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The use of Integral Theory to evaluate architectural sustainability – a case study

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Abstract: DeKay's concept of Integral Sustainable Design (ISD) is based on Integral Theory, a framework proposed by the American philosopher, Ken Wilber. It offers four simultaneous perspectives (represented by quadrants) which each take a different view of the problem. The 'experiences' quadrant focuses on individual human experiences. The 'behaviours' quadrant looks at environmental performance. The 'cultures' perspective focuses on the collective interpretation of meaning, symbolism and worldviews and the 'systems' quadrant investigates the response and interaction with context. Integral Theory can act as a reminder for architects of the different perspectives that a sustainable building should address. In order to evaluate ISD, the Waterfront Campus Building of Deakin University has been used as a case study. The building, its performance, impact and perception, has been evaluated using both quantitative and qualitative data. Two surveys have been conducted to gather qualitative data to: (i) determine the experience of building users (staff and students) and (ii) the perception of non-users (Geelong residents and tourists). Data from building services and a site analysis has enabled quantitative assessments to be made. These inputs have been analysed, guided by ISD, to evaluate the usefulness of ISD as a sustainability assessment tool.

Keywords: Sustainability; assessment; Integral Theory.

1. Introduction

The built environment in all its forms is probably the single biggest contributor to the increased human impact on the planet. The impacts are wide ranging, numerous and well researched. For example, there is the: operational energy to heat and cool the structures; embodied energy in the construction materials used; loss of biodiversity at all stages of manufacture and use; water consumption and effect on run-off; and the waste generated from cradle to grave. These are the conventional metrics by which, at the very least, we should be evaluating our new buildings. The built environment has other impacts, however. The built environment shapes the way we behave, think and experience the world around us. If we are serious about building in harmony with the planet, rather than against it, we must consider a wider context, one that includes surrounding ecosystems, their interaction, dynamics and interdependence. If our actions are seen and framed in a more holistic way, we may then truly embrace 'sustainable development'.

This latter term was first brought to global prominence by Gro Harlem Brundtland nearly 30 years ago (WECD 1987) and, despite the criticisms, it has remained on the world agenda ever since. It explicitly (or implicitly) underpins much of what those who care about the planet do in their private and professional lives. Today, as we face the life-threatening impact of changing the planet's climate, the concept of any future 'development' and what it looks like is probably the single biggest challenge confronting humankind. It has been suggested that sustainable development has four key principles (Palmer et al. 1997) - futurity, environment, participation and equity – and these principles are a useful reminder of the interaction between the environment and society. Sustainable development as a concept has unfortunately been found wanting and not delivered a clear way forward. It has been interpreted in many different ways, usually to suit the purposes of the proponent. Others have argued that 'weak' and 'strong' sustainability must be differentiated and that only the latter which places the planet (environment) at the centre of all decisions should be adopted.

An alternative theory that brings a new perspective to the thinking about our built environment and one that might guide our future actions is Integral Sustainable Design (ISD). The framework of ISD aims to provide an approach to sustainability, that is not just more holistic in terms of criteria considered but which seeks to establish a new paradigm where buildings are evaluated from a perspective of 'being within nature', rather than outside of it, no matter how sensitively. The aim of this paper is test the appropriateness of ISD to evaluate the sustainability of a particular building. To the authors' knowledge this has not been attempted previously although some generalizations of the applicability of ISD to the built environment have been suggested (Du Plessis and Brandon, 2014). To acquaint the reader with the fundamentals of ISD, this paper begins with the theoretical considerations and model proposed by DeKay and Bennett (2011). The building used as a case study in this research is then briefly described followed by an overview of the methodology adopted in this analysis. A detailed description of the research method used to address each of the four components is then given together with the particular results generated. Discussion of these results, both separately and as a whole then follows. Some conclusions of the strengths and weakness of the ISD method are then drawn.

2. Background Theory

According to DeKay and Bennett (2011 xxiii), the concept of ISD aims to improve the relevance, meaning and positive effect on people and nature.

> "Integral Theory is a meta-theory, a network structure of other valid theories from multiple domains of knowledge. Its primary offering is that the world is disclosed differently depending on the perspective taken and that many perspectives are necessary to get a whole and complete understanding of the world, or even fully grasp any particular occurrence. As such it uses two primary frameworks: 1.The four perspectives (quadrants), which arise from fundamental distinctions of value, and 2. Levels of complexity, which arise from the unfolding sequence of development in human individuals, cultures and physical systems, which manifest as developmental sequences such as those for values, cognition, biological evolution, economic systems and worldviews."

