Delivering Sustainable Design Excellence:
The potential role of architectural precedent

Double-blind review process

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ABSTRACT: *This paper aims to explore the role that critical engagement with precedent might play in the delivery of architectural Sustainable Design Excellence. It is argued here that there are currently two divergent core paradigms in the field of architectural design: one based upon a conceptually underpinned process of Conjecture and Analysis, termed here Architectural Design Excellence; while the second, termed Sustainable Performance Excellence, seeks its delivery through a process termed by Bamford, Analysis and Synthesis, of constituent problem fragments. The central role of precedent in architectural design processes is acknowledged in both contexts, and as such it is argued that critical engagement from a sustainable performance perspective with case studies that demonstrate architectural design excellence may provide an effective route for achieving their synthesis. Online coverage of the 21 Stirling Prize winners, 1996 – 2016 (as a proxy for Architectural Design Excellence) were evaluated using a framework for holistic sustainability and the results presented in summary here. It was found that sustainable performance was largely ignored in the available critique, despite some performing well within the narrow measure of energy performance as evidenced through DEC's, thus limiting precedents'' potential role within the delivery of a future synthesised sustainable design excellence paradigm.*

KEYWORDS: *Architecture, Design, Sustainability, Precedent,*

1. INTRODUCTION

Sustainability is now well established as a global driver for action across industry and politics [1]. However, there are concerns associated with the increasingly narrow focus on low carbon presenting a barrier to the pursuit of holistically sustainable architecture, responding to environmental, economic and social sustainability. Although, Environmental Assessment methods have had some impact in encouraging engagement with these wider themes [2]. Additionally, holistic sustainability is rarely found to coincide with architectural design excellence; as indicated both by sustainability's relative deficiency in architectural awards such as the Stirling Prize and in the ongoing professional debate regarding the poor quality of sustainable building design [3].

This paper explores the hypothesis that the sustainable building design process - and in particular the role that precedent plays in this - lies at the heart of this otherness; seeking to consider precedent's role, as a generative tool, in a future synthesis of architectural and sustainable design processes; in order to enable the delivery of smart, healthy and *sustainable architectural design excellence*.

2. ARCHITECTURAL DESIGN PROCESSES

The Architectural design process has been the subject of much research, leading to a breadth of typically iterative and cyclical models. Although not a wholly rational practice, the processes described each have structure, components and procedures [4].

2.1 Design Process: Architectural Excellence Lens

It can be argued that at the heart of design processes associated with architectural excellence, lies the generation of a concept: *"Nowadays, a building is appreciated because of its concept, its meaning, its underlying and integrating idea…"* [5]. Where such design concept(s) work to provide the constraining variables that inform the functions and aesthetics of the design, *"structural integrity, clarity of circulation, appropriateness of proportions, and so on."* [6]. The generative process for such concepts is relatively individual, and typically stems from the client, the site and its context, the design team, experience, knowledge and architectural precedent [7]: the latter defined as *"…a culturally approved building that lends authority to new designs based on it."* [8]. Bamford [9] argued that this is largely a descriptive integrative and holistic process,that ultimately relies on a process of Conjecture and Analysis (C/A). Whereby the design generating ideas are*"…quickly tested against constraints and there is enormous value in making mistakes."* [10].

2.2 Design Process: Sustainable Performance Lens

While, for the sustainable design process, it is argued that the pursuit of sustainable performance, rather than a project derived concept, lies at the heart of the design process; indeed that the theoretical concept or driver is itself sustainability. One of the most pertinent problems is therefore the focus on building performance and energy use, whereby sustainability begins to be perceived as a linear end point and not a process [11]. There is thus, perhaps, a contradiction between architects working with dynamic knowledge as in the (C/A) process above, relating to imagination, intuition and experience and the need for sustainable buildings to achieve static benchmarks and legal standards. This might best be identified as Bamford's Analysis and Synthesis (A/S) [9], whereby, *"design starts by dismantling problems into fragments, synthesising and evaluating possible solutions…" [10].*

