buildings

MDPI

Article

Translating across Disciplines: On Coding Interior Architecture Theory to Advance Complex Indoor Environment Quality

Linda Pearce †

School of Art, Architecture and Design, University of South Australia, Adelaide, SA 5001, Australia; linda.pearce@unisa.edu.au; Tel.: +61-8-8302-0202

† This text has been expanded from an original conference paper: Pearce, L.M. Sensory pleasure of interiority: Finding transdisciplinary research language for complex indoor environment quality. In Proceedings of the 51st International Conference of the Architectural Science Association, Wellington, New Zealand, 29 November–2 December 2017.

Received: 29 March 2018; Accepted: 14 June 2018; Published: 21 June 2018

Abstract: While indoor environment quality (IEQ) measurement is an established process, it omits the pleasure of interior environments, possibly due to its perceived subjectivity in the context of objective productivity and profitability. Given the significant commercial interior design industry, which engages with the complexity of indoor habitation, there exists an opportunity to expand the scope of IEQ appraisal through inclusion of the interior architecture discipline as an IEQ stakeholder. This theoretical paper reframes existing building appraisal as convergent methods that are contingent on the discipline and audience, and proposes a sequential mixed methods research process that allows subjective and objective research methods integration. Drawing on the interior architecture discipline, and its holistic 'interiority', a content analysis of selected theoretical texts identifies candidate quality components for future development and use in environment quality measurement. The intention of this process is to translate across the interior architecture and architectural science disciplines by coding interior architecture perspectives into possible measurable variables. These broader candidate variables would likely be more inclusive of the lived experience and agency of occupants of interior spaces. Furthermore, they offer the possibility for extended complex indoor environment quality data for future use in advanced statistics.

Keywords: interior design; interior architecture; indoor environment quality; methodology; convergent methodologies; human factors

1. Introduction

Buildings have interiors and interior designers often design those interiors. In solving the wicked problem of Green Building, the first part of this statement is being addressed through significant building science and architectural science research efforts together with the development and application of practical ratings tools, such as GreenStar, Leadership in Energy and Environmental Design (LEED), Building Research Establishment Environmental Assessment Method (BREEAM), and the WELL Building Standard. The second part of this statement, that interior designers have a significant role in interiors, needs further investigation in the context of aspirational human-oriented design solutions in Green Building. This discursive paper takes the proposition that the profession of interior designers and their scholarly discipline of interior architecture may have a unique and useful perspective for indoor environment quality (IEQ) and initiates the translation of these perspectives to IEQ appraisal.

Interior design emerged as a professional in the nineteenth century [1]. Debate about the delineations of interior practice and origins is ongoing [2,3], with interior design, also known as interior

architecture and spatial design, and practitioners known as interior designers. Interior designers are influential in creating enclosed built environment spaces. As a profession, interior designers make up 31% of the built environment design professionals (excluding urban planners) in Australia (up from 28% in 2011, [4]). While not all interior design is done by interior designers, interior designers are responsible for the creative design and detailing of new buildings and renovated interiors that include, but are not limited to, spatial planning, fixtures, finishes, furniture, materials, and lighting. In addition to designing the functionality, aesthetics, and atmosphere of enclosed spaces, in commercial projects they interpret the commercial brand and organisational design, and translating these to a creative spatial design which maximises productivity ([1] (p. 71), [5,6]).

The interior design profession also contributes to vernacular trends. In Australian residential buildings, nearly as much is spent on furniture, floor coverings, and houseware goods as is spent on clothing ($1.2bn vs. $1.4bn, December 2016, ABS report 8501.0, [7]). Interiors are more than shelter, yet pleasure in all building classes, not just residential, is considered equal to productivity.

This paper is positioned in the broader definition of interior architecture, i.e., ' ... the design of structurally created interiors ... ' [1] (p. 2), which includes interior design, decoration, and an understanding of structure and services. The associated body of scholarly knowledge is referred to here as interior architecture. The broadness of the practice of this discipline is seen as both opportunity and challenge for inclusion in built environment quality [8]. Interior architecture scholars tend towards theoretical knowledge in arguing their history, design interpretation, and professional practice. For this knowledge to be of interest to a new audience, it needs to be translated.

This paper develops a recent conference paper [9] to open this translation process. It starts by noting that architectural science and building science have a history of inter-disciplinarity and convergent methodologies and provides precedents where other subjective theories have been coded for use in appraising indoor environment quality. This translation process is put into a methodological research context in Section 3. In Section 4, it applies this extended research process to translating interior architecture theory for use in architectural science research and provides a visual demonstration using a Green Building. Section 5 discusses how this theoretical knowledge and process can be further developed.