ISD 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 is based on Integral Theory, a framework proposed by the American philosopher Ken Wilber. ISD suggests that four simultaneous perspectives on a problem can be represented by quadrants each of which takes a different view of the problem (Figure 1). 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, and finally the 'systems' quadrant *(lower right)* investigates the response and interaction with context. Although developed as a philosophical framework, for architects Integral Theory can act as a reminder of the different perspectives that a sustainable building should address in the following way:

- the building should perform well *(upper right quadrant)* i.e. consume a minimum of resources and have minimal environmental impact. This can be evaluated by quantitative and measurable criteria, which are commonly represented in building rating schemes.
- the building should be well-integrated into its context *(lower right quadrant)* and consider the immediate site and climate, the biological and cultural region, responding to a comprehensive theory of place, engaging local, regional, global and universal forces such as climate change and urbanisation.
- the building should offer a rich experience to different individuals *(upper left quadrant)*. It should stimulate all the human senses (not just the visual sense), trigger positive feelings and emotions, provide health, well-being, comfort and delight, and enforce the consciousness of natural cycles, transformations (i.e. seasons, weather, time of day), ecologies and evolutions to strengthen the connection of individuals to nature.
- the building should convey symbolic meaning about cultural values *(lower left quadrant)*. It should fit into the cultural context; the design should express what is important to society on a local regional and global level; it should be ethically responsible; and is itself a product of practices and perceptions embedded in the building culture and pattern languages used by that building culture.

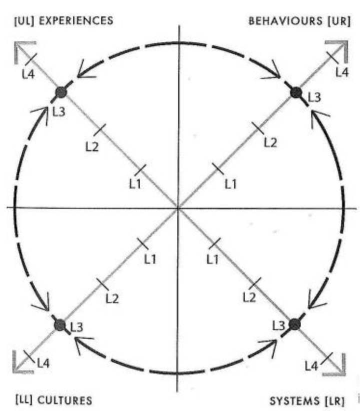

Figure 1: Quadrants and levels of Integral Theory (source: DeKay and Bennett, 2011).

The two left hand side quadrants are therefore qualitative (subjective) and the two right hand side quadrants are quantitative (objective). While DeKay uses the term 'behaviours' for the upper right quadrant and 'systems' for the lower right quadrant, for the sake of clarity in the discussion with architects and occupants, the term 'performance' is added to the upper right and the term 'context' is added to the lower right quadrant. Table 1 summarizes the focus of each quadrant and the main method of investigation. While the quantitative quadrants are more straightforward to measure numerically, the evaluation of qualitative quadrants might require the additional expertise of social scientists and psychologists.

Table 1: Summary of the quadrants of Integral Theory and methods of investigation.

Quadrant	Qualitative or quantitative	Main question	Method of investigation
Upper left - Experiences	Qualitative	How does an individual person experience the building?	Human senses, feelings, emotions, consciousness, experience
Lower left – Cultures	Qualitative	How is the building perceived by society?	Mutual understanding, worldviews, symbolism
Upper right – Performance/Behaviours	Quantitative	How does the building perform?	Measurement, calculations
Lower right – Context/Systems	Quantitative	How well is the building integrated into its context?	Mapping, systems understanding

3. The Waterfront Campus Building

The building chosen for analysis using the ISD concept is the Waterfront Campus Building (WCB) of Deakin University in Geelong (Figure 2). The building was originally constructed as a woolstore for Dalgety and Co. in 1891. However, it has undergone various transformations in use (including the assembly of the 'Dalgety Ford') and appearance prior to its current transformation into a university building in 1996.

Figure 2: Deakin University's Waterfront Campus Building.

4. Research methods overview

The research methods used to analyse the sustainability of the building were guided by the four quadrants shown in Figure 1. The performance of the building *(upper right quadrant)* was analysed using traditional performance metrics namely energy and water consumption, as well as lighting and thermal comfort. Estimates of embodied energy were also made. An architectural site analysis was conducted to determine how well the building fitted within its context *(lower right quadrant)*. An on-line survey was used to determine the experiences of users of the building *(upper left quadrant)* and a street survey in two locations in Geelong was used to assess how well the building was perceived by outside society. The results of each individual analysis are presented below.

