the Bridgend farmhouse are presented instead of just one, to illustrate the practical effects of the theories explored in this thesis.

COMBINATION OF FIRST AND SECOND SET OF PARAMETERS

In chapter two, a first set of parameters was established to assess the visual aspects of a sustainable design. In chapter three, a second set of parameters was made to distinguish three main strategies in renovation. In this chapter, these parameters are combined to generate an output of three different design proposals, as is shown in Table 4. These are the three *chosen* combinations which were considered the most relevant for this case study. It would be possible to choose other combinations as well.

Table 4: Combination of parameters resulting into proposals (by author)

VISUAL PARAMETERS		RENOVATION PARAMETERS		RESULTING PROPOSALS
Parameter S1 : very seamless	+	Parameter R1 : past state	=	Proposal 1: Conserving
Parameter S2 : medium seamless	+	Parameter R2 : current state	=	Proposal 2: Modulating
Parameter S3 : not seamless	+	Parameter R3 : future state	=	Proposal 3: [Sign]ificant

Specific names were chosen for each of the types of refurbishment and design proposals.

The intertwining of parameters S1 and R1 is interpreted as a design that will try to preserve both the ‘original’ building and aesthetics, i.e. the state it was in when still functional and before deterioration. The design has to be a seamless uniform entity and will conserve the historical outlook and image of the past in the most expressive way. Therefore, proposal 1 was called ‘*Conserving*’. The retrofitted buildings will only show their new environmental goals in a subtle way. From its outlook, people might not see that the building is upgraded sustainably.

Proposal 3, which combines S3 and R3, was labelled ‘*[Sign]ificant*’ as the building will clearly signal a new stage in its evolution. In order to accommodate the new, public function best, a new extension is regarded as necessary. It will be clearly distinguishable because of

its new and different materials. Significant visible changes are done and the farmhouse becomes a ‘sign’ of sustainability.

Proposal 2 was called ‘*Modulating*’ as it balances between the approaches of proposal 1 and proposal 3. The current state of the building is respected, this means that no major ‘fake’ returns to the past will be executed, nor will there be large new additions. The overall site will be medium seamless as no major new external materials will be introduced.

A more detailed interpretation brings about different strategies for the farmhouse itself versus the steadings. The first reason for this is because they are in a different current state: the farmhouse is better preserved while the steadings are closer to being ruins. The second reason is that the house and the steadings have a major different ‘value’: the farmhouse is considered the most important structure on the site, while the steadings are rather its attributes. The practical interpretation of the author of each of these proposals on several detailed physical aspects of the renovation can be seen in Table 5. The amalgamation of these aspects will form the overall visual representation of the three proposals.

Table 5: Detailed external and internal consequences of the strategies (by author)

Type of renovation	Internal insulation application
Conserving	Only roof of house
Modulating	Only roof in house, walls and roof in steadings
[Sign]ificant	Walls and roof of house and steadings

Type of renovation	Extensions and steadings
Conserving	No extension, harling on steadings redone
Modulating	No extension but steadings altered, harling/rendering on steadings not repaired
[Sign]ificant	New extension, steadings removed

Type of renovation	Windows (timber frame)
Conserving	Original sash windows restored, double window
Modulating	Sash windows but double glazed
[Sign]ificant	Replaced by modern double or triple glazed

Type of renovation	New external materials
Conserving	None
Modulating	None
[Sign]ificant	Scottish timber

Type of renovation	Roof
Conserving	Scottish slates and pan tiles
Modulating	Scottish slates (what can be seen today)
[Sign]ificant	Modern roofing

Type of renovation	Interior walls
Conserving	All preserved or restored
Modulating	Some of them removed (the ones that were severely damaged)
[Sign]ificant	All removed (except the 60 cm walls which were originally exterior walls)

Type of renovation	Passive/local strategies
Conserving	Trees for shading
Modulating	New windows faced south(-west)
[Sign]ificant	Scottish timber, new windows faced south(-west), trees for shading new addition

Type of renovation	Renewables
Conserving	None or invisible (e.g. geothermal could be considered)
Modulating	Solar panels integrated on steadings
[Sign]ificant	Solar panels on farmhouse

Type of renovation	Modern technology/electrical appliances
Conserving	Wireless sensors (avoiding new cables in historical materials)
Modulating	Visible where appropriate
[Sign]ificant	Clearly visible as an educational tool

Type of renovation	Rainwater collection
Conserving	None
Modulating	Subtle
[Sign]ificant	Large

Type of renovation	Modern technology/electrical appliances
Conserving	Courtyard like when it was still functioning as a farm
Modulating	Mainly lawn
[Sign]ificant	Sustainable low-maintenance garden

PROPOSAL 1: Conserving (very seamless + past state)

Figure 19: Design proposal 1

Proposal 1 is the most conservative approach. The proposal restores the outlook that the building had about 50 years ago. This stage in time was chosen because it concerns a state of which a correct and accurate description could still be provided by some written and photographic material and, most importantly, by the former inhabitants. The Darlings have lived there from 1965-2001 and have expressed their deep concerns for a renovation and restoration of the site to the state they used to know it by. The design was based on their description of the former state of the building (Darling, 2013 and Appendix P). Both the farmhouse and the steadings had a (beige-)white harling layer and the farmhouse had an extra layer of white paint. A part of the steadings had orangy-red pan tiles instead of the dark Scottish slates. There was a courtyard with trees in the center.

The design proposal also stays the closest to the original breathable construction method, materials and internal outlook: insulation is only added in the roof of the farmhouse not at the walls, so that no interior space is lost. Only destroyed elements can be remade or removed.

Overall, the design has a very seamless outlook that only includes materials that were common in this time. No external eco-gadgets such as solar panels are used.

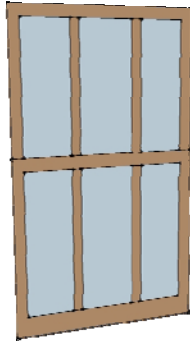


Figure 20: Sash windows

The original sash windows, which are lost, will be re-fabricated exactly as they were (single glazed), to contribute to the original outlook. An extra window is added internally though, otherwise the heat losses would be too exorbitant.

The sustainability of the project does not concern reaching quantitative environmental benchmarks, as for instance more insulation would have to be added for that. The energy performance and comfort levels will not be the best they can be. The sustainability lies in the connection that the building keeps with the landscape, it represents a harmonic coexistence with nature. In people's mind, the typical farmhouse typology is what fits well together with the surrounding landscape. Therefore, the natural image and the cultural image are the most respected in this approach.

PROPOSAL 2: Modulating (medium seamless + current state)

Figure 21: Design proposal 2

This proposal does not go back to the outlook of the building 50 years ago, instead it rather deals with the current state, situation and outlook: the farmhouse is still in a relatively good state, but of the steadings only the rough stone walls remain; their best time has passed. Therefore it is not considered necessary to bring them back to something they were, instead they are considered as an element that can be altered and modernised. The red pan tiles and the white rendering of the steadings will not be restored; a transparent protection layer for the walls is preferred. However, the roofs of the steadings are rebuilt. Only slates and no pan tiles are used to cover the roofs, as there is a reason now why they should have two colours now or in the future. Internal wall and roof insulation is added in the steadings, as well as extra doors and windows. This results in spaces that have much more functional potential compared to proposal 1. In the farmhouse, most of the internal walls are still respected, and no internal wall insulation is added there. Roof insulation remains present however, like in proposal 1, but probably with a thicker layer. The chosen windows will look like the original sash windows, but will be double-glazed.

There is an introduction of some eco-gadgets (solar panels) which do not fit with the older materials, but only on the steadings, not on the most valuable part, the house. However effort is done to make them fit in visually in a rather seamless way. Additional low-tech technologies are allowed.

The front garden will be a simple lawn which can be used for outdoor activities.

The design still very much reminds of a farm, though in a less literal way. The quality of the spaces in the steadings has been upgraded and the energy performance will be better than that of proposal 1.

PROPOSAL 2 ALTERNATIVES

These alternatives present some different window arrangements. Simulation can show which of the window configurations would be best for the final functions in terms of thermal performance and daylighting.