This paper should be read in the context of the *Special Issue: Human Factors in Green Building* which has called for discourse, as well as empirical research. This paper aims to provide a scholarly background to expand indoor environment quality, using a specific body of knowledge: interior architecture. It is not intended as a practical addendum to existing methods, but as a foundation for future scholarly research and practical application to new and expanded methods of IEQ appraisal.

2. Coding Precedents of Subjective Experience

IEQ has a history of adapting its data collection processes to include subjective measures and make it useful to researchers and practitioners. This section highlights the range of processes and some historical precedents of the methods of coding the subjective experience.

2.1. Implicit Adaptability of IEQ

Indoor environment quality ranges from a precise definition of thermal, acoustic, visual, and air quality measures [10] through to wider interpretations that include other human factors, such as control and size of space [11]. IEQ is also sometimes conflated with post occupancy evaluation (POE) [12] (Table 14.1, p. 172). While POE has historically offered flexible options for appraising a building [13], IEQ has also been coded and commercialised for use during the design stage, as indicated by the commercial sustainability of LEED, BREEAM, and GreenStar ratings tools [14].

Large-*N* post occupancy evaluations with IEQ successfully exploit the repeatability of survey test instruments that code specific IEQ components [15]. In contrast, small-*N* building studies use other data collection procedures, such as walkthroughs or interviews [16] to develop rich case studies. These methods are common to other disciplines: environmental psychology [17], environmental

behaviour [18], design [19,20], or other interested research from outside of the built environment professions [21,22]. All of these use either self-reported measures or expert interpretation, or a combination of both, and many relate back to some physical measure of the corresponding building [12]. Others have approached IEQ medically, such as a complex stressor on occupants' physiology [23] or by using neurobehavioural tests in controlled settings [24].

When studies report interior design components in IEQ/POE studies, the descriptions can be brief. For example, in one study, 'office layout design' and 'look and feel' is all that is provided to describe the interior architecture [10]. There is also a variety of terms used. Indoor environment quality is the predominant term, with others using 'internal environment conditions' [25]. When discussed in interior architecture literature IEQ has been described as 'interior environment quality' [8]. These examples show that while there is a need to acknowledge the quality of interiors, the literature is inconsistent in processes and definitions. It is also flexible and suggests exploration and innovation.

2.2. Coding the Subjective—Precedents in Building Science

In IEQ, qualitative human attitudes and perceptions of the built environment have been translated into repeatable questions and efficient surveys. The coding process depends on the research discipline and audience, but the recognition that occupants are important is consistent in the three precedents summarised here: thermal comfort, POE, and light preferences.

Early last century, Bedford clearly described how he coded the responses from participant interviews in 1936 to create his sensation of warmth scale [26]. He also reflected on the usefulness of coding his interviews as a scale, concluding that the process is beneficial for his purpose:

> The use of an arbitrary scale cannot be avoided, but it may be thought that a more reasonable scale could be constructed by assuming a normal distribution of the personal feeling of warmth. This point has been examined, but it is found that the use of a scale based on this assumption does not significantly affect any of the conclusions set out in this Report. It has, therefore, been thought desirable to use the simple scale set out above. [26] (p. 19)

The ASHRAE thermal sensation scale presents a similar coding and standardisation of subjective experience [27,28] and is implicitly accepted (by its intended audiences) as a complementary test to other physical methods used to interpret thermal comfort for specialist [29] (p. 12 in Chapter 9) and generalist audiences [30] (pp. 158–178). Thermal comfort also extends to biological reward of sensory pleasure, alliesthesia [31,32] and combined with other perception codes, including, but not limited to, personalisation, control, furniture comfort, collaboration space, and other traditional IEQ [33].

In post-occupancy evaluation, while interviews and walkthroughs provide rich understanding, they are labour-intensive to both collect and interpret. Scale questions, often in detached Likert response format [34], code selected occupant perspectives and create benchmarking opportunities (e.g., [35]), but can also be designed for specific circumstances according to researcher interest, such as the 'friendliness' of classrooms [36].

As an alternative to Likert scales, semantic scales may be used to test extremes between two adjective pairs on a scale. These responses can then be used to determine underlying meaning constructs using factor analysis [37]. These methods are found in earlier environmental psychology examples investigating perceptions of light [38], or affective states in different interior environments [28,39]. These semantic scale examples are highly controlled environments, as is appropriate to the psychology protocols, but, in the latter case, the 'décor' variables are extremely limited: white vs. dark (a walnut panel) vs. blue walls vs. orange walls. From the perspective of design application, these parameters are not particularly useful due to the vague description and the changing design fashions. Furthermore, the semantic pairs used were collected by testing undergraduate students [40,41] and may not fully describe other occupants' experiences, or the interest of professional designers.