5. ISD-guided analysis

5.1. How do users experience the building? (Upper left quadrant)

This part of the study investigates the perception of the building user. The participation rate for the on-line survey was very high. Of the 220 people who participated in the survey, 54% were students and 46% were staff (Q1). The next two questions asked participants to identify their 'favourite space' within the campus, either inside or outside (Q2), and the importance of the various human senses (sight, hearing, smell, taste and touch) in experiencing that favourite space (Q3). Participants were also asked what they preferred to do in their favourite space (Q4) and whether it enabled them to be aware of conditions outside the building (Q5).

As the question about 'favourite space' was open-ended, a number of spaces were identified such as the library, café, staff lounge room on Level 6 and courtyard. The library was the most preferred space for most of the students and staff lounge room on Level 6 was the most preferred room for most of the staff. In terms of the importance of various human senses, sight was the most important followed by hearing. Both smell and touch were similar in terms of importance and taste was found to be the least important (Table 2). The majority of the people felt that their favourite place enabled them to identify the time of the day i.e. they experienced daylight (Table 3). In summary, most of the favourite spaces have one thing in common i.e. a lot of windows and a view of Corio Bay. This finding is not unexpected as the users find sight as the most important sense.

Table 2: Relationship of human senses to favourite space.

	not important	**medium importance**	**most important**	**total score**
Sight	6	49	166	381
Hearing	35	110	67	244
Smell	80	91	40	171
Touch	73	98	36	170
Taste	152	37	21	79

Table 3: Favourite space and ability to experience natural conditions.

Natural conditions	Number of responses
Time of the day	204
Rainfall	179
Patterns And Intensity Of Sun	164
Wind	152
Seasonal change of flora and fauna	120
Temperatures	117

5.2. How do outsiders experience the building? (Lower left quadrant)

The purpose of this part of the investigation was to determine the attitude of 'outsiders' to the building. By 'outsiders', we mean local residents or visitors to Geelong. The views of these people would hopefully be an indication of whether the building fitted into its cultural context and whether it expressed to them what is important at a local and regional level. In other words, how well the building conveyed cultural meaning (DeKay, and Bennett 2011). To determine these local perceptions, street surveys were conducted over two days in two different locations of Geelong. Both locations were within 500 metres of the building and in busy pedestrian thoroughfares. Passers-by were asked if they would take part in a survey for Deakin University and told that the survey only contained 11 questions and therefore it would not take long to complete. Surprisingly, only 21 responses were collected over the two days, with people seemingly reluctant to take part. The surveyor thought that people may have believed that she was selling something and this explained their reluctance to participate. The level of response is in sharp contrast to the on-line survey of users of the building, namely staff and students, where the response was more than ten times the street survey number.

The first question (Q1) simply asked if the person being surveyed recognized the building. Over 90% of people responded in the affirmative. Over 76% of those interviewed had actually been inside the building (Q2), which indicates that despite its location on the edge of the CBD and down on the waterfront, the local community had ventured inside and experienced the building more deeply for some reason. The building's café is open to the public and is sometimes used for 'events'. In addition, concerts are also held in the large performance space within the building. The general reaction to Q3 was that the building improves its waterfront location with nearly 62% responding positively. However, the survey discovered that it was not the main interest when visiting the waterfront location. Perhaps unsurprisingly, over 70% focused on their natural surroundings i.e. Corio Bay and the surrounding views rather than the buildings. The building's importance to Geelong was recognized by a positive response (76%) to the next question (Q5) but those surveyed were much more equivocal about whether the building fitted their image of a university building (Q6). People were fairly equally split (52-48%) on this question and perhaps these mixed feelings are reflected in the response to subsequent questions. A positive (57%), although not overwhelming, response to whether the building reflected an important view of Geelong to visitors (Q7) was offset by a strong view that the building was not particularly attractive (Q9) with only 38% saying 'Yes' and the same percentage even thought a new building should have been constructed rather than re-using an existing building (Q8). However, two out of three respondents did feel the building had something to offer society. Table 4 summarises the results of the survey.

Table 4: Summary of street survey questions and responses (percentages).