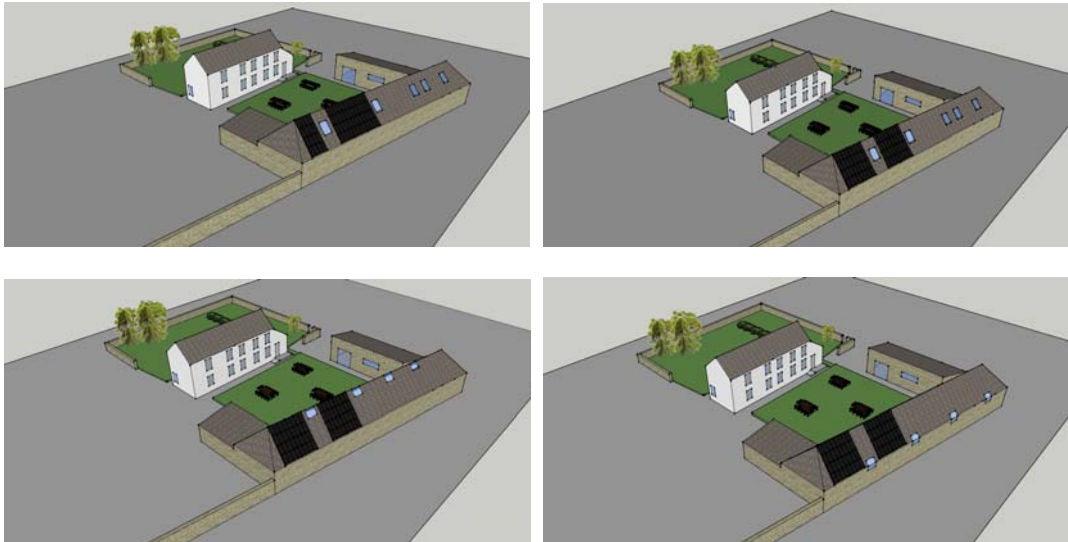


Figure 22: Slightly changed alternatives for design proposal 2

PROPOSAL 3: [Sign]ificant (not seamless + future state)

Figure 23: Design proposal 3 (front)



Figure 24: Design proposal 3 (back)

The changes in design proposal 3 are the most significant and sustainability is expressed in the most visible way. The design moves on to a new stage and adds a contemporary extension, i.e. a public entrance that represents our time and building methods nowadays. It represents the theory that buildings have to evolve through time. There is a clear difference between the old and new parts (aesthetics). The steadings are not seen as useful anymore and are therefore removed. However, the external walls at the edges are kept to define the domain.

This last proposal is the least conservative one; even some small changes to the sides of the exterior wall are allowed to connect the new and the old parts.

Substantial technology is added; this proposal is the one that is the closest to the technical image. It is not integrated seamlessly and it is not aimed to do so. The solar panels on the roof of the farmhouse and other technologies are very visible. The inside walls are removed (except the ones that used to be external walls) and internal wall and roof insulation is added everywhere. There is a full thermal upgrade so that ambitious quantitative benchmarks and comfort levels are reached. Moreover, there is an improved daylighting because of the open floor plan. Technology and appliances are also visible on the inside.

The windows will be modern looking and double or triple glazed.

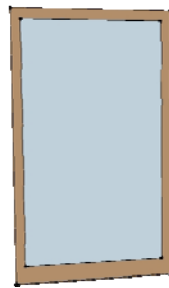


Figure 25: Modern looking windows

The new extension, which includes a new public entrance and multifunctional public spaces, is mainly made out of Scottish timber. Massive timber as a construction method can show people that timber buildings can be solid as well and can give timber a more positive connotation. The windows are mainly orientated to the south (-west) and deciduous trees can provide shade in summer.

The garden will be a low maintenance sustainable garden, according to the concept of the American landscape architect van Sweden.

The farmhouse tries to demonstrate environmental sustainability in many ways as a tool to educate people.

There is a clear evolution from proposal 1 to proposal 2, and from proposal 2 to proposal 3 (Figure 26).

Some inspiring precedent projects can be found in Appendix Q.

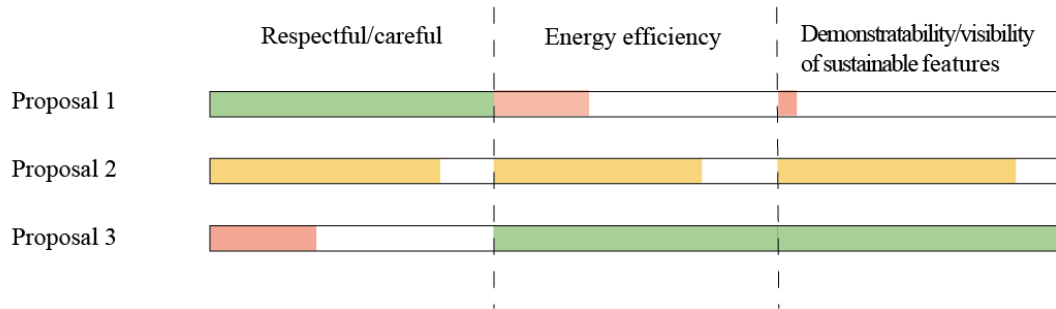


Figure 26: Summary of the results of the proposals

These proposals also have different impacts on the usability and functionality of the inside spaces. As a result, the proposals fit very well with the three options for the programmatic use that are being considered by the renovation group (Appendix N):

- Proposal 1: Almost all functions in the farmhouse, storage in the steadings;
- Proposal 2: Many functions in farmhouse; classroom, workshops and possibly kitchen in steadings;
- Proposal 3: The public entrance also serves as an exhibition space, a classroom and a large open kitchen and cafe are placed in the new extension (with terrace); other functions in the farmhouse. The addition is built with the notion of ‘tractability’ in mind, i.e. the design quality that allows the place to be used, changed and adapted by its users (Craig, 1980 and Botta 2005). This proposal is the most appropriate as a ‘showroom’ for sustainable features.

4.5 Conclusion

The three design proposals show that the criteria of seamlessness and visibility on one hand and views on renovation on the other hand can result in very different design proposals for one and the same project.

The large differences between the approaches could be refined to their ramifications on practical choices: they had different effects on the materials, external layers, insulation, windows, building services, used renewable energy sources and so on. There was a clear and consistent strategy: from analysis to evaluation to choice.

However, it is important to keep in mind that there is no seamless one and only correct bridge between theory and practice. The architect has to make a sensible decision about how to do this. Also, a too literal conversion would result into caricature buildings rather than good designs. An example of this is shown in Figure 27. This should be avoided as the building should be mainly concerned about timeless qualities and enabling a good integration in the community, i.e. the building has to be accepted in the community to fulfil its planned functions. These caricatures might not fulfil visual expectations and might not even meet efficiency demands anymore in a certain amount of years (e.g. solar panels might not be considered an efficient resource anymore).



Figure 27: A radicalised version of proposal 2

Some approaches were common for all projects, such as respecting cultural-historical, social and environmental values, whereas for other approaches, a sensible choice has to be made.

These three design proposals are neither the only three options, a different mix of the two parameter sets could be applied as well.

The complexity of the renovation of a traditional building in Scotland has been explored and explained. This can hopefully be a valuable tool for making informed decisions about the renovation strategies for the project in reality.

CHAPTER 5: CONCLUSION OF THE THESIS

This thesis has shown that there is a multitude of theories that could support a renovation strategy.

Chapter 1 started by explaining that sustainability is an evolving discourse in architecture. It is being tested how it can become an inherent part of building practices. Especially for renovation projects, this will become more and more relevant. There is a need for a coherent framework on how to approach sustainable renovation in order to achieve successful projects. In order to establish such a framework, the research was split into two components.

The first part of the theoretical research, chapter 2, focused on the images of sustainable architecture. It is expressed in many ways and many of them are criticised. A review of these criticisms has shown that they mainly occur when sustainable projects do not take aesthetics, forms and present-day expectations of buildings by people seriously into account.

Next, the key theories behind the expressions of sustainable architecture were unveiled. They included six logics (eco-technic, eco-centric, eco-aesthetic, eco-cultural, eco-medical and eco-social), which can be reduced to three images (technical image, cultural image and natural image). Each of these theories seeks to tackle the environmental problem from a different perspective. The tension between eco-minimalism and eco-gadgets had to be remarked as well. Eco-gadgets can be very useful but they should not be misused. The theory about mimicking vernacular architecture completed the necessary vocabulary set of this chapter. All of these approaches have a useful function in the search for and debate about a new architectural theory: as described in Aristotle's dialectics, only by investigating and comparing various points of view on an issue, we can get to know all the different aspects of it and get a holistic understanding of the complete context and complexity.

Every approach induces a different kind of communication about sustainability between the building and the users. Some approaches are very subtle while others will be noticed immediately.

An objective method for assessing the visual representation and aesthetic implications of sustainable architecture was found: a scale of seamlessness. This led to a first set of three main parameters for the framework: very seamless, medium seamless and least seamless. It describes both how coherent the various parts of a building are and how seamless the building is integrated into the local context. It can be used to discuss or relate to any of the images, but, most importantly, also for sustainable renovation.