There is a clear need to collect subjective data efficiently using some form of repeatable test instrument, as has been demonstrated in thermal comfort, post-occupancy evaluation and environmental psychology. These are examples of where disciplines have responded to discipline needs; however, there are limits to the usefulness of the analysis when translating across disciplines from, say, IEQ for facilities management to useful inputs to interior designers.

3. Research across Disciplines

From one architectural science perspective, architecture is split, somewhat neatly, into art and science [42] (p. ix). A common critique of research of human factors in buildings is that it is subjective. Despite this, researchers and practitioners still attempt to integrate the subjective into architectural and building science, suggesting it is a necessary component of the topic. This section makes explicit one model of the integration process as a framework for integrating theoretical interiors knowledge.

Disciplines have their own taken for granted rules and scope of interest. Crossing these boundaries has been described as multi-disciplinarity, inter-disciplinarity, and trans-disciplinarity research [43] (p. 21). Others suggest that this is not helpful given that, while disciplines exist as separate specialisations, they are constantly evolving over time, making it difficult to consistently apply these terms [44].

Another approach is to consider the knowledge production context. It has been proposed that there are two 'modes' of knowledge production. Mode 1 refers to discipline-dependent scientific research processes used by independent scientists within an academic institution, whereas Mode 2 knowledge is 'socially distributed knowledge' created within a range of contexts with quality measured by its contextual value [45]. In the case of human factors in Green Buildings, the contexts of the coding precedents above suggest that indoor environment quality and post occupancy evaluation, by virtue of the range of practitioners, in both research and professional practice contexts, should be located as Mode 2 knowledge production. The application of this mixing of discipline knowledge can be described as convergent methodologies. In life and physical sciences, this is offered as a means of addressing complex real-world problems that have interconnected physical and social components and require a network of discipline expertise, and their specific tools, to solve the relevant query [46].

The term 'convergent methodologies' is also found in architectural science, but in the context of mixed-methods common to social science, where 'triangulation' is used as a metaphor used to integrate the findings [47]. Social science texts provide further instruction through reconciliation, or 'meta-inference', of parallel research strands [48]. Thus, rather than a network of experts, in architectural science the convergence is oriented towards networks of methods.

There seems to be two options for convergence. To include interior architecture knowledge into building science both convergence approaches need to be realised. First, as a mode 2 knowledge production process, interior architecture needs to be recognised as part of the network of expertise. Second, this expertise needs to be accessible and one approach (and there are others) is to translate it for use in building science. To facilitate this latter convergence, it is proposed to decouple methodology from method under the knowledge claim of pragmatism, and then demonstrate convergence as a sequential research continuum from recognising a surprising phenomenon to inclusion in research.

3.1. Decoupling Methodology and Method

Research methodology, how research is designed and the research methods deployed to answer research questions, and the quality of those answers, depends on the worldview of the researcher and their discipline [48]. Research quality adjudication differs between methodologies, depending on positivist or constructivist, objective or subjective, positions with disciplines using specific methodologies and taken for granted protocols [49] (p. 81). This complies with mode 1 knowledge production that uses strict discipline-specific protocols. Yet, in practice, as evidenced by IEQ and POE, this is clearly not the case and may be accidently innovative.

Separating methods according to knowledge claim has been queried. It is recognised that there is power contained within mixed-methods for interdisciplinary research:

> . . . it is highly likely that much can be learned about generative and thoughtful mixed methods practice from the extraordinary explosion of provocative mixed methods empirical work and from more concerted *and* deliberate conversations across disciplines and fields of applied inquiry practice. [emphasis in original] [50]

This does not mean that anyone and everyone may create good-quality knowledge; rather, in the case of the built environment, inquiry should aim to develop 'informed judgement' to create 'responsive cohesion' within the built environment [51] (pp. 85–88). This is evident in post occupancy evaluation research precedents using both qualitative and quantitative data (e.g., [52,53]), suggesting implicit mixed methods.

Returning to methodology and worldviews, the location of mixed methods in the epistemological debate varies from constructivist according to architectural research methods [49] (pp. 218–219), to being technically independent of epistemology [54], to pragmatist [55], thus offering a symptom of how knowledge paradigms are continuously under debate [56].

Pragmatism offers an explanation about researching across disciplines for three reasons. First, it acknowledges the flexibility and continuous improvement needed in research methods. Pragmatism is described as a 'living philosophy' [57] (p. 4) where, rather than relying on expert beliefs, the perception exists that knowledge is 'fallible' and must be constantly refuted, or strengthened, to resolve 'doubt' as more evidence appears, through continuous evaluation [57] (pp. 15–19).