No	Question	Yes	No
Q1	Do you recognize the building?	90	10
Q2	Have you been inside the building?	76	24
Q3	Do you think the building improves its waterfront location?	62	38
Q4	When you are down at the waterfront, what do you mainly look at – the buildings or nature?	29	71
Q5	Do you think the building is important to Geelong?	76	24
Q6	Does the building fit with your idea of a university building?	52	48
Q7	Does the building reflect a view of Geelong that you would like visitors to understand	57	43
Q8	Do you think a brand new university building should have been constructed on this site rather than re-using an existing building?	38	62
Q9	Do you think the building is attractive?	38	62
Q10	Do you think the building offers anything to society?	67	33
Q11	Do you have further comments you would like to make about the building? If so, what are they?	24	76

Further comments were made by five (24%) of those surveyed (Q11). Four out of the five comments were 'negative' and related to the appearance of the building in one way or other. Perhaps this is not surprising since the respondents were not 'users', rather they were 'observers' of the building. Of interest and significance to this research are the following statements that:

- "More work should have been done on the façade. It is a box";
- "More signs to clearly state that it is a university";
- "It should look more like the old days when it was the woolstore";
- "Having the university in the city is fantastic for Geelong";
- "Could have a façade face lift".

5.3. How well does the building perform? (Upper right quadrant)

This quadrant represents the area with which most building designers and others interested in sustainable buildings will be familiar. How well does the building perform in a technical sense? Several metrics have been used to evaluate the building: energy and water use, embodied energy, thermal comfort and lighting, and each of these is discussed below.

5.3.1. Energy

The WCB has a gross building floor area of 56,000 m^2 and there are 3,938 full time equivalent students who attend this campus. In addition to the students, 600 staff use the building. The campus building consumes 13,097 MWh of energy per year and produces 10,855 tonnes of greenhouse gas emissions. There are several benchmarks against which this criterion can be evaluated. One of the benchmark available is the Tertiary Education Facilities Management Association (TEFMA). According to TEFMA (2012, cited in GHD, 2014), the best practice energy benchmark for existing buildings is 740 MJ/m^2 per year. The energy usage intensity of the WCB is 841 MJ/m^2 which exceeds the TEFMA best practice by 13%. The energy consumption per student is 25% more than the TEFMA benchmark. Another metric is the Australian NABERS commercial office building rating (NABERS 2003). By supplying the measured energy consumption and associated carbon emissions, estimates of star rating can be made in various usage and occupancy scenarios. Ranges of 50-70 hours per week for 1000-1800 occupants were assumed. In the five scenarios considered, the WCB had the performance equivalent of a 3.5-4.0 star-rated building. Considering that the WCB is a refurbished building and that a 6.0 star rating is the optimum, this is considered to be a reasonable performance.

5.3.2. Water

The total annual potable water consumption is 6,992 kL and the waste water produced is 3,798 kL. Dividing this by the total equivalent full-time student load (EFTSL), the total water use including consumption and waste is equivalent to 2.74 kL/EFTSL. This is only 20% of the TEFMA benchmark of 13.6 kL/EFTSL.

5.3.3. Embodied energy

Estimation of the energy embodied in a building is a complex calculation process requiring large amounts of data, which is beyond the scope of this research. Nevertheless an approximation of the emissions avoided by re-using an existing building can be made, as opposed to the emissions generated by constructing a new building. Crawford (2011) has calculated the carbon dioxide emissions for a new three-storey commercial office building. The floor area of building was 11,600 m^2, compared to the WCB which is 56,000 m^2. Crawford estimated that emissions from the embodied energy in the construction of the smaller building were 22.9 kt CO_2-e. Maintenance and refurbishment of the building over a 50-year timeframe are assumed to be the equivalent of 1% per annum of the building's initial embodied energy i.e. 11.4 kt CO_2-e. Using this ratio as an indication of the energy embodied in the initial refurbishment of the WCB means that the embodied energy of the refurbished building is approximately 55 kt CO_2-e, compared to 110 kt CO_2-e that would be incurred if a new building had been constructed.

5.3.4. Thermal Comfort

Measurements were conducted in four selected locations to analyze internal thermal comfort conditions. As the building is fully air-conditioned, the PMV/PPD model has been used. Figure 3 shows the Predicted Percentage Dissatisfied in each of the four selected areas. Note that the measurement time varies in each area. Since measurements were taken in winter, a clothing value (CLO) of 0.8 and the activity level of 1.2 MET (metabolic rate) was assumed.