2.3 Working Towards a Synthesis

What is clear is that both design paradigms, architectural (C/A) and sustainable (A/S) are striving for excellence, but are applying different lenses to its meaning; inhabiting mutually exclusive camps with distinct processes, languages and design tools, including precedents. It is argued here that a synthesis of thinking should enable their integration, and thus effective delivery of healthy and design-excellent buildings. Two approaches towards this synthesised future, can be proffered: one, which requires a wholesale change in the judging of architectural excellence, perhaps *"a new measure of beauty"* [3]; a second, that effectively enables a synthesis of the two design approaches and ensures that the qualities of each might be brought together. The latter scenario is considered here to be optimal in achieving a paradigm shift towards built environment sustainable design excellence. Of course, such changes might be achieved through a range of actions, not least, in the long term, through interventions in the education of Architects and associated professionals [9]. However, the larger and more pressing challenge is to influence the actions of those already educated and practicing, indeed, who set current architectural culture.

First, it is argued that the re-sequencing of the design process, as inferred by the Integrated design process (IDP) [9] is paramount. Sustainability must be integrated into the very essence of the design; becoming integral to the overarching design concept itself, from the earliest inception phases; thus overcoming problems associated with current widespread late adherence to assessment tools, whereby sustainability is diminished to *"an endless series of checklists, spreadsheets and credits"* [12]; and placing a strong, project specific, conceptual generator, beyond sustainable performance, at the heart of this new design process. This requires a valuing and retention of the C/A based design process and the derivation of a design concept that is itself informed both qualitatively and quantitatively, but not dominated by, sustainability. Second, timely access to appropriate information, tools, simulations and advice that can appropriately inform design will be required [10]. Here lies the potentially transformative role that precedent could play in delivering sustainable architectural design excellence.

Lawson [13] suggests the development of design expertise moves through 3 phases: *"…acquisition of the design domain schemata…"; "…development of a growing pool of precedent…" and; "…the identification of … guiding principles which develop over time and further structure and filter the continued acquisition of precedent…".* Therefore, where sustainable thinking has been integral to the process of achieving design maturity, one might argue that sustainable precedents will have informed this development and where not, a more individual architectural design sense might have developed.

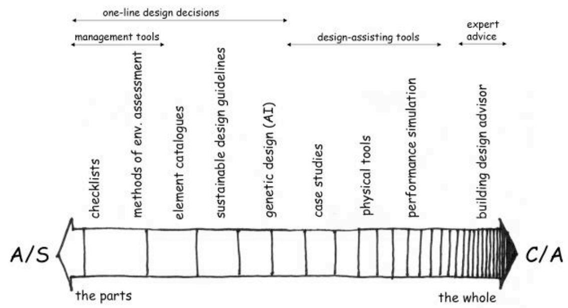

Figure 1: Position of tools according to A/S and C/A paradigms [10].

A synthesised future design paradigm, will require access to precedents that are critically evaluated in terms of both architectural design excellence and sustainable performance: that meet both the Architectural professions' current criteria for excellence (as represented by Architectural media and winners of prestigious prizes); as well as those that meet sustainable design, construction and performance criteria. Rather than mutually exclusive pools of precedent, architectural precedent analysis could also present critical evaluation of building performance, and where buildings do not perform, critique might proffer informed debate over alternative solutions to stimulate professional debate, and feed-forward learning.

3. ARCHITECTURAL PRECEDENT: THE STIRLING PRIZE

In order to begin to inform this debate and to evaluate the current relationship between Architectural design excellence and sustainable performance, the Stirling prize winners (1996 – 2016) were selected as a coherent set of building precedents, where the Prize was deemed a proxy measure for Architectural Design Excellence.

This work therefore seeks to explore the potential for typical Architectural Design Precedent to inform sustainable architectural design excellence. It should be noted that future work is required whereby buildings hailed for their sustainable design excellence are analysed for their architectural design excellence. However, although some definitions exist, the latter is much more difficult to characterise as clearly as sustainable design currently is [15].

YEAR	BUILDING	DESIGN TEAM
1996	The Centenary Building	Hodder Associates
1997	The Music School, Stuttgart.	Michael Wilford & Partners
1998	American Air Museum in Britain	Foster and Partners
1999	NatWest Media Cntr, London,	Future Systems
2000	Peckham Library & Media Centre	Alsop & Störmer
2001	Magna Science Adv. Centre	Wilkinson Eyre Architects
2002	Gateshead Millenium Bridge	
2003	Laban	Herzog & de Meuron
2004	30 St Mary Axe	Foster and Partners
2005	The Scottish Parliament	EMBT/RMJM
2006	New Area Terminal-Barajas Airport	Richard Rogers Partnership
		Estudio Lamela
2007	Museum of Modern Literature	David Chipperfield Architects
2008	Accordia	Feilden Clegg Bradley Studio
		Maccreanor Lavington
		Alison Brooks Architects
2009	Maggie's London, Charing Cross Hospital	Rogers Stirk Harbour + Partners
2010	Museo Naz. d.Arti d.XXI Secolo	Zaha Hadid Architects
2011	Evelyn Grace Academy	
2012	Sainsbury Laboratory, University of Cambridge	Stanton Williams
2013	Astley Castle	Witherford Watson Mann Architects
2014	Everyman Theatre	Haworth Topkins
2015	Burntwood School	Allford Hall Monaghan Morris
2016	Newport Street Gallery	Caruso St John Architects

Table 1: Stirling Prize Winners: Buildings and Design Teams 1966 – 2016 [14]

This paper will summarise the evaluation of the winning buildings against holistic sustainability criteria, presenting a first step in understanding the potential for current Architectural Precedent to inform the proposed new Paradigm of *Sustainable Design Excellence*.

3.1 Method

In order to evaluate this Prize winning Architecture, it was first necessary to establish the phase of their development that would be assessed. While, it is valid to argue that true sustainability, and even architectural excellence, cannot be evaluated until a building has been occupied for a number of years, such in-use data is largely either non-existent or inaccessible beyond the building users or immediate building development team, as this results from additional investment of time and money in Post Occupancy Evaluation (POE) [16]. Therefore, as a proxy for POE, where available, Display Energy Certificate (DEC) data was sought. These standards provide benchmarks against average performance for building typologies [17]. This represents a significant gap in precedent knowledge for the appropriate and informed application of precedents in future projects which must be tackled in future work. As a result the *design & construction phase* is the focus of this work.

In order to undertake an evaluation of these buildings for their sustainable design, it was then necessary to identify an appropriate framework. Existing sustainability assessment tools are widely applied across the industry to assess buildings during this phase. Such tools came into prominence in the 1990's (Cole, 1998) and although there are many methodologies available on the market, BREEAM (established in UK in 1990) and LEED (established in USA in 2000) are the most commercially successful, well established and international of these. Indeed 2 of the Stirling prize winners have been BREEAM Assessed: 2012, Sainsbury Laboratory, received an interim certification of 75.59%, Excellent; while the 2014, Everyman Theatre received a final certification of 70.19%, also excellent. However, it must be noted that such tools typically focus on environmental aspects of sustainability and no widely applied, universal tool presently exists for the holistic evaluation of sustainability.

The European project, "Openhouse" aimed *'to develop and implement a common European transparent building assessment methodology'* [18]. The resulting assessment tool, based upon a study of existing initiatives and their synthesis produced 56 indicators, across 6 categories. This was selected as a key source for the assessment framework applied here. Some alterations to the open house methodology were however, deemed necessary: removal of those factors that were considered to be beyond the control of the architect; as well as those that were typically addressed through legislation, (e.g. access to potable water). Finally, comparison of this theoretically derived framework was undertaken against those factors broadly acknowledged elsewhere to be representative of holistic sustainable design excellence, a proxy for which was provided by Sassi's Strategies for Sustainable Architecture [19]; providing a sense check to pragmatic realised case studies.

No. of Indicators		Social	8
Environmental	24	- Accessibility	1
- Energy	4	- Education	1
- Lighting	3	- Community	3
- Materials	5	- Health & Comfort	3
- Water	4	Economic	7
- Site Design	4	- Building costs	3
- Waste	3	- Performance management	2
- Climate Change Adaptation	1	- Employment opportunities	2

Table 2: Themes, indicators & No. of Criteria for Literature Based Sustainability Design Assessment

Finally, the framework was employed in assessing published material typically accessed by architectural designers when informing architectural precedent studies during the design process. These included: architectural and wider traditional and online media sources; websites of the RIBA, architectural and other built environmental professionals associated with the completed buildings; and the websites for the buildings' owners / occupants. In terms of content analysis, these were simply assessed through the application of a qualitative indicative scale of 0 to 2 for each indicator, whereby: 2 was awarded where design was evidenced to be fully responsive to an indicator; 1, where there was partial evidence of compliance and 0 where no evidence was found.

3.2 Findings: Energy Performance

As already stated DECs were sought as a proxy for POE: calculated using actual annual energy consumption in comparison to building typology benchmarks. Their availability is however, limited as in the UK only public authority buildings require publication of DECs where they are: *"at least partially occupied by a public authority";* they have a *"total floor area of over 250 square metres";* and *"it's frequently visited by the public" [20].* Private organisations are not required to have a DEC calculated but *"may still need an Energy Performance Certificate if the building is sold or rented".* As such, where DECs were not available, Energy Performance Certificates (EPCs) were sought as an alternative: although these are based upon theoretical performance of buildings and as such are less indicative of building performance in reality. *"All domestic and commercial buildings in the UK available to buy or rent must have an [EPC]" [21].*

Using the UK government's Non Domestic energy performance register [22] 8 valid DECs were found, calculated between 2016–18 and 4 further EPCs were found for buildings that had been bought or sold during this period. An EPC was reviewed for the Scottish Parliament, as DECs are not required in Scotland.

YEAR	BUILDING	YEAR	DEC	
1996	The Centenary Building	2015	57	C
1997	The Music School[1]	N/A		
1998	American Air Museum in Britain	2016	15	A
1999	NatWest Media Center[2]	N/A		
2000	Peckham Library and Media Center	2016	90	D
2001	Magna Science Adventure Centre	2015	13	A
2002	Gateshead Millenium Bridge[2]	N/A		
2003	Laban[2]	N/A		
2004	30 St Mary Axe[3]	2011 (EPC)	138	F
2005	The Scottish Parliament[1]	2009 (EPC)	30	B
2006	New Area Terminal- Barajas Airport[1]	N/A		
2007	Museum of Modern Literature[1]	N/A		
2008	Accordia[4]	(EPC)	79	C
2009	Maggie's London, C. Cross Hospital[2]	N/A		
2010	Museo Nazionale d. Arti d.XXI Secolo[1]	N/A		
2011	Evelyn Grace Academy	2017	117	E
2012	Sainsbury Laboratory	2016	351	G
2013	Astley Castle[4]	N/A		
2014	Everyman Theatre	2016	32	B
2015	Burntwood School	2017	177 - 179	G
2016	Newport Street Gallery	2015 (EPC)	52	C

[1] Not in England/Wales –DEC Unavailable [2] Does not meet requirements for DEC
[3] For the Sterling Restaurant @St Mary Axe [4] Domestic Property

Table 3: Building Energy Performance Summary

For ease of interpretation an EPC or DEC of 100 is considered to be typical for any building typology in the UK stock. It would therefore be reasonable to expect buildings considered as excellent in their field to at least perform above this baseline, while excellence could be interpreted as achieving an A rating (0-25). Based upon those buildings for which this data was found and including both EPCs and DECs: 17% achieved an A rating (0-25), synonymous with excellence; 50% a rating 26<100, synonymous with good performance; and 33% a rating of >100 below average. This finding could therefore be interpreted as suggesting that many of these projects have fallen short, and in some cases very short, of excellence in terms of energy performance.

3.4 Findings: Environmental

As has already been reported, 24 indicators for Environmental aspects were applied within the analysis (Table 4):

Energy:	**4**
Inc. fabric thermal efficiency, air tightness, passive design strategies, efficient systems & renewable energy systems.	
Lighting:	**3**
Including daylighting strategies, avoidance of light pollution and efficiency lighting systems.	
Materials	**5**
Inc: their dimensions, building small, renewable, certified and low impact materials and role in 'design for delight'.	
Water	**4**
Inc: minimising use (efficient systems design & education); alternative sources and consideration of waste treatment.	
Site Design	**4**
Inc: design to promote sustainable transport; ecological value: appropriate density & incorporation of SuDs.	
Waste	**3**
Including reuse of buildings / materials, minimisation during construction and design for deconstruction.	
Consider Climate Change Adaptation	**1**
Design to consider climate change adaptation	

Table 4: Environmental Theme Assessment Indicators

Overall for the Environmental assessment: the maximum was 50% in 2009; the minimum was 0% in 1997; with an average of 28% (Fig 2).

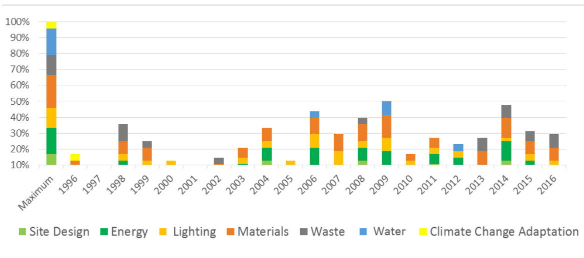

Figure 2: Annual Environmental Indicator Assessment

It can be seen that the consideration of environmental factors is relatively sporadic; with no identifiable trend towards attention to environmental sustainability, and with no apparent improvement, even incrementally, in recent years.

In terms of coverage of particular environmental themes (Table 5) there are buildings that haven't addressed any of these factors (Min = 0%). While, those aspects that appear be considered relatively consistently, (comparing Figure 2 & Table 5) include Site Design and Energy. Lighting and Materials are fairly consistently addressed, with waste to a lesser extent. Finally, Water aspects are rarely considered and Climate Change Adaptation, never.

Environmental	Indicators	Average	Max	Min
	24	28%	50%	6%
Site Design	4	38%	75%	0%
Energy	4	36%	88%	0%
Lighting	3	35%	100%	0%
Materials	5	34%	70%	0%
Waste	3	25%	83%	0%
Water	4	5%	50%	0%
Climate Change Adaptation	1	0%	0%	0%

Table 5: Average Environmental Themes Assessment

3.5 Findings: Social

For the social aspects of sustainability 16 indicators were applied within the analysis (Table 6):

Community	**3**
Inc: Participation: identify and engage stakeholders / encourage ownership / design to enhance identity & quality of life & for provision of and access to facilities.	
Accessibility	**1**
Inclusive barrier free access	
Education	**1**
Promotion of sustainable lifestyles: Including ease of operation	
Health & Comfort	**3**
Inc: Design to promote Health; Minimise noise & internal air pollution; & promote a restorative environment.	

Table 6: Social Theme Assessment Indicators

It can be seen in Figure 3, that the overall level of achievement in this pillar was much higher than for the environmental and economic pillar: average of 63%; maximum of 100%, again in 2009; while, the minimum was again 0% in 1997; and 81% achieving an assessment over 50% (the maximum achieved for the environmental assessment). As such, the consideration of social factors across the Stirling Prize winners can be seen to have been reasonably consistent over the years.

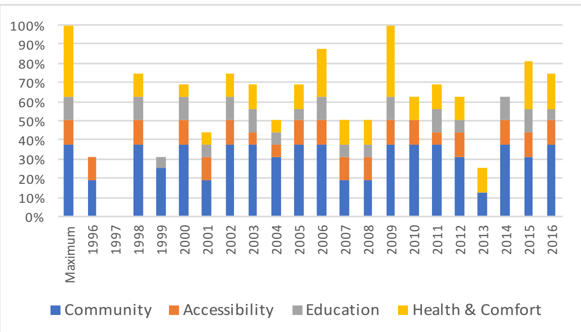

Figure 3: Annual Social Indicator Assessment

While, in terms of coverage of particular social themes, Table 7 illustrates that some cases have not addressed themes associated with accessibility, education or health & comfort (Min = 0%). While, those aspects that have been considered relatively consistently include Community, Accessibility and Education, (comparing Figure 3 and Table 7); while Health and Comfort is least well addressed.

Social	Indicators	Average	Max	Min
	16	**63%**	**100%**	**25%**
Community	6	84%	100%	33%
Accessibility	2	82%	100%	0%
Education	2	68%	100%	0%
Health & Comfort	6	35%	100%	0%

Table 7: Average Environmental Themes Assessment

3.6 Findings: Economics

Finally, just 7 indicators were applied within this phase of the analysis (Table 8):

Employment Opportunities	**2**
Inc: Consider mixed use development & Promote opportunities for local employment	
Building costs	**3**
Inc: Life cycle costs vs capital cost / Design for Maintenance, Longevity & Flexibility	
Building Performance management	**2**
Inc: Effective building handover & Setting building performance targets	

Table 8: Economic Theme Assessment Indicators

It can be seen that the overall level of achievement in this pillar of sustainability was very low (Table 9 & Figure 4): an average of 18%; a maximum awarded of 36%, in 2006 and 2012; and a minimum of 0%, in 1997, 1999 2005; and there was again no trend towards improved engagement.

Economic	Indicators	Average	Max	Min
	14	**18%**	**36%**	**0%**
Employment Opportunities	4	33%	100%	0%
Building costs	6	17%	67%	0%
Building Performance Management	4	4%	50%	0%

Table 9: Average Environmental Themes Assessment

In terms of coverage of particular economic themes it can be seen in Table 9 that some cases have not addressed any of the indicators associated with economics (Min = 0%). Where only Employment Opportunities and Building Costs appear to have been reasonably consistently considered.

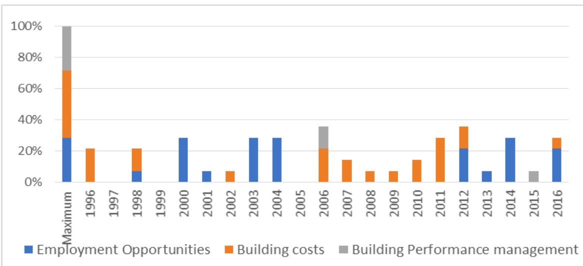

Figure 4: Annual Economic Indicator Assessment

While the low level of engagement with Building Performance Management speaks of the lack of commitment to Post occupancy evaluation, and the industry's lack of self-reflection, on how buildings actually perform versus how they were designed, as suggested above in Section 3.2.

4. CONCLUSION

Results presented here suggest that while Stirling prize winning buildings are exemplars of architectural design excellence, they perform weakly against indicators of holistic sustainable design excellence. It is the exception that a number of buildings performed reasonably well across the three pillars, where this sporadic approach suggests a lack of understanding, rigour and structure in the implementation of sustainability in building design. When analysed both collectively and in detail, Social sustainability is predominant in all years: perhaps not surprising as this is the area of sustainability that architects have traditionally addressed; while, environmental and economic indicators of excellence are much less well understood or widely applied.

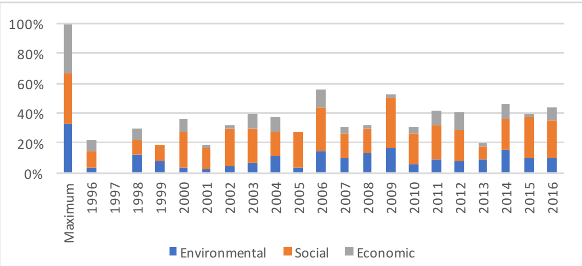

Figure 5: Annual Pillar Assessment

It is acknowledged that there are limitations to this research. Firstly, the analysis relies on publicly available data: although, arguably this speaks to how architects and media are electing to describe projects; indicating the need for wider discussion of sustainable performance in the critical evaluation of buildings, perhaps as much as of their actual performance. Secondly, that a consistent application of sustainability indicators across such various projects may have skewed results, where some may have little relevance in particular contexts. Thirdly, the lack of POE data to inform this work; where, engagement with project stakeholders: owners, occupiers, users and design teams, to verify these initial results will now be sought. Finally, engagement with other, accessible published project documentation, including planning applications and building regulations submissions will be used to inform the next phases of this work. In conclusion, we propose that it is through the development and publication of a *combined* architectural and sustainable critique of precedents, in a manner accessible to all Architects, that both architectural sensibilities and sustainable performance might be promoted and achieved as we work towards the delivery of Sustainable Design Excellence

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