Second, it acknowledges that research is done for specific audiences and, when presenting knowledge, the intended audience must be convinced [58]. Where knowledge is found to be incorrect by the intended audience it could be rejected outright, but this is in danger of throwing out the knowledge baby with the fallible bathwater. 'Perspective fallibilism' allows knowledge to be considered as truth from a particular perspective but acknowledging the contradiction with another similar body of knowledge [57] (pp. 49–50), or may open up an interdisciplinary 'dialogical encounter' [59]. In a built environment performance evaluation, including IEQ, this is useful to consider where the intended audience consists of a wide range of stakeholders.

Third, it acknowledges the necessary junction between professional practice problem solving and scholarly knowledge creation. Pragmatism is attractive because it allows the inclusion of real-world practical knowledge, or praxis [60], and this makes it particularly useful in a practice-based academic discipline such as architecture [61]. Mixing of methods has been recommended for applied disciplines, including architecture research [61], thermal comfort investigations [62] using a mix of observational, survey, or other data (e.g., [63,64]), in architectural practice [65–67] and POE IEQ.

The purpose of the above discussion was to acknowledge current building and architectural research activities as being implicitly mixed and note that these do not fit neatly into the epistemology-methodology-method relationships that are described in research education texts [49]. This offers a freedom to seek new interpretations of the architectural science and building science research process that are inherently Mode 2 practical research and might include interior architecture in the network of expertise.

3.2. An Argument for Sequential Convergence of Research Methods

Extending architectural science beyond physics to include people in the research is not new. Last century, Hillier and Leaman raised limitations with scientific method, and discussed a number of paradoxes associated with the application of 'scientific certainty' to psychology and variability in human behaviour. As an alternative to physical 'spatial space' in a 'man-environment paradigm', they suggest a 'logical space' constructed by society and analogous Levi-Strauss' structural sociology, where social structures both describe and act on a population [68].

Gidden's later sociology theory of structuration considers that structure is created through recursive social practices includes social structure, but also acknowledges agency of individuals within social structure. Society should be studied:

> ... neither the experience of the individual actor, nor the existence of any form of societal totality, but social practices ordered across space and time. Human social activities, like some self-reproducing items in nature, are recursive. ... they are not brought into being by social actors but continually recreated by them via the very means whereby they express themselves *as* actors. In and through their activities agents reproduce the conditions that make these activities possible. [69] (p. 2)

In later work, Hillier [70] expressed concerns with applying Giddens' arguments, since Giddens is specific in his insistence that space is a social construct, whereas Hillier maintains space is a unique spatial paradigm describable separately as space syntax. Taking the broader position discussed here, the spatial paradigm, and its representations, could also be considered as part of a larger recursive mixed methods discussion—providing rich visualisation in and of itself—yet also contributing to discussions about social production of space in the context of different audiences, which is a result of power structures and other privilege.

Returning to Giddens, structuration is of interest to designers since it reminds designers to acknowledge that their designs are contingent on occupation and time [71]. Applying this to building appraisal, rather than rejecting the scientific empiricism of environmental space for a logical space, this opens up the re-examination of positivist approaches towards building appraisal as both providing limits to occupation and a response to occupant agency. This opens up the possibility of surprising occupation, as described by interior architecture, and learning from it.

In science and technology studies (STS), Latour argues that the separation of science from non-science, objectivity from subjectivity, never existed, and that this separation is a constructed political decision, which should be reversed [72] (p. 144).

> Half of our politics is constructed in science and technology. The other half of Nature is constructed in societies. Let us patch the two back together, and the political task can begin again. [72] (p. 144)

Similarly, philosopher A.N. Whitehead argues that we should not 'bifurcate' nature because there is an interaction between cause of awareness and awareness:

> ... everything perceived is in nature. We may not pick and choose. For us the red glow of the sunset should be as much part of nature as are the molecules and electric waves by which men of science would explain the phenomenon ... (Whitehead CN29 in [73]) (p. 33)

This is particularly useful since it acknowledges that different interpretations of the world, objective physics and subjective beauty, exist simultaneously, implying that we naturally use different methods to understand our world. This does not mean that the methods are wrong (heat transfer physics is clearly useful), but stepping outside of a specific community opens up choices about research methodology and methods.

Environmental psychology is an obvious gateway to user experience within built environment research [74]; however, ambiguous yet persistent experience of interior is not necessarily covered to suit the building *design* community to put into practice. While there are research efficiencies and validities associated with psychology's science methods, if variable selection is undertaken without designer input, this reductionist approach of coding or quantising indoors is of limited use.

The interior architecture scholar must consider the opportunities: their knowledge base includes ephemerality that may not be knowable beyond interior theorists and personal narrative, the latter clearly important, as seen by the commercial success of the building adaptation industry, but must also engage with scientific methods and inter-disciplinarity. This is where pragmatism and reframing the objective/subjective paradigm is useful for researching across disciplines.

Decoupling methods and methodology and mixing methods under pragmatism epistemology, considers positivist and constructivist research methods as complementary and inter-related through

abductive logic [49] (pp. 34–35), [48] (p. 89). Abductive logic argues that knowledge starts with observing a surprising phenomenon, initiating a circular deduction and induction knowledge creation process (Figure 1a). This is a sequential mixing of research methods where triangulation is a convergent dialogue between theoretical statements and empirical observations [75].

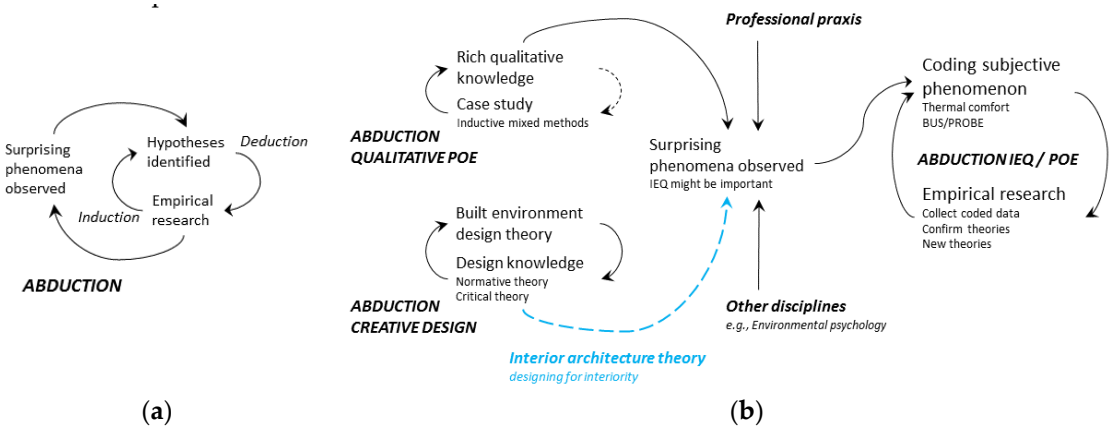

Figure 1. (**a**) Abduction; and (**b**) interconnected/sequential abduction in IEQ/POE.

Indoor environment quality measures come from somewhere (Figure 1b). Architectural science clearly uses surprising phenomena from professional practice and research to trigger new lines of inquiry (e.g., [52]). Someone observed an effect or a need and developed *useful* hypotheses and tools to quantify indoor environment quality. This is abduction in practice. The start of this process is coloured by the originator's tacit knowledge. Any extension of professional praxis [76] (pp. 37–44) will influence the process, but will also provide 'practical wisdom' [60]. Current IEQ approaches are fit for (the current) purpose. This paper is interested in expanding the existing inductive origins of environment quality. The inclusion of interior architecture sources is just a sequential continuum of the abduction process.

4. Interior Architecture as Source Discipline

This section reviews briefly the interior architecture discipline and then interrogates selected literature for new interpretation of interior occupancy as a source of observed surprising phenomena. This process is shown diagrammatically in Figure 2.

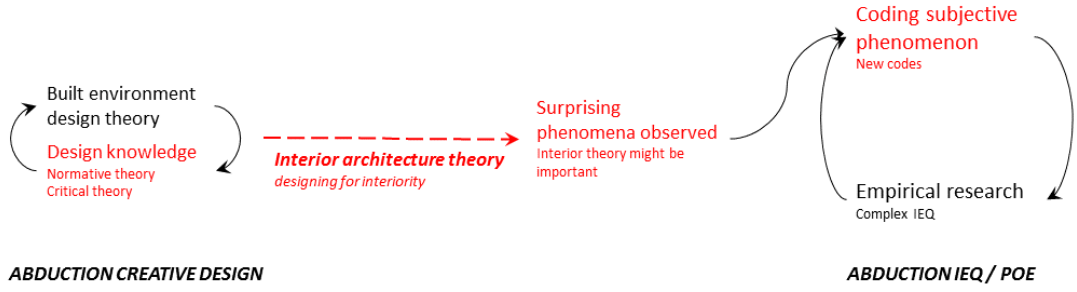

Figure 2. Pathway for introducing interior architecture theory into IEQ, based on Figure 1.