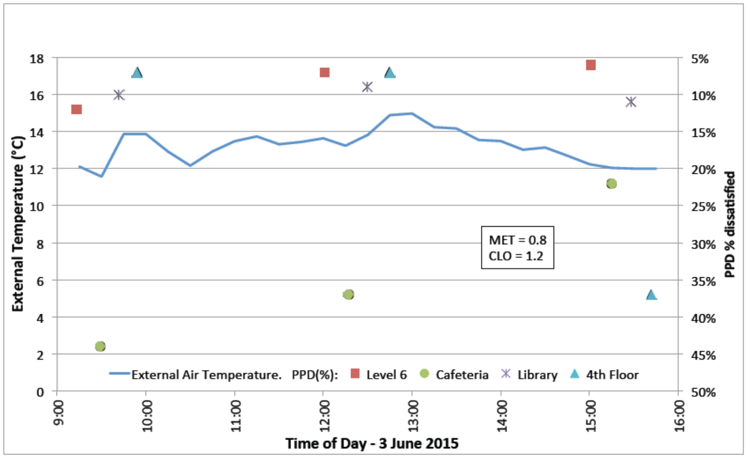

Figure 3: Comfort analysis in various areas of the WCB.

Interestingly, our results indicate that there can be a high variability in comfort for specific areas (cafeteria and 4th floor offices). For most of the areas the PPD is quite reasonable; however, in areas of greater activity and transition such as the cafeteria, comfort can vary significantly throughout a day. Again, considering that this is a refurbished building, the energy and comfort performance appear to be reasonable.

5.3.5. Lighting

Lighting measurements were taken in one of the atrium spaces adjacent to the design studio on the 4th floor on a cloudy day in May using a handheld lux meter. Figure 4 shows the floor plan and view of the 48 m^2 space. Natural light enters through glazing of the saw toothed roof. Artificial lighting is provided by four T5 fluorescent lamps, 39 W each, giving the total lighting power density is 3.3 W/m^2. The artificial lighting system is integrated with daylighting through motion sensors. According to the Australian Standard (AS 1680.1), the minimum recommended lighting levels in such spaces is 160 lux. BCA section J mandates 6 W/m^2 as the lighting power density of such space. The lux levels varied from 300 to 800 lux during the day which was significantly above the minimum levels. However, at night, the lux levels were 50-200 lux leaving the corners under-lit.

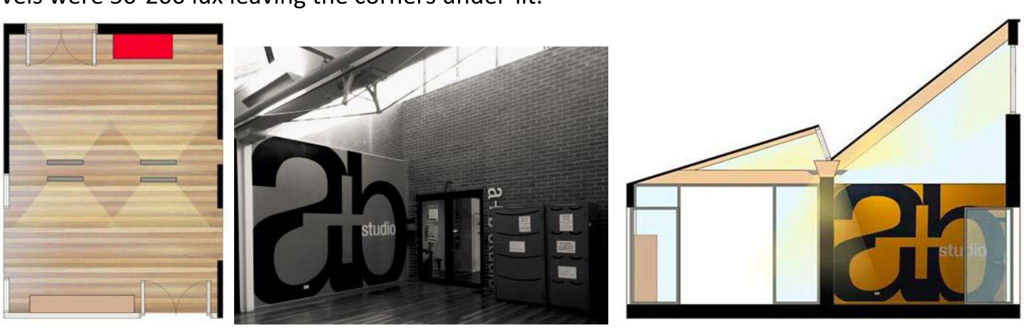

Figure 4: Floor plan, view and section of the atrium space chosen for lighting evaluation.

5.4. How well does the building fit in its context? (Lower right quadrant)

The purpose of this part of the investigation is to evaluate to what degree the context of the WCB has been used to its full potential with regards to sustainability. This section is discussed as a site analysis commonly performed in early stages of architectural projects. While for architectural projects a site analysis is typically performed to generate design ideas, in the context of this paper the intention is to define potentials for sustainability and then to evaluate to what degree the WCB uses those potentials.