The second part of the theoretical research, chapter 3, concerned conservation and renovation specifically. The chapter has demonstrated that even between the theorists about renovation, there are major disagreements. However, renovation always concerns social, cultural and historic qualities that should be preserved if they are valuable, which adds complexity to these projects. The specific values of places were also described in phenomenological theories. Even in contemporary sustainable renovation, these qualities that go beyond quantitative benchmarks and eco-gadgets remain very relevant and important and they should be researched to make a renovation project succeed. Moreover, the existing fabric and historic buildings have certain materialistic properties on which not any modern material can be imposed without any problems.

From the renovation theories, a second parameter set of three main categories was derived: restoring the former state, respecting the current state and evolving towards a new stage.

In the final chapter, the two parameter sets were united in a framework and three combinations were chosen. The principles of these combinations were applied and interpreted for the Bridgend Farmhouse. This resulted into the '*conserving*' design proposal, the '*modulating*' design proposal and the '*[sign]ificant*' design proposal. They had different effects on the detailed choices of materials, finishes, addition and demolition, level of thermal upgrading and services for the farmhouse on one hand and the steadings on the other hand.

Some characteristics remained the same in all of the proposals, because they were considered necessary to comply with keeping the values that form the character of the place and maintaining the farmhouse as an icon in the community. The variable parameters however have illustrated the many ways in which the renovation design can be approached.

Although the three proposals are very different, all of them got a very positive feedback from the farmhouse renovation committee when their strategies and visual outcomes were presented (Golding and Ross, 2013). They have praised how the three proposals correspond very well with the three options for the programmatic use of the building and meet their expectations. The thesis will be followed by a final presentation for the committee members. The outcome of the thesis has provided a framework that can help them making an informed decision about which strategy to choose.

Good renovations should become common practice and the strategies discussed in the thesis could induce projects with holistic considerations of ecological, cultural, historical and economical aspects. In this way sustainable renovation shall contribute to sustainable development on a larger scale.

APPENDICES

Appendix A: Synopsis of the logics defined by Guy and Farmer (2001)

The *eco-technic* logic is based on the belief that science, technology and management can provide the solutions to environmental problems. The logic is techno-rational and policy-oriented. A key feature of this logic is the globalizing point of view: mainly global concerns such as the depleting ozone layer are addressed. The approach is mostly based on quantitative calculations (especially energy-efficiency) and is very anthropocentric. High-tech methods such as intelligent façades are used. The architecture of Norman Foster, Richard Rogers and Nicholas Grimshaw is classified as eco-technic.

The *eco-centric* logic stands in stark contrast to the eco-technic logic. It goes beyond anthropocentric concerns and defends a full precautionary protection of ecosystems instead. The dynamic interaction between the living and the non-living is essential. Nature is believed to be easily disrupted and each building is seen as an act against nature: their footprints should be reduced. The buildings that emerge from this logic are analogous to ecological systems in a way (e.g. cyclical processes), they often have a holistic design and they are made of natural (earth, timber, straw), reused and recycled materials. The aim is to reduce dependency on centralized infrastructures as well. An example of these eco-centric buildings are the domestic self-sufficient ‘earthships’ (e.g. by Mike Reynolds in New Mexico). An ‘earthship’ can be seen in Figure 5.

The *eco-aesthetic* logic shifts the debate about sustainable architecture beyond the efficient use of resources and the reduction of ecological footprints. The goal is to convey a new identification with nature and the non-human world. It is an idealistic theory that strives for social change, and global universal consciousness, which begins with individual reflexivity and ecological awareness. The role of architecture is to be a metaphorical and iconic expression of these societal values. This will gradually lead to ‘whole new civilisations and cultures’. There is a strong New Age dimension and a romantic view on nature, and a rejection of western rationalism, modernism and materialism is recommended. Individual creativity and aesthetic and sensual values are important. Appropriate architectural form is prioritized above physical performance, and is mainly made possible by advances in structural engineering, computer modelling, automated production, and novel materials. This logic is related to the ‘organi-tech’ architecture of Santiago Calatrava, Frank Gehry and

Future Systems (Figure 6), to the ‘cosmic’ forms of Japanese architects such as Arato Isozaki and to the artistic fusion of landscape and architecture in the work of SITE.

The *eco-cultural* logic engages with both environmental and cultural concerns: the development of a sense of being indigenous to a place, and a responsibility for protecting landscape and ecosystems from disturbance are both essential. Existing cultures and places should be preserved: regionalism is chosen over globalism (eco-technic). The emphasis on place is based on Heidegger’s phenomenology and the importance of the genius loci and the peculiarities of an environment (cfr. section 3.2). Eco-cultural designs are related to vernacular architecture and use local building materials to respond to the (micro-)climatic conditions. The designs by Glenn Murcutt (Australia, Figure 7), Charles Correa (India), Geoffrey Bawa (Sri Lanka) and Hassan Fathy (Egypt) are regionalist approaches.

For the *eco-medical* logic, a healthy (indoor and outdoor) environment prevails: the quality of air, water and urban space has to be eminent. These will then be healing environments (physical and psychological) and will sustain individual health. Reducing technological intensity might increase instead of decrease well-being. The interior of buildings is critical: healthy living indoor climates where hazardous products are avoided are fundamental (Figure 8) and the ‘sick building syndrome’ should never occur. Attention should be paid to natural and tactile materials, colours and scent in order to meet all of our needs. ‘Baubiologie’ (building biology) is the study of these objectives. Traditional buildings with organic treatments and finishes are the result. The eco-medical approach has inspired for instance Peter Schmid (The Netherlands), Floyd Stein (Denmark) and the Gaia Group (Norway).

The *eco-social* logic goes beyond the concern for the individual and is based on social ecology. The root cause for the ecological crisis stems from wider social factors. Democracy, full participation and freedom are essential for an ecological society. This logic proposes a decentralization of industrial society into smaller self-sufficient and communal units (that take responsibility for their local environment) and working with intermediate technologies that are based on an understanding of the laws of ecology. This vision can be seen in the participatory design processes of Lucien Kroll (Belgium), Ralph Erskine (UK), the self-built by Peter Hubner (Germany) and those who use the Segal Method and in the communities of Findhorn (Scotland), Christiania (Denmark) and Arcosanti (Arizona).

Appendix B: Synopsis of the images as defined by Williamson, Radford and Bennetts (2003)

The basic principle of the *natural image* is that we should work with and not against nature, because nature knows best. Sun paths and local microclimate are things that could be and should be worked with; “*a vine may be used rather than a mechanical system*” to provide shade (p.27).

The archetypal visual image is the remote and isolated self-sufficient building in harmony with or dominated by its surrounding landscape. The natural image corresponds with the eco-centric logic, but also with the eco-medical (a healthy mind in a healthy body in a healthy building) and the eco-aesthetic (natural finishes; soft, organic, sensuous curves; humility).

The *cultural image* encompasses both the eco-cultural and the eco-social logic. The motto is: local culture knows best. We have become too careless about our places (cfr. phenomenology and Christian Norberg-Schulz); places and artefacts have become meaningless. Sustainability means protecting and continuing the character of the place. The sustainability of the building is sublimated to sustainability of the place. We should respect the uniqueness of every place, and where this was damaged, the authentic place should be restored (‘healed’), as Christopher Alexander argues in ‘*A New Theory of Urban Design*’. These issues will be addressed more extensively in Chapter 3.2.

Materials, colours and buildings should be drawing on the local vernacular: designs are informed by and respect local traditions, but they are not simply copying it.

The *technical image* corresponds with the eco-technic logic. ‘*Technology can deal with any project at any place*’ is the catchphrase. Norman Foster expresses that “*architects have always been at the cutting edge of technology*” (1999 cited in Williamson, Radford and Bennetts, 2003, p.31) and he believes that this is the way we should continue. Nature is seen in function of human life instead of harmony with it. The environmental problem has to be addressed with global solutions and success is a quantitative assessment. This architecture should result into efficient people in efficient buildings, and should be universally applicable.

Appendix C: Eco-bling versus eco-minimalism according to H. Liddell (2013)

	ECO-BLING	ECO-MINIMALISM
FIRE ELEMENT	<ul style="list-style-type: none"> - <u>PV solar cells</u> (a lot of PV cells for not very much energy) - <u>Heat pumps</u> (energy supply: electricity, costs 3x gas) - <u>CHP</u> (only works with a constant round-the-year demand for hot water) - <u>Solar collectors</u> (inefficient on overcast days, payback time) - <u>Condensing boilers</u> (cheap ones fail to condense after a short period, oversized ones operate inefficiently) - <u>District heating</u> (demand needs to be consistent and distances short) 	<ul style="list-style-type: none"> - <u>Passive solar energy</u> (ensure that it has somewhere useful to go) - <u>Solar shading</u> (essential if benefit is not to become a nuisance) - <u>Low-energy equipment</u> (better value for money) - <u>Phantom loads</u> (dealing with inefficient stand-by modes) - <u>Renewable tariffs</u> (defraying carbon costs of essential electricity) - <u>Minimum boilers</u> (operating at full load, but reduced load) - <u>Passive house standard</u> (principles)
AIR ELEMENT	<ul style="list-style-type: none"> - <u>Conservatories</u> (negative energy contribution when heating system in them) - <u>Small wind turbines</u> (unlikely that many houses are on a prime wind-turbine site) - <u>Mechanical ventilation</u> (hygroscopic materials are 9x more effective at dealing with indoor humidity) 	<ul style="list-style-type: none"> - <u>Airtightness</u> (majority of heat losses through uncontrolled draughts) - <u>Shelter planting</u> (trees and bushes for energy conservation) - <u>Natural ventilation</u> (obviate the need for fans) - <u>Natural/hybrid ventilation</u> (low fan power assistance)
EARTH ELEMENT	<ul style="list-style-type: none"> - <u>Green roofs</u> (another superfluous clip-on badge) - <u>Recycled materials</u> (last resort, requires significant processing) - <u>Local materials</u> (not always most abundant, architect maybe no experience) - <u>Timber cladding</u> (often as a camouflage for a limited understanding) 	<ul style="list-style-type: none"> - <u>Biodiversity</u> (greenscape and bluescape) - <u>Design for recycling</u> (easy recyclability) - <u>Benign materials</u> (guaranteed healthy materials) - <u>Mass timber</u> (carbon sequestration) - <u>Maintenance</u> (insurance against premature replacement)
WATER ELEMENT	<ul style="list-style-type: none"> - <u>Reed beds</u> (land-hungry, not in urban context) - <u>Grey-water recycling</u> (might not withstand antisocial habits) - <u>'Living machines'</u> (energy intensive) - <u>Embodied water</u> (argument against paper construction, aluminum, plastic, steel) - <u>Rainwater harvesting</u> (in case of filtering and dual plumbing systems) 	<ul style="list-style-type: none"> - <u>Water conservation</u> (conservation plumbing fittings, e.g. low-flush WC) - <u>Hard surfaces</u> (retained water, rainwater as an opportunity) - <u>Soft surfaces</u> (run-off delay) - <u>Moisture mass</u> (absorbent finishes deal with humidity)

Appendix D: General guidelines for sustainable design

Guideline 1: Use a holistic approach; aesthetics, functions, context, landscape, (micro-) climate, comfort and LCA are all important and should work well together in one design.

This is designated by Williamson, Radford and Bennetts as ‘responsive cohesion’: “*Responsive cohesion is the essence of designing, of trying to make a coherent whole out of many parts. [...] Buildings cannot be pure expressions of sustainability because that is never the sole objective, the sole reason for their existence.*” (2003, p.136) The building should be designed as an integrated whole and should connect aesthetics, environmental systems, appropriate technologies and the building’s multiple cultural contexts.

A good example of this is the Oxford Ecohouse by Susan Roaf (Roaf, 2007), where she integrated all of the aspects in the design process; in contrast to houses of which the design and plans were made first and the ‘eco’ goal was added during the last stage of the design.

The building should not be an add-up of marketable environmental appliances from a catalogue, as stated previously.

The guideline is also related to the ‘Integrated Design Process’ (Hansen, 2005).

A connection (and maybe a fusion, cfr. SITE and ‘folding’ (Hagan, 2001)) with the landscape, context and history of the place is necessary in most cases.

A building can be sustainable because of its features, but also because of its meaningful connection to the surrounding landscape, i.e. a more subtle way, as is illustrated in Figure 28.

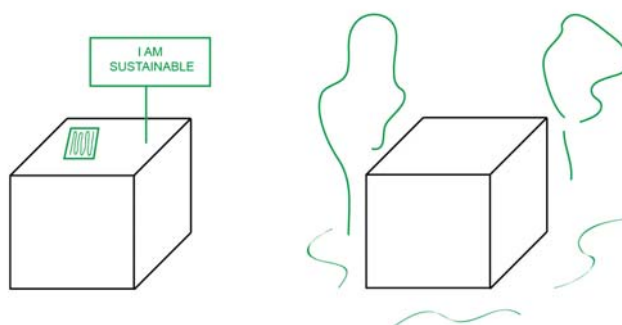


Figure 28: Two buildings that are sustainable in two different ways

Guideline 2: Do not see a building as a separate entity.

This guideline is strongly related to guideline 1. It refers to the book ‘The Selective Environment’ by Dean Hawkes et al. (2001). Buildings should no longer be built with an exclusive approach, i.e. building as a stand-alone unit, ignoring the outside climate and not working with it, but with a selective approach, i.e. responding to climate and microclimate.

Guideline 3: Do not use unnecessary expensive eco-gadgets.

Guideline 4: Never copy any building method without understanding it (e.g. no fake vernacular).

These two guidelines were explained in section 2.3 and 2.4.

Guideline 5: Do not use make the buildings caricatures.

They have to be something people will want to live and work in and identify themselves with. Caricatures probably only further damage the existing image and enhance the impression that it is 'ugly'. The buildings should not forget to comply with the 'Gestalt', i.e. the subconscious idea of the features that something must have to be recognised as something, that people have of a comfortable, enjoyable house or building.

Guideline 6: Be smart about the design: be aware of the effects of spaces, shapes, colours and materials on people, just like in non-sustainable design.

This refers to Hosey's question: "Can we be as smart about how things look as we are about how they work?" (2012, p.5) The knowledge that has been gathered throughout the years about how buildings should look and feel to make people happy, should not be omitted.

Guideline 7: Do not see sustainability as a restriction in the design process.

As there is not only one environmentally correct solution, sustainability should not be seen as a restriction to the aesthetic potential. To the contrary, it might even lead to a greater creativity: instead of the common 'how shall we fit a concrete and steel structure in here', there are now many architects exploring more creative solutions again (a creativity with timber where nobody might have been interested in 20 years ago e.g. in Norwegian and Austrian architecture solutions.) Sustainable architecture can rather be a source of inspiration to enrich the intelligence of our buildings and to give the chosen aesthetics a (non-superficial) reason. Being creative by making both beautiful and smart solutions is what architects should strive for after all.

Guideline 8: Try to establish timeless qualities; do not just design for the present situation.

Marie Antoinette Glaser (Glaser, 2011) explains why our buildings should be dynamic and durable, but also able to change and adapt over time. Steward Brand has stated that "buildings keep being pushed around by three irresistible forces: technology, money and fashion" (1994, p.5); but these inflexible 'fashions' should be avoided.

Guideline 9: Take up a more humble role as an architect when necessary.

This guideline refers to a statement by the architect Anna Heringer. When necessary in the context, an architect should tone down ‘ego-architecture’ and take up a more humble role; e.g. respecting the most appropriate forms and materials even if they are not the trademark of the architect (Heringer, 2012 and Craig, 1980). The image of the architect and his visible role are not the priority; sometimes architects have to express themselves in a more subtle way.

Salim’s (2010, p.407) view corresponds with this: “*Sustainability is not about more iconic architecture*”, especially when this architecture “*ignores the present cultural context, in the name of difference and iconicity*”.

Susannah Hagan writes a similar conclusion: “*It could also be argued that the straightforward expression of the devices of environmental design are the best (because the most obvious) way for environmental architecture to make itself visible, though, like any set of visual elements, their significance would have to be understood by the viewer before the intended meaning could be conveyed. Such expression would, however, achieve only what Eisenman refers to as ‘iconicity’, that is representing as well as deploying making its environmental function. To enter the realm of ‘beauty’, in Eisenman’s terms, and ‘visibility’, in mine, expression would have to exceed this ‘iconicity’.*” (2001, p.163)

Appendix E: Critical case study of eco-bling in Belgium

Forty-five years after Renaat Braem has declared Belgium “*the ugliest country in the world*” (Braem, 1968) because of its lack of a good spatial planning, most of his criticisms still apply. The entire country houses an equal number of inhabitants as the greater urban area of Paris. Ribbon developments dominate the country and ruin the rural areas; Belgium is being parcelled to the degree that the rural areas and landscape are ruined (Figure 29; Van Broeck and Borret, 2013). The dream of the average Belgian is to own his very own piece of land and to build a dwelling in a fake farmhouse (‘fermette’) or a fake rectory (‘pastorie’) style (Figure 30), usually designed by turn-key firms. This is supplemented with an eclecticism of any other possible styles (Figure 31). Often, extensions to the houses are made in a later stage as well (e.g. porches). The built environment is lacking uniformity and an identity that can be seen in a city like Edinburgh. The dwellings are not integrated seamlessly in the landscape neither are the building styles are not seamless compared to each other.



Figure 29: Belgian landscaping: ribbon developments



Figure 30: The fake farmhouse and fake rectory style

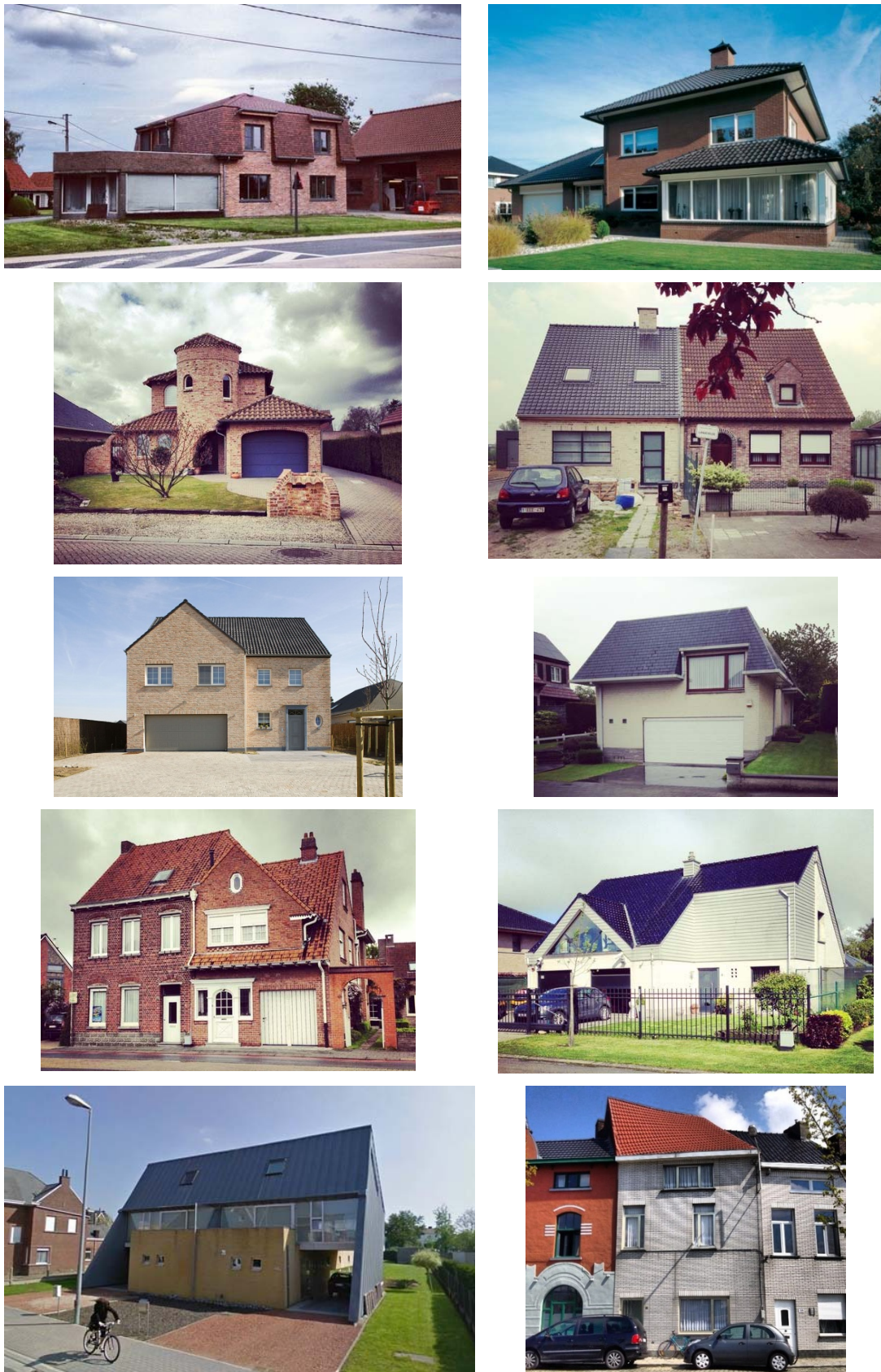


Figure 31 (a-j): Examples of Belgian eclecticism: all of these could be found in just one street

Since sustainability has become a widely marketed concept, the average Belgian will pick a house from a catalogue, and if he wants to it be sustainable, he will add solar panels on the roof sooner or later. He will then think that he has a ‘sustainable’ house (Figure 32). Certain turn-key firms are a good example of fake green marketing: by promoting some buildings from their own catalogue as completely airtight and very sustainable. However, in practice, these homes often turn out to be not airtight enough, as proved by measurements from the University of Leuven (KUL, 2009). Sustainability has simply become a valuable marketing tool for these turn-key firms.



Figure 32: The average ‘sustainable’ house in Belgium (ad-hoc patchwork)

These ‘sustainable houses’ are being built without paying any attention to the surroundings, the site orientation, the context and the landscape; they are only more economical sometimes. Every house on the middle of its parcel in a ribbon development, is not a good way of using space. The embodied energy of dwelling, including e.g. the car travel to the city for work, is not taken into account. This is an example of undiscerning ‘sustainable’ design using superficial clip-on badges: the eco-gadgets, which often convey a false message. There is no truthfulness in the aesthetics of the building: the style represents a function that the building does not have, and the solar panels do not even fit with this style, neither do they represent a truly sustainable building. The buildings and their ‘sustainability’ are not seamless and have no connection to each other. Sustainable architecture is about more than a standalone building, and it is so much more than installing solar panels. These houses may even have a negative effect: when adding solar panels, people might think that they can continue living an unsustainable lifestyle. Moreover, it doesn’t show people how intelligent a sustainable building can be. People have to realise that the matter is urgent and necessary, and that it is not just about a temporary trend to put solar panels on roofs.

Another problem that arises is that architects in Belgium can write the label of ‘green architect’ on their business card after just one short series of lectures about sustainable building, focused on qualitative benchmarks and the addition of insulation. There should be a more holistic approach that is not limited to numbers, sales and market values.

The good architects of Belgium are designing in a more holistic way and will take the time to read and understand this discourse of sustainability. Good designers will not see this as an obstacle but will take it up in their expression seamlessly and will design in an inclusive way. This was explained in the general guidelines (Appendix D). Sustainable architecture could be the guide to a way out of current practice; it could be the incentive towards a better, more esthetical architecture and a more intelligent way of using space. Passive houses that are designed in a holistic way are much more appealing unities (e.g. dwelling WVW in Kalmthout, Belgium, and Oslo’s first passive house) and ‘fold’ with their context.

Van Broeck and Borret are arguing to stop with ribbon development and to concentrate all building developments in the city and village centres, with the addition of some residential towers: *“only with more urbanity will rusticity be able to survive”*. There would only be natural elements and seamlessly integrated buildings in the rural areas, while new towers would fit in seamlessly in further urbanized areas.

Unfortunately, many recent tower projects in Belgium are not successful and not the kind of projects that Van Broeck and Borret have in mind: they are too grim as their bases are not connecting with/open to the community and surroundings. There are already too many big expensive buildings with great discomfort; and curing these problems will be even more expensive than if they would have been avoided. There is a dire need for experiments with good large sustainable buildings like e.g. the Moray Council in Scotland. This is of course a generalised and simplified view. Luckily, there are already some architects engaging themselves to make better buildings. A good example of this is the ‘Balk’ by the architect Stéphane Beel in Leuven (Figure 33).



Figure 33: ‘Balk van Beel’

Appendix F: Annotations for Chapter 2

ANNOTATION 1

The visibility of sustainable buildings discussed in Chapter 2 mainly covered the areas of shape, materials and general outlook. However, a similar discussion can also be held about the visual expression about the building services (this goes beyond the scope of the thesis). Should they be clearly visible, seamlessly integrated, or completely covered up? These questions are addressed in more detail in the papers ‘*Environmental controls: bridging architectural expression and performance*’ and ‘*Responding to architectural expression and performance*’ by George Baird (Baird, 2002a and 2002b).

He uses what Rush has identified as the levels of visual integration of building services:

- 1) *not visible, no change*: not visually accessible to user,
- 2) *visible, no change*: exposed but not altered beyond its functional requirement,
- 3) *visible, surface change*: exposed with superficial alterations,
- 4) *visible with size or shape change*: visually accessible to users but sized altered beyond most simple and economical,
- 5) *visible, with location or orientation change*: visually accessible but position changed from optimal.

ANNOTATION 2

A second domain concerning visibility which wasn’t included in the chapter was the effect of (interactive) displays. Research (Vande Moere et al., 2011) suggests that these displays can help to encourage a behavioural change. In Figure 3Figure 34, a low-tech example from this research is shown: a board on the front side of a house is showing its daily energy consumption compared to the days before and its neighbourhood ranking. It might encourage a friendly competition between the residents of the area: “*My house is more sustainable than yours!*”

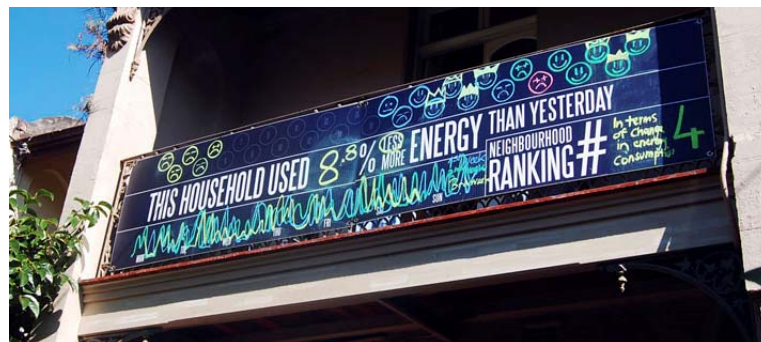


Figure 34: Letting the neighbours watch your energy consumption

A more high-tech version of a public display can be seen in Figure 35: this is an example of a display that counts the number of cyclists that pass by every day. The effect of these (digital) displays is also a whole research area on itself. Some displays/urban screens (and their effect on people) that could be tested in Edinburgh (in the context of the case study of Chapter 4) are proposed in Figure 36. They could show the amount of houses in an area that have been upgraded sustainably, or show data about car, bicycle and public transport use per data zone in Edinburgh.



Figure 35: Eco-Totem bicycle counting

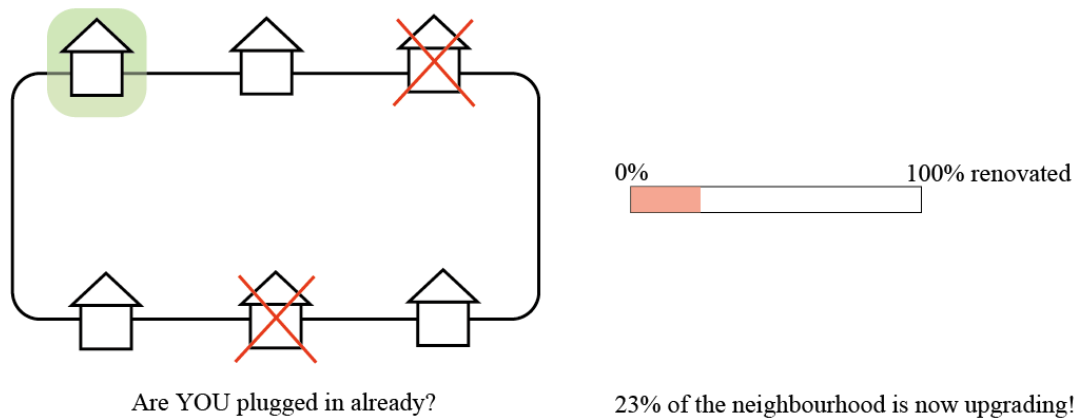


Figure 36: Proposal of displays that could be tested in Edinburgh

Appendix G: Excerpts from ‘Energy Efficiency of Historic Buildings’

Application of Part L of the Building Regulations (English Heritage, 2011)

03 Understanding the building before carrying out upgrading works

When proposing any works to modify an older building it is important that it should first be properly understood. This means understanding its construction, condition and the way it performs. It also means understanding the building's qualities. In many cases far more damage has been caused to historic buildings by hasty ill-informed alterations than by simple neglect. If a building is properly understood, works can be targeted to the places where they are most needed, or, in the case of major changes, the places where they will do least harm. Not only is such a targeted approach better for the building, it can also be more cost-effective.

The qualities that need to be understood in any historic building are those which make it special such as original windows, doors and joinery. A building's qualities in some cases are not always physical, but they will provide the underlying reasons why particular parts of a building or place are significant, and thus worthy of protection or designation.

Very few historic buildings or places survive as originally built. The majority will be made up of works from different periods, derived from and expressing different values. When simple modifications are proposed to individual building elements such as walls, windows and floors, the significance may well seem obvious and uncomplicated. This may well be so, but caution is still recommended, as things are not always what they may seem at first sight and the full consequences of proposed changes may be more extensive and potentially damaging than first anticipated. There is also a danger that a range of small individual modifications, each of which may be quite tolerable in its own right, can together cause unacceptable damage.

MAINTAINING CHARACTER AND SIGNIFICANCE

SENSITIVITY OF HISTORIC BUILDINGS

A historic building in its townscape or landscape setting, complete with its interior decoration, fixtures and fittings, can be regarded as a composite work of art and document of history. Historic buildings vary greatly in the extent to which they can accommodate change without loss of their significance. Some are sensitive to even slight alterations, particularly externally, and where they retain important interiors, fixtures, fittings and details. Others may have changed significantly and restoration is not considered feasible or sensible. These considerations will influence the extent of change that is appropriate to improve energy efficiency.

When alterations for energy conservation are proposed, regard should be given to:

- ensuring that the building is well understood, to avoid damage
- minimising disturbance to existing fabric
- reversing the changes easily without damaging the existing fabric (especially changes to services)
- appreciating that some buildings or parts of buildings are of such quality, importance or completeness that they should not be altered at all save in the most exceptional circumstances.

The significance of historic buildings clearly encompasses the more obvious architectural and aesthetic values, but it also includes less tangible elements such as associations with historic people and events, examples of technological innovations, aspects of social history and links with a building's setting and other heritage assets.

English Heritage's *Conservation Principles, Policies and Guidance* (2008) lists four primary categories of heritage value:

Evidential value derives from the potential of a place to yield evidence about past human activity. This aspect is of particular relevance in places where there may be archaeological remains, but the archaeology within the structure of a building, while less familiar, may be every bit as important.

Historical value derives from the ways in which past people, events and aspects of life can be connected through a place to the present. This may be illustrative, by demonstrating important aspects of past lives and assisting the interpretation of the historic environment, or it may be associative, through being linked to a notable historical person or event.

Aesthetic value derives from the ways in which people draw sensory and intellectual stimulation from a place. This will include both the fortuitous qualities which have evolved naturally in a place over time, as well as the design values attached to a deliberately created building, group of buildings or landscape.

Communal value derives from the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory. This can cover *commemorative* and *symbolic* values important to collective memory, *social* values which contribute to people's identification with particular places, or the *spiritual* values people associate with special buildings and places, whether attached to organised religions or not.

Appendix H: Critical case study: BREEAM for sustainable renovation

BRE is publishing two new versions of BREEAM, focused on refurbishment: BREEAM Domestic Refurbishment (published in 2013) and BREEAM Non-domestic Refurbishment (will be finished in 2014).

This is a very good evolution and certainly a stepping in the right direction to split environmental upgrading criteria for renovation from the environmental upgrading criteria for new buildings. However, the document has not changed the original version or from EcoHomes fundamentally: there is not that big a change in the criteria and the document concentrates on quantitative aspects. It is more related to 'environmental renovation' than to 'sustainable renovation'. There is a risk that it becomes a tick-the-box exercise.

This document could further evolve by incorporating ways to assess quantitative criteria in the future as well. John Brennan has addressed the following issues: Can any kind of architecture be sustainable if it meets defined quantitative, technical benchmarks? External variables such as landscape, climate and response to social and economic criteria for sustainability are more important than measurable performance and stylistic appearance. (Lee, 2011, p.18) And as an addition to those variables, the cultural and historic values mentioned in Chapter 2 should be taken into account in the assessment of a renovation project. How people and communities feel about what is happening to a historic building is at least equally as important as quantitative goals.

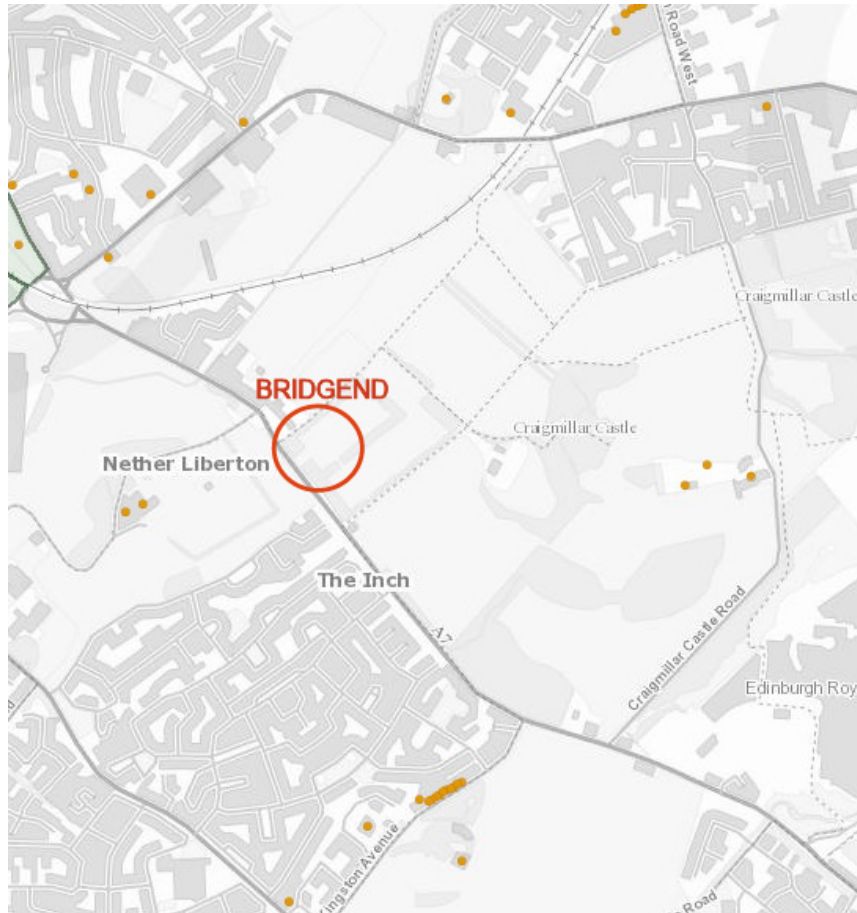
Similar criticisms apply for EPB/EPC schemes which are based on rough quantitative estimations about the building instead of on accurate POE measurements and thorough site research.

Appendix I: Ways in which the building can educate about sustainability

The Farmhouse could show off many types of sustainability in the education centre:

- Rainwater collection for toilets and gardens
- Composting
- Organic gardening and cooking workshops
- Smart metering
- LED lamps
- Solar energy (*'Make your own solar panel!'*)
- Passive techniques
- Recycling
- Aerated taps
- Food sharing
- ...

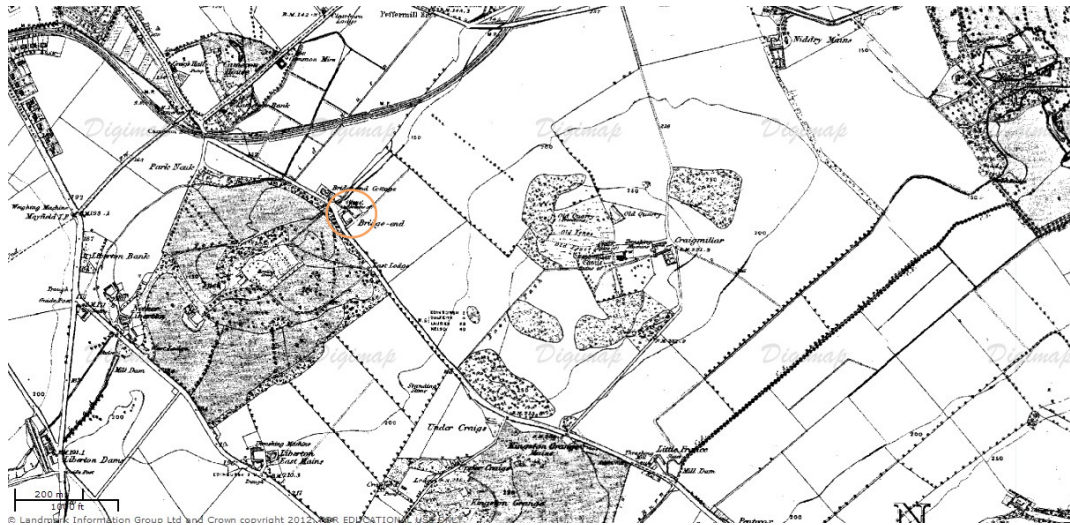
Appendix J: Listed buildings in the surroundings of Bridgend Farmhouse



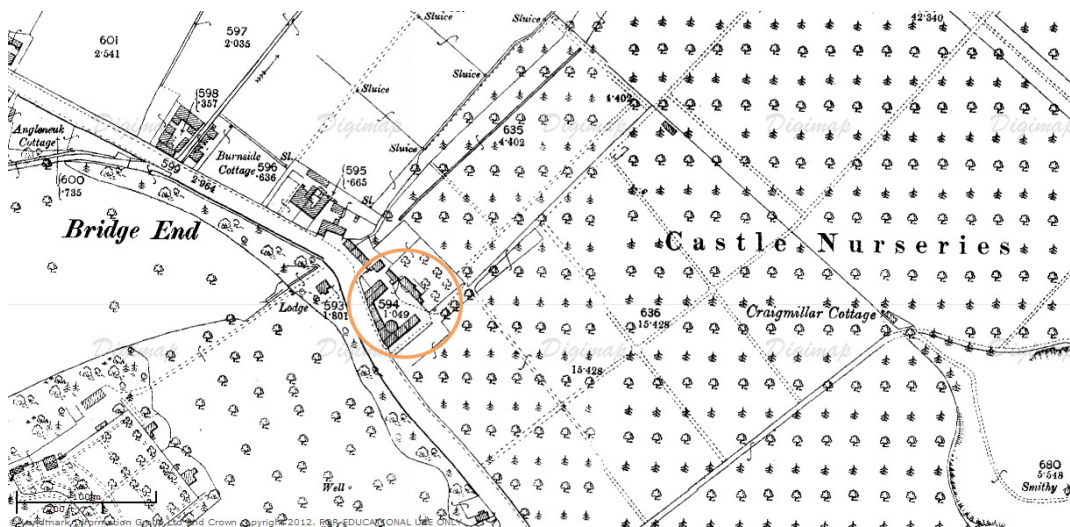
The farmhouse itself is not a listed building (The city of Edinburgh Council, 2013).

Appendix K: Historical maps and photos and Bridgend

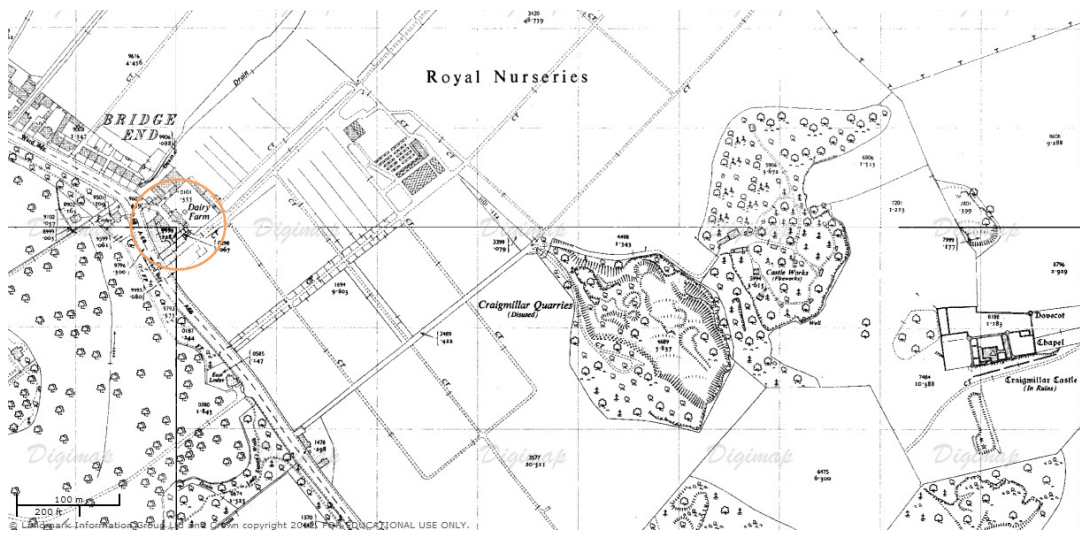
The maps and photo were found through the National Library of Scotland (NLS, 2013) and Digimap (2013).



1850



1890



1940



Aerial photo 1944-1950

The site lies at the heart of the significant historic settlement of Bridgend, associated with the site of both a Royal Hunting Lodge and the site of the late-medieval Lady of Bridgend Chapel, both constructed by James V. Historic accounts show that by the 18th century the chapel had been converted into stables which were part of a complex of buildings which formed Bridgend Farm (The city of Edinburgh Council, 2011).



Photo with the Bridgend farmhouse in the background, 1910, source:
http://www.edinphoto.org.uk/0_a/0_around_edinburgh_-_bridgend_looking_se.htm



Almost the same view, 100 years later (2013), by author

The Craigmillar area is an area where community work has been integrated for a long time, in connection to the housing schemes. Many documents could be found about 'comprehensive plans for action' and 'recommendations for the enhancement of the quality of life in Craigmillar' and 'recommendations for improvements in housing, jobs and the arts: a document produced by a community that is determined to help itself' (Craigmillar Festival Society, 1978).

Appendix L: Photos of the site and current state of the building

Photos by the author from site visits on 30 May, 13 June, 30 June and 30 July 2013 are shown.



These photos show the south and west facing façades of the building. The roof has been damaged by fire and the windows are lost.



These photos show the north and east facing façades of the building.



The (northern) garden of the farmhouse is shown left and the bike path next to the building is shown right.



On the left the adjacent allotments can be seen and on the right the domain edge of the farmhouse.



These photos display the nearby recycling centre and Craigmillar Castle park.



The ground floor of the building is in an abandoned state.



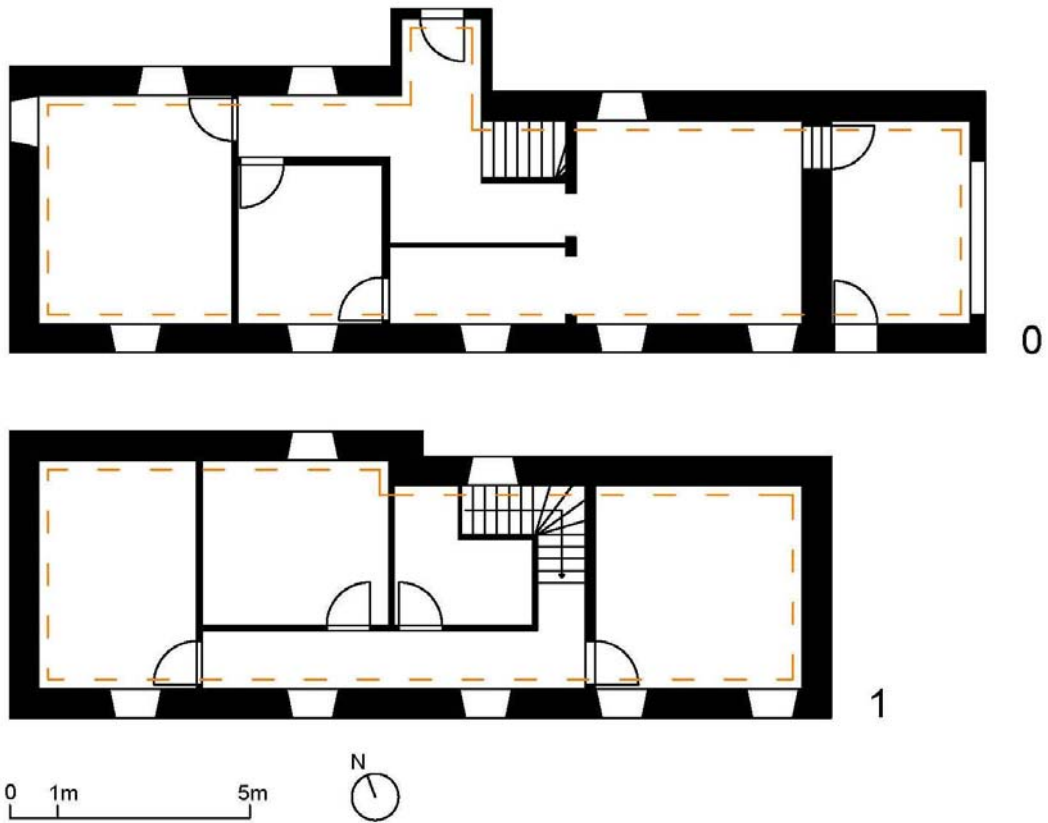
Several fires have occurred on the first floor of the building. The internal layers and walls are severely damaged or destroyed. Only the structural timber floor and external walls remain useful.



The photo on the right shows that the section of the structural timber of the roof has remained fully intact in most places, so probably it is structurally sound. In some places, it will need repair.

Appendix M: Floor plans of Bridgend Farmhouse

A laser measurement tool was used to measure the dimensions for the floor plans.



The orange dotted line represents the space that is lost at least when 20 cm of insulation is added.

Appendix N: Programmatic options for the Bridgend Farmhouse

Option 1 ('The wee option'): Working in partnership with one or two local 'anchor' organisations to provide a place with a strong ecological theme based upon healthy eating and living for e.g. children with learning disabilities. Most spaces in the farmhouse would be modest meeting rooms and a small kitchen would be present. The rooms upstairs could be rental spaces and a storage space for specialist and useful equipment and facilities would be provided on the site as well.

Option 2 ('Spreading out'): Working with a wider range of organisations to offer multi-functional spaces to enable outdoor education, healthy eating and living activities linked to the park and the allotments. There would be a slightly larger kitchen. The outside buildings would serve as workshops for crafts and activities, and as additional rental spaces.

Option 3 ('Thinking BIG'): Establishing a multi-agency management group to deliver a larger development based around the farmhouse. This option would provide heritage or exhibition spaces, a small library, a larger kitchen and associated café, a variety of workshops around the building and guided tours through the park.

This summary was based on the document 'Three options exercise' (Bridgend Inspiring Growth, (n.d.)a).

Appendix O: Most important practical guidelines for renovating traditional buildings in Scotland

The typology of the case study used is a traditional farmhouse. Traditional buildings in Scotland are defined as those built before 1919 (Historic Scotland, n.d.).

Apart from the historical, social and cultural guidelines that have been stated, these Scottish buildings also have some materialistic aspects that require special attention. These buildings have to be treated differently from more recent projects, as their materials often had characteristics and responses different from our modern materials.

The first aspect that requires special attention is that these buildings often have a high *thermal mass*.

The second aspect is that these buildings, in contrast to our current buildings, often had a high *breathability*.

This results into the fact that we should use breathable insulation materials when the building is thermally upgraded. Natural insulation materials are appropriate.

The third aspect is the use of *lime* and the major differences in behaviour between lime and cement (McKee, 2011; Griffiths 2012).

Appendix P: Notes from the interview with the former inhabitants of the Bridgend Farmhouse

Mr. Harry and Mrs. Doris Darling were the last inhabitants of the Bridgend farmhouse. They lived there from 1965 to 2000. A telephone interview with them has taken place on 17 July 2013. Some of their key statements and opinions are summarized in this appendix.

On the previous outlook and the condition of the farmhouse as they knew it:

- One part of the steadings had Scottish slates on its roof, while the two other parts had orangy-red pan tiles.
- Red sandstone was used.
- Thick flooring, no woodworm, certainly not downstairs.
- The current staircase is not the original one, which was a round spiral staircase.
- The buildings were harled by the previous inhabitant, which was born in the farmhouse, in the late 1800s or early 1900s.
- The house was painted white by the Darlings.
- There were big trees inside the yard but the previous farmer cut them away.

On the history of the function:

- The farm was originally a dairy farm.
- After cases of bovine tuberculosis, it was turned into a piggery.
- The Darlings have turned it into a cattle farm.
- They left the farmhouse in 2000. Since then the farmhouse has not been used.

On the reason why they left:

- The farmhouse and farmland were theirs.
- The council took over the land to plant a forestry to protect deciduous trees and to make a pass-through to Craigmillar.
- Because the council took their land away, the animals had to go away and they had to get out of the farmhouse.
- The council locked it down and the pan tiles and slates were removed from the steadings.

On the Bridgend allotments and the renovation action group:

- Wonderful to have the allotments there.
- Awful to see what has happened to the building since they left.
- Hope to see the farmhouse restored to how they used to know it by.

Appendix Q: Precedent projects

Outlook of a similar renovated Scottish farmhouse:



Example of restoring the original outlook (harling) of the steadings, cfr. proposal 1:



Combination of white coloured house and stone coloured steadings (left) and example of ridge windows (right), cfr. proposal 2:



Materials and outlook for the extension, cfr. proposal 3:



Use of timber in open entrance/public space (left) and shape of interior space of the extension (right), cfr. proposal 3:



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