4.1. Interior Architecture—A Brief View from the Theoretical Scholars

Interior practitioners draw on rich theoretical traditions. Interior Architecture (IA) is ' . . . the design of space through human occupation' [77] (p. 8), or ' . . . design of the near environment' [8], such that:

> Designers act upon interiors through multiple entry points that include atmospheric conditions like color and light, understanding the client's needs, giving form and shape to materials, and unifying these elements into a captivating design. [78] (p. 11)

Thus, it is taken for granted that occupants should feel pleasure about the built design. Occupancy is seen as 'familiarity' with an interior due to ' . . . the close proximity of people, objects, and space' [77] (p. 3). It is also concerned with the temporality of designed spaces, particularly the need to adjust infrastructure to occupants as their needs change [2,74], leading to shorter lifecycles for interior architecture than architecture.

The interior architecture knowledge base comes from a wide range of research methods and knowledge claims, such as, but not limited to, theoretical approaches [79], including envronmental psychology theory [20]; empirical approaches, such as controlled experimentation, e.g., [39], historical, e.g., [80], and social sciences, e.g., [81]; and practiced-based research by design [82].

Interior preferences are highly complex and subjective, and are both individual and constructed through socialisation [83]. In professional design, aesthetics and pleasure of occupancy of a space are commensurate with its functionality objectives. While the term 'space' is often used in describing an interior (e.g., [1] (pp. 114–143)), the term 'interiority' offers an active view of occupying space:

> Interiority is that abstract quality that *enables the recognition and definition of an interior*. It is a theoretical and immaterial set of coincidences and variables from which "interior" is made possible. [84] (p. 112, emphasis added)

Interiority is development of enclosure and boundaries, originating from historical interior design [85], but also the pure sensory engagement of linking personal with spatial interiority [86] (p. ix). It is a developing concept, beginning as a social theory and moving to a recursive activity of spatial construction [87].

This theoretical literature of interior architecture offers a significant body of knowledge about the holistic understanding of interiors. This offers additional qualitative assessment to architectural and building science in the form of alternative phenomenology and interpretations; however, translating theory into coded formats needs deliberation. It has been asserted that itemising spatial components, and breaking down interiority, is not particularly useful for interior architecture, and it is recommended to:

> . . . recognise that multiple paradigms operate simultaneously—the sensorial experience, the cognitive or thoughtful, evaluative experience, and the immediate confrontation or immersive experience—[so that] a more holistic understanding is facilitated. [88]

In contrast, the duality of environmental quality components is also noted: light can be measured scientifically and holistically as an 'antediluvian affect' [89]. Similarly, from the environment psychology perspective, it is acknowledged that a range of checklists and test instruments are needed to fully cover interior features as well as perspectives [20]. Thus, measuring environment quality is not an either/or situation: both quantitative and qualitative, objective, and subjective methods have their individual validity and purpose, reinforcing each other, suggesting that interior architecture is not hostile to scientific methods.

The research efficiencies of quantitative surveys used in architectural and building science remain attractive, particularly for generating large datasets. The following speculative exercise tests the coding processing using interior architecture as a new source of variables for IEQ.

4.2. Code Development from Interior Architecture

Following the sequential pragmatic abductive process in Figure 2, this section searches interior architecture theory for new codes for future inclusion in IEQ. It does this by using content analysis [90] (pp. 282–285) in which selected interior architecture texts are examined for new words and phrases to describe interiors. The interior architecture texts were selected because they are used in interior

architecture education at the author's university workplace and represent contemporary thought about the interior architecture discipline. The source authors are listed and the edited books are coded as B + W = Brooker and Weinthal [77]; W = Weinthal [78]. The terms presented are those that provide 'surprising phenomena' and expanded interpretations relative to current IEQ.

Table 1 lists preliminary sense variables found in these texts. They provide nuanced interpretations of interiors and acknowledge that interiors change over time. While personal data collection is appropriate for some of these, visual data can be used to make observations of the application of these codes. This is illustrated here with images of Level 5 of the Jeffery Smart Building at the University of South Australia (Adelaide 35° S). This library and learning centre was designed by John Wardle Architects in association with Phillips Pilkington Architects. It opened in 2014 and was certified with a 5-Star Green Star—Education Design (v1) rating in 2016 [91].

The photos in Figure 3 show that there are distinct zones as indicated by the interior architecture's furniture and fittings selections. This creates near vs. far vision within the space. These are also differentiated be rectilinear and regular forms (library stacks), technology-rich areas (individual workstations), and the curved edges of the pendant lights and their relationship to the stand-up desk on a hard floor covering. In this case, locations could be characterised with codes, such as 'fixture edges' (rectilinear vs. curved, or strict vs. casual). There is also an 'internal visual distance' (near, mid, far).