5.4.1. Climate

The climate in Geelong is temperate (Peel et al. 2007). The mean maximum temperature is highest in January and February (25 °C) and lowest (about 14 °C) in July and August with a gradual de/increase in the transition seasons (BOM 2015). The mean minimum temperature shows a similar distribution with highest values (around 14 °C) in December to February and lowest values in July (about 5 °C). In case of natural ventilation, the comfort zone for the operative indoor temperature in Geelong ranges from a minimum of 17.4 °C to a maximum of 27.3 °C (ASHRAE 2010), as determined with the software climate consultant (DAUD 2015) based on climatic data generated with Meteonorm (2015). The outside temperatures are: within the indoor comfort temperature range for about 15% of the year; below the comfort zone for more than 80% of the year; and above the comfort zone for less than 5% of the year. Although an assessment of outdoor temperatures alone is of limited value for indoor comfort assessment, it at least gives an indication that the climate requires heating rather than cooling and that the climate offers a potential for natural ventilation. With regards to the WCB, it can be concluded that the current operation as a fully air conditioned building is a missed opportunity. The climate analysis indicates potential for operation of the building in mixed mode, with natural ventilation potentially possible for a number of months of the year. This offers a reduction potential for energy consumption due to air conditioning.

The mean solar exposure in Geelong varies significantly between summer and winter, with highest values (about 25 MJ/m2) in December and January and lowest values (about 7 MJ/m2) in June and July with gradual de/increases in between. The saw-tooth roof of the original wool stores is still in place and this provides perfectly north-oriented sloping roof areas with minimal roof obstructions for the integration of photovoltaic installations. Only buildings to the south of the campus are taller, therefore there is little solar obstruction by surrounding buildings. A preliminary analysis (GHD 2014) investigating PV feasibility for the WCB estimated that if the majority of the available roof space was used, approximately 480 kWp of solar energy could be generated to complement the site energy demand. This could potentially provide 30% of the peak demand during summer and offset 9% of the campus electricity consumption. It is also useful to note that the solar generation during daytime aligns well with the peak electricity demand. The mean rainfall is lowest in January (30 mm) and highest between May and November (45-50 mm) with a gradual increase from January to May and a more significant decrease from November to December (BOM 2015). Given the large roof area of the WCB, this offers the potential for water harvesting. Collected grey water could be used for toilet flushing and significantly reduce the potable water consumption. This, however, requires significant storage space within the campus.

5.4.2. Energy supply

According to the Deakin Energy Audit (GHD 2014), the energy consumption of the WCB is covered to 44% by natural gas and to 56% by electricity purchased from the grid. The predominant primary energy source for electricity generation in Victoria is brown coal, resulting in a greenhouse gas emission factor of 1.32 kg CO2-e/kWh (DIICCSRTE 2013) which is the least efficient in Australia. This further strengthens the above-mentioned potential for the use of renewable energy as a cleaner alternative.

5.4.3. Transport to and from the site

The WCB caters for more than 3900 full time students and a large number of staff. Travel surveys undertaken by Deakin University indicate that more than 60% of staff and 30% of students drive to Deakin as a sole occupant driver, which is responsible for 39,000 tonnes of greenhouse gas emissions each year (DU 2015). Alternative modes of transport available at the WCB are the local bus network with important interchanges in Moorabool Street (10 minutes walk from the WCB and the Geelong railway station (5 minutes walk). The campus does not currently have a dedicated station in the public bus network. Deakin University encourages carpooling and operates an intercampus bus between the WCB and other campuses as well as several car parks. For students and staff commuting from Melbourne, the regional train network provides an alternative, with the station in Geelong located in walking distance from the campus. While local students are eligible for a price reduction on the public transport network, international students as well as staff are not offered a financial incentive to consider more environmental modes of transport. It can be concluded that the resulting greenhouse gas emissions due to travel to and from the WCB have potential for further reduction.

5.4.4. Land use

The WCB is located in a zone dedicated to public use such as retail, commercial, restaurant as well as institutional and public facilities. The surrounding area around the campus is largely sealed by buildings and roads and there is limited space for vegetation. The waterfront along the north of the campus buildings is dedicated to recreational use and one of the major attractions in Geelong. The nearest green spaces from the campus are at the waterfront as well as Johnston Park to the South. The large amount of sealed surface has potential to increase the heat island effect (Steele 2013) which in may influence the effectiveness of natural ventilation. In the south-east corner of the WCB, there is a small grassed area would provide potential for planting of native species, which could enhance the experience of the campus users as well as contribute to mitigate the heat island effect and strengthen native flora and fauna. The WCB itself has a heritage as well as design and development overlay, which needs to be considered in developments and refurbishments of the campus.

6. Discussion

Being only a pilot project, the scope of this study was limited in scale, and thus the authors feel that the requirement for breadth in terms of the integration of qualitative and quantitative assessment to some degree compromised the depth of evaluation in each individual quadrant. For most quadrants additional parameters could have been investigated or the selected ones could have been investigated in more depth, which was beyond the scope of the study. One important insight gained was that the current framework of Integral Theory does not give guidance as to what the ideal level of depth vs breadth of investigated parameters should be and whether this ratio should be similar for all investigated buildings or change depending on the project.

Another observation was that the interrelatedness of investigated parameters sometimes made it difficult to ‘file’ them in just one specific quadrant. For example, the potential to install a photovoltaic system is driven by the climate, a contextual parameter *(lower right quadrant)*, but the system itself contributes to the reduction of the building’s primary energy consumption which is a performance metric *(upper right quadrant)*. Also, most respondents in the field study of building users selected a favourite space that had a visual connection to the outside *(upper left quadrant)*, but particularly to the views at the waterfront *(lower right quadrant)*. Additionally, sometimes the recommendations in different quadrants were found to be in conflict with one another. For example, the field study among the Geelong public revealed that the façade of the WCB does not communicate the interior of a university very well and did not seem visually appealing to many respondents *(lower left quadrant)*. However, the performance analysis *(upper right quadrant)* revealed that a significant amount of embodied energy had been saved by reusing the building with its original façade as opposed to a new construction. This raises the question of a weighting or prioritising of the different quadrants and perspectives.

The answer to the question of how to prioritise between the different investigated parameters can potentially also be derived from the findings. For example, a number of respondents in the survey among building occupants selected the cafeteria as their favourite space. The thermal comfort analysis for this space, however, indicated a rather large percentage (up to almost 45%) were dissatisfied throughout the day, which would be categorised as a thermally inacceptable space, according to AHSRAE Standard 55. This indicates, that individual occupants consciously or subconsciously prioritise different parameters in their use of the building and further research to reveal these decision-making processes could be interesting.

Overall, the following main conclusions can be drawn from each quadrant: *(upper left)*: all selected favourite spaces allow occupants contact with the outside environment, and in particular sight of the waterfront views which are a major attraction at the site. It has to be noted in this context that this view is only available to a minority of spaces and a large number of spaces are internal with no external views. *(lower left)*: the WCB is known to the public in Geelong, however more appreciated for its societal value as a university as opposed to its aesthetic value. *(Upper right)*: In terms of energy performance the WCB performs worse than comparable standards, however in terms of water consumption, lighting and embodied energy it performs better, while thermal comfort varies depending on the space. *(lower right)*: The context analysis revealed a number of underused potentials, e.g. for mixed mode ventilation instead of year around air conditioning, integration of photovoltaics and water harvesting as well as improved public transport. In summary it can be concluded that the WCB scores well in some parameters of each quadrant but not in others, which could be interpreted as an average but not excellent overall rating. The mix of strengths and improvement potentials seems about even in the lower left and upper right quadrant. The lower right quadrant shows more improvement potentials than strengths. The strengths of the upper left quadrant are largely related to the context of the building and there does not seem much variety with regards to the qualities that occupants appreciate a space for.

7. Conclusions

This study indicates that ISD can be a useful framework to evaluate a building’s sustainability in a more holistic sense than current building rating schemes, as it allows for the integration of qualitative and quantitative parameters. A building which performs very well in the sense of the upper right quadrant, without offering the occupants an experiential quality will be an incomplete attempt as much as a highly experiential building which completely ignores the context or results in a very poor performance of quantitative performance criteria. Further research and application of this framework would be helpful to gain additional experience. While Integral Theory in its current stage cannot replace building energy rating schemes, it can act as a reminder for building designers, who are commonly more concerned with the qualitative parameters and engineers or energy auditors who are commonly more concerned with the quantitative side of a more holistic view on sustainability. This framework can also prove useful in the environmental teaching of architecture students. Further research is required to establish the minimum breadth and depth of parameters to investigate for each quadrant in order to produce meaningful holistic results. In this context the balance between accuracy and diversity of investigated parameters, as well as time and money spent on the investigation will be important, and should be addressed in the future development of ISD as an evaluation framework.

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