Visual mapping of the Integral Sustainable Design approach

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Abstract: This paper aims to advance the understanding of Integral Sustainable Design (ISD) as an approach for the environmental assessment of buildings. The potential of ISD is the integration of qualitative as well as quantitative perspectives on a subject. ISD offers a bottom up approach to environmental assessment, whereas most common building energy rating schemes follow a top down approach. This paper explores how two and three-dimensional visual mapping can be used to integrate the qualitative and quantitative assessments of buildings. It is suggested that the ISD approach is suitable for the architectural design process even in the early design stage. It also enables the designer to identify and focus on synergies between the design intention and environmental requirements rather than their differences.

Keywords: Integral Sustainable Design, mapping, environmental assessment, environmental design

1. Introduction

There is now widespread recognition that the current generation of efficient or green buildings is insufficient (e.g. Reed, 2007; Hes and du Plessis, 2015). The underlying philosophy of these buildings is that we should conserve as many non-renewable resources as possible, minimize greenhouse gas emissions and if possible minimize impacts on biodiversity, water use etc. As our environmental crises continue to worsen, it has become clear that much more is required from our built environment. An alternative paradigm must therefore be adopted. This new way of thinking has emerged in various forms under different banners, e.g. Positive Development, biophillic or regenerative design. Collectively, these new ways of thinking embrace the concept of regenerative sustainability, which dictates that the built environment must do more than conserve; it must ‘put back’ i.e. restore nature. Only in this way, can the damage done by past behaviour be ameliorated.

New ways/tools of informing and guiding designers have emerged such as REGEN (Svec et al. 2012) and LENSES (undated). The emphasis of these tools is not on ‘box-ticking’, rather it is guiding outcomes through collective decision making, inclusive of all - users, non-users, builders, designers alike.. Non-technical issues such as the feelings of users and locals about a building are included. Broad
environment impacts are also considered, not just those as interpreted in current rating schemes. Good
guidance for designers, those with ultimate responsibility for the building design, is critical. Overly
complex analysis tools will impede the adoption of regenerative buildings. For example, the two tools
cited above require much data and skilled operators. This paper proposes ways of visualizing and
guiding designers who adopt another proposed method of designing a new generation of buildings. That
method is Integrated Sustainable Design (ISD). The paper begins with an overview of ISD and then
describes how the results of using the tool can be mapped and visualized in a three dimensional way.

2. Integral Sustainable Design

ISD is based on Integral Theory, the philosophical approach proposed by the American philosopher, Ken
Wilber (2000). It has been further developed by Zimmermann (2005) for application with ecological
questions and DeKay (2011) has made it available for the architectural discipline with his book defining
the concept of Integral Sustainable Design (ISD). It has been embraced as a useful framework applicable
to a wide range of fields, ranging from ecology (du Plessis and Brandon, 2014) to business (Paulson,
Integral Sustainable Design (ISD) which seeks to overcome the ‘art vs science’, ‘design vs technology’
and ‘analysis vs creativity’ thinking that has dominated the design disciplines for the past decades.
Although it acknowledges the intention and worthiness of environmental rating schemes such as LEED,
it questions the objective-only approach and gives no credit for experiences of beauty and the
relationship people have with nature. ISD suggests that four simultaneous perspectives on a problem
can be represented by quadrants each of which takes a different view of the problem. The ‘experiences’
quadrant (upper left) focuses on the individual human experiences, while the ‘behaviours’ quadrant
(upper right) looks at the environmental performance. The ‘cultures’ perspective (lower left) focuses on
collective interpretation of meaning, symbolism and worldviews on nature, and finally the ‘systems’
quadrant (lower right) investigates the response and interaction with context and systems(Figure 1).

![Figure 1: Quadrants and levels of Integral Theory](image-url)
Although developed as a philosophical approach, for architects ISD can act as a reminder of the different perspectives that a sustainable building should address. Commonly environmental issues are approached with top down methods such as building energy rating schemes, which break down a greenhouse gas emission goal and other environmental goals into separate performance criteria and sub criteria that are assessed quantitatively. While this approach has been successful for quantitative assessment parameters, it does not accommodate qualitative criteria very well. In order to overcome this limitation, a bottom up approach to identify parameters and methodologies for holistic assessment of qualitative as well as quantitative parameters is necessary. In contrast to the top down approach, the bottom up approach focuses on the links and synergies between individual parameters rather than their differences and thus offers a different perspective to address the future requirements of the built environment. In contrast to rating schemes, ISD does not prescribe a set of assessment criteria, instead its intention is to identify and establish parameters of importance in the context of a specific project, thus potentially leading to a more-project specific rather than ‘one size fits all’ type of solution.

3. Responsibility rather than rating

ISD is an approach to a more comprehensive understanding of sustainable design. It is based on the underlying assumption of Integral Theory that there are always multiple perspectives from which a given question or topic can be investigated. With regards to sustainable buildings, a designer’s view or definition of nature is likely to shape the thinking as well as the resulting design. ISD is based on four quadrants, each introducing a different perspective, and four levels of understanding for each quadrant. ISD suggests different definitions of nature for each of the four levels. On the traditional level the understanding of nature is based on the concept of nature being ‘managed’. On the modern level, the understanding is to ‘use’ nature, e.g. in terms of resources. Postmodern thinking is centred around the idea of ‘saving’ nature, whereas the integral viewpoint suggests that nature and culture are united (DeKay 2011). Designing from one viewpoint or another is likely to lead to different proposals of what sustainable architecture would look like. And vice versa, a design is likely to communicate the underlying viewpoint on nature that the designer had. Each viewpoint predefines certain choices as more or less ethical and shifts particular design approaches or technologies in or out of focus (Table 1). For example, on a traditional level, the building manages nature or natural forces as experienced by the senses. On a modern level building is a response to an intellectual understanding of how natural resources can be used efficiently for the benefit of the building. On a postmodern level nature is understood as a complex ecosystem, with the building attempting minimum interference. At an integral level, the building becomes an integral and responsive part of a living ecological system.

Table 1: Four quadrants at four levels of Integral Sustainable Design as defined by DeKay

<table>
<thead>
<tr>
<th>Level</th>
<th>Experiences (UL)</th>
<th>Cultures (LL)</th>
<th>Behaviours (UR)</th>
<th>Systems (LR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional</td>
<td>Sensory mediation</td>
<td>Nature managed</td>
<td>Embedded practices</td>
<td>Tacit systems</td>
</tr>
<tr>
<td>Modern</td>
<td>Intellectual mediation</td>
<td>Nature used</td>
<td>Building science</td>
<td>Logical systems</td>
</tr>
<tr>
<td>Postmodern</td>
<td>Contextual mediation</td>
<td>Nature saved</td>
<td>Cyclic analogues</td>
<td>Complex systems</td>
</tr>
<tr>
<td>Integral</td>
<td>Self mediation</td>
<td>Nature united</td>
<td>Responsive structures</td>
<td>Living systems</td>
</tr>
</tbody>
</table>
This illustrates a fundamental difference between the framework of ISD and common building energy rating schemes. A rating scheme is defined by a set of assessment criteria which through the nature of these criteria communicate the underlying perspective on nature. The approach of ISD is the exact opposite, in that the framework first raises awareness that there is the possibility of different perspectives on nature, and then rather than prescribing a set of criteria, it raises the awareness of designers to make responsible choices depending on the individual challenges they are facing. Where a rating scheme, by offering criteria to be “ticked off”, to a certain degree takes responsibility off the designer, ISD does the opposite by emphasizing the designer’s responsibility. This responsibility proposed by ISD can be empowering for a designer as the pool of potential choices and methodologies is not limited to those on a list of criteria. At the same time it can be challenging, as responsible choices require broad knowledge and are likely to be very project specific.

In this sense however, ISD is very well matched to an architectural design process. A design process starts with a brief and a site, and then it is the responsibility of the architect to synthesize various requirements into a design proposal. This involves defining what is important for a particular project and to deal with conflicting requirements. There is no universally prescribed way how to design a building and it is largely a result of the design intentions of the architect, which explains the diversity of proposals in architectural competitions. Similar to that ISD can be interpreted in a way where a ‘sustainable’ building can have many different faces, depending on the perspective and the choices made by the designer.

4. ISD as a mapping tool – a case study

4.1. Mapping to analyse a building (2D)

Figure 2 illustrates an attempt to visually map the findings from a case study ISD analysis of the Deakin University Waterfront Campus Building in Geelong, Victoria, Australia across the four quadrants of IT. The analysis has been performed as part of a previous pilot project (Roetzel et al 2015), and due to the small scale of the study it was focused on parameters that were readily available rather than being a result of comprehensive research. The intention of the mapping was to highlight interconnections between parameters and therefore only parameters with at least one link to another parameter have been included.

As can be seen in Figure 2, the 2D map shows more parameters in the right hand side quadrants (UR performance and LR context). This can be interpreted in two ways. Firstly it is possible that the researchers paid more attention to the right hand side quadrants, and secondly it can indicate that the design of the building has a stronger emphasize on the right, rather than the left hand side quadrants. The arrows in the map show how parameters within and across quadrants influence each other, and it can be assumed that the parameters with mostly outgoing arrows are causes whereas the parameters with mostly incoming arrows are effects or responses. In the case of the Waterfront Campus building, the most influential parameter (four connections) is the geographic location in Geelong. The location

- impacts on individual travel modes to the campus due to limited public transport in Geelong as opposed to Melbourne
- provides beautiful views across Corio Bay
- predefines brown coal as a primary energy source in the state of Victoria, Australia
- determines the temperate climate zone
The reuse of an old woolstore for a university building is the second most influential parameter as derived from this map. It:

- makes for a well-known building, as it has been around for a long time and is connected to the city’s past importance in wool trading
- predefined survey responses of people in Geelong saying that the building does not look like a university
- reduces the embodied energy of the campus building due to adaptive reuse rather than new construction

The views across Corio Bay influence two other parameters, visual comfort of occupants enjoying the view and the windows facing the views (and the northern sun) have an indirect influence on thermal comfort.

The parameter most influenced by others, i.e. the one with the largest number of incoming arrows is greenhouse gas emissions. This is due to the high amount of individual car travel and the predominant primary energy source with a rather high emission conversion factor being brown coal in Victoria.

While further testing with different buildings and a larger number of parameters would be helpful, it can be concluded that the parameters which have the largest number of outgoing as well as incoming arrows in the map are parameters that require particular attention of the designer, as they may provide
the strongest potential for responsible choices. E.g. in the state with the worst CO2 conversion factor for electricity in Australia, measures that lower CO2 emissions will be relatively more influential than in other states.

4.2 Mapping to compare different buildings (3D)
ISD is commonly visualised in a two-dimensional diagram as illustrated in Figure 3. However DeKay discusses the four quadrants (experiences, behaviours, cultures and systems) in the context of the four levels, traditional, modern, postmodern and integral. These levels can be thought of as an additional third dimension in the visualisation of ISD.

![Figure 3: Two-dimensional visualisation of ISD](image)

An attempt to visualise ISD in three dimensions is illustrated in Figure 4. The limitation of this visualisation however is, that the image depicts the transitions between levels as clear boundaries, which does not accurately reflect the ISD approach. The levels are roughly sequential in the sense that on a global scale post modernism got broad attention after modernism. However ISD argues, that each new level did not make the previous one superfluous, rather it added an additional perspective, and that all the four levels are available and valid today depending on the specific challenge a designer is facing. The attempt to draw boundaries with one line clearly defining in and out is therefore limiting, but pursued in Figure 4 for the sake of visual simplification.

The advantage of this three dimensional representation is that it is a simplified way of mapping the intentions or focus area of a project as illustrated in Figure 5. For example, a community centre (A) might have a strong emphasize on the lower left quadrant (cultures), a project that blurs the boundaries between built form and landscape (B) might have a strong emphasize on the lower right quadrant, a hammam (C) could be expected to have a focus on individual experiences, whereas a building housing a nuclear reactor (D) would be strongly represented in the UR quadrant. This very simplistic method of visualisation enables a quick comparison between projects.
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A question that arises in this context is whether it is feasible or desirable for all quadrants to be at equal levels for all types of projects. Figure 5 is based on the assumption that by their very nature, different building types might have a bias in one or another quadrant. The purpose of a hammam, for example, is to provide individuals with a sensory experience of or protection from natural forces (upper left quadrant, traditional level) and without doing that it would defeat its purpose. On the other hand the building housing a nuclear reactor could lead to a disaster if the performance of the envelope in containing radiation and preventing pollution of the surrounding natural environment was not the absolute priority (upper right quadrant). This is not to say that the other quadrants are not also significant for these buildings, but the nature of the project seems to suggest an order of priority among the quadrants. This is in opposition to Buchanan’s (2012) interpretation of Integral Theory applied to architecture, suggesting an even balance between quadrants as a design goal. His discussion however is focused on less extreme building types such as houses and public buildings where an even balance might be more realistic.
For a designer this simplified way of visualising the quadrants and levels can be useful in two ways. At the start of the design process it can help to establish:

- what are the project’s desired relationships with nature as viewed from the perspective of the four quadrants
- at what level of design response would be appropriate

At later stages of the design process the intentions defined at the start can serve as a benchmark for the assessment of the success of the project. The quadrants and levels can also act as a reminder for perspectives that might offer potentials for improvement when further explored.

4.3 The difficulty to with quadrant boundaries

One major finding from our previous research on this topic is the interconnectedness of the four quadrants. As pointed out in the lessons learnt from a case study project (Roetzel et al 2015) for many aspects of a building it is not straightforward to associate them with one quadrant or another as from an integral perspectives several quadrants would be related. E.g. a photovoltaic system will contribute to the energy performance of the building, a parameter commonly associated with the upper right quadrant. However the output is also determined by the climatic context, which is a parameter related to the lower right quadrant. In several cases it was difficult to draw clear boundaries between quadrants. This implies a challenge when visualising the framework of ISD. On the other hand the parameters which are “difficult to file into one single quadrant” are the ones with the most interconnections with parameters in other quadrants. As identified in the 2D mapping exercise above (building analysis) it is these parameters however, which seem to have the largest potential for synergies, which means they may be key parameters in environmentally responsible decision making.

It could be hypothesized that a building’s success in environmental terms could be established by the degree of interconnections between quadrants, and the difficulty to relate particular aspects of a building to only one quadrant.

5. Conclusions

Integral Sustainable Design as described by DeKay is a theoretical approach to environmentally responsible architecture. This paper reflects on an initial pilot study conducted by the authors, aiming to explore how this theoretical approach can be made available to architectural practice. Many lessons still remain to be learnt concerning the potentials and limitations of ISD as an assessment approach. This paper reflects the current understanding by the authors as part of an ongoing research process.

Lessons learnt so far:

- ISD highlights the importance of integrating qualitative as well as quantitative perspectives. As such it is more closely aligned with the discipline of architecture at the intersection of art and science, compared to quantitative-only rating schemes.
- ISD has potential for better integration with the architectural design process compared to common building energy rating schemes. Rating schemes often require rather detailed information for an assessment to be performed, and are therefore assessed in later stages of a design process when this information is available. ISD does not predefine a particular level of detail of analysis and can therefore be useful already in early design stages.
- when used as a mapping tool, ISD can act as a reminder for a holistic design approach acknowledging multiple perspectives on a project and the responsibilities that are associated with each perspective. It can also help to identify synergies between different perspectives, i.e. where the architectural design intentions go hand in hand with environmental responsibility.

Lessons still to be learned:
- further research is needed to establish how ISD can be applied at different scales of a project. The investigated pilot project focused on a room or building scale, but the potential for ISD to be used at a larger scale (urban, regional) would be worth further exploration.
- further research is required to investigate the case study project not only from the perspective of the four quadrants but also considering the four levels.
- further research into the synergies between the approach of ISD and the architectural design process can advance the understanding how ISD can be made useful for architectural practice and what potentials and challenges are.

Acknowledgements

The authors would like to thank Prof. Mark DeKay for his generous feedback on the pilot study that lead to this paper.

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