Table 1. Selected preliminary content analysis of selected key texts—senses.

IA Topic	Source	Content
Senses—acoustic intimacy	Pallasmaa (W) Cantwell (Ch 38, B + W) von Drathen (W)	Presence/absence/time marker Harshness/softness/tranquillity Directionality
Sense—Sense of body/bodily resonance in space	Pallasmaa (W) Cantwell (Ch 38, B + W) von Drathen (W)	Scale/volume Interaction Gravity—apparent vs. defying
Senses—Vision extended (seen vs. potentially touched)	Pallasmaa (W)	Near vs. far Surfaces, contours, edges Agreeableness/unpleasantness Affection/indifference/stress
Senses—touch	Pallasmaa (W) Cantwell (Ch 38, B + W) von Drathen (W)	Texture and density Weight; Eye vs. body Temperature and light
Senses—olfactory	Pallasmaa (W) Parkinson (Ch 22, B + W)	Memory Association

(**a**) (**b**)

Figure 3. Level 5 northern study area, Jeffrey Smart Building, University of South Australia: (**a**) view to the southwest; and (**b**) view to the north (photos copyright of the author).

Table 2 addresses the interpretation of the interior enclosure. This enclosure is not the building envelope familiar to Architectural Science. Rather, it provides an exemplar from the perspective of the Interior Architecture discipline in its focus on the experience of being in a space and looking out.

In the example, there is a distinct interior fashion in the furniture selections, materials and colours. There are two tables shown in Figure 3. The table on the right is at traditional office desk seating level. The one on the left is higher and, while it has high chairs around it, it is also useable when standing, making it contemporary with current design trends for standing workplaces. This change in height contributes to the design style, but also to near vs. far vision compared to the previous table.

There are two types of permeability in the space. The first is the traditional view out of the building. The views out of the space to the exterior are obstructed by automatic blinds (Figure 3). This is due to the time of day that the photos were taken (summer morning in January, so north and east side blinds are down).

Within the space, each zone is delineated by changes in fixtures, furniture, colours and materials. These signify interiority and this creates small interiors within a large interior. There is visual permeability between each space with changes in privacy and openness. This could be coded as 'interior permeability' (low vs. high). The wall seat joinery in Figure 4 is functional, yet it does not adhere to an 'instantly detectable function' or 'affordance' as described in environmental psychology [20] (p. 30). Its unusual design shape brings attention to the wall, where the perforations of the acoustic panelling provides texture. The window mullions in Figure 5 are angled. The photograph, taken on an angle, highlights the texture this design decision makes to the space. Both of these examples, when compared to a plain plasterboard wall or glazed curtain wall, are high 'wall texture'.

Table 2. Selected preliminary content analysis of selected key texts—interior enclosure.

IA Topic	Source	Content
Historical and Geographical design influence/Fashion trends	Massey (Ch1, B + W) Scott (Ch 10, B + W) Shyder (Ch 29, B + W) Sparke (Ch 39 B + W)	Design style/hybrid Diffusion Flexibility Fashion
Threshold/connection between public and private	Griffith Winton (Ch 3, B + W) Parkinson (Ch 22, B + W) Moreno (Ch 26, B + W) Verghese and Smith (Ch 36, B + W)	Entrance openness Sense of privacy Permeability in and out (views and physical)
Materials and colour and surfaces	Verghese and Smith (Ch 36, B + W) Bachelor (W) Weinthal (W) Seigel (W)	Texture and Moulding, Light Cultural norms of colour (national, commercial, fashion) Safety of materials
Technology	Keeble (Ch 37, B + W) McQuire (H)	Comfort (heat, light) control Surveillance/Linkage Domestic vs. industrial tech Work vs. pleasure technology Ambivalence vs. defined outcome Participation

(**a**) (**b**)

Figure 4. Level 5 southern study area, Jeffrey Smart Building, University of South Australia: (**a**) contextual view towards the southwest; and (**b**) wall chair detail (photos copyright of the author).

Occupied spaces generally include some form of spatial agency. Table 3 addresses the effects of agency on spaces and has grouped together variables associated with personalisation under material culture, where everyday objects, and their deliberate arrangement, contribute to meaning and occupation. Here, too, Interior Architecture offers a wider and more nuanced evaluation of interiors [92].

Table 3. Selected preliminary content analysis of selected key texts—material culture.

IA Topic	Source	Content
Material culture (fixtures, fittings, decoration, furniture, that dress an interior)	Griffith Winton (Ch 3, B + W) Massey (Ch 35, B + W) Blauvelt (W) Schouwenberg (W) Helguera (W) Betsky (W)	Functional/everyday objects Pleasure objects Exhibition/installation of objects Participatory action of design/decoration Observed/reported/Preference

The images were taken prior to the start of the university term, so there is little evidence of use and occupation agency through personal and moveable objects. The stationary and fixed everyday objects used are coordinated both in materials and colour and demonstrate deliberate interior design agency to create symbolic meaning of a contemporary learning space.

The example here demonstrates the code of 'exhibition' where the installation of objects is present. The selection of pendant lights of variable size is an installation of objects in space above the high table (Figure 3). While the task lighting could have been provided with recessed fluorescent lights, as is done elsewhere, the design selections here create a place within the space through this installation. The wingback chairs in both Figures 4 and 5 also represent deliberate decisions to select functional objects with a novel form that suggests an installation of an object rather than a functional seat. This is similar to environmental psychology's collative properties of a room and its 'surprisingness' [20] (p. 285). Here, the designers have added complexity and a gradual reveal of possibilities rather than an instant understanding. Different audiences will understand this differently: for example, student users will interpret this space differently to professional designers whose principal concern is the interiority and atmosphere, yet both audiences are correct.

(**a**) (**b**)

Figure 5. Level 5 southern study area, Jeffrey Smart Building, University of South Australia: (**a**) contextual view towards north east; and (**b**) west study area (photos copyright of the author).

Table 4 presents examples of the Interior Architecture discipline's approach in interpreting user experience. Noting that Interior Architecture draws from a wide range of disciplines, the influence of environmental psychology is evident; however, perspectives, such as immersion and engagement with spatial design, offer additional perspectives for review. This content is similar to codes currently used in IEQ. For these, survey test instruments are most appropriate for collecting user experiences. Longitudinal visual data could capture changes in interiors, such as temporary installations, and use anthropological research methods. Alternatively, the author is currently investigating mobile eye tracking technology combined with wearable technology to capture biological responses to represent the user experience.

Table 4. Selected preliminary content analysis of selected key texts—user experience.

IA Topic	Source	Content
Desire and delight	Moreno (Ch 26, B + W) Parkinson (Ch 22, B + W)	Immersion Preference/Liked
Transience/change	Farrelly (Ch 11, B + W) Littlefield (Ch 17, B + W) Moreno (Ch 26, B + W)	Preference Liked Permanent vs. temporary
Health and wellbeing through design for operational rationality vs. compassionate interior design	Parkinson (Ch 22, B + W)	Natural light, noise reduction, layout, views Engagement with spatial design Compassionate/welcoming space Emotional/physical stress Psychological/social support Overload/Peace/Stimulation Movement agency
Spirit of place/meaningful occupation	Farrelly (Ch 11, B + W) Verghese and Smith (Ch 36, B + W) Cantwell (Ch 38, B + W)	Likely a combination of other variables, e.g., factor analysis
Experience and familiarity of spatial environment	Verghese & Smith (Ch 36, B + W)	Time spent in environment Peripheral vs. primacy State of mind Associate physical/memory

The example here is a relatively new construction with less than four years of occupation. While it is classified as a 'Green Building', from the perspective of interior architecture, it may perform better than other buildings because the fabric is newer, has less deterioration, and is well maintained. Furthermore, it may have a better quality interior design because more design effort may have been

expended on it, as is consistent of expectations for landmark buildings. The consequence of this is that the final configuration of a Green Buildings may be contingent on the recursive and socially constructed forms of its interior design. Thus, inclusion of the interior architecture discipline theory offers additional content and codes to incorporate into indoor environment quality appraisal. For the educational building, this would require additional terms to describe the indoor environment quality, such as fixture edges, internal visual distance, internal permeability, wall texture, and exhibition, in this case, with possibly more if user experience and longitudinal occupation observations are included.

5. Discussion and Conclusions

5.1. Complex Indoor Environment Quality

Architectural science and interior architecture use different words—indoor and interior, respectively. Where indoor environment quality is a set of physical measures with some preference variables, interior literature is broader, exploring the holistic phenomenological and interiority experience of the body. Through considering the sequential convergence of methods, it allows theory to influence empirical research. Interiority has been introduced here as a sense of enclosure, rather than as a physical enclosure. This intellectually frees up the reliance on building fabric, but it should not remove the building fabric from the research challenge: maintaining an exclusive position on either the scientific or humanist side does not progress interior architecture (or other building knowledge) and that, in practice, physics and interiority (phenomenological or other theory) are interconnected through human experience:

> Pallasmaa, Murcutt, and Zumthor's influence on designers has been broad but not received conditionally because of their unusual confidence in the dominant need of the body as it meets the forces of nature as the generator of architecture. [89]

Thus, any measure of environment quality needs to be explicit in its starting point and scope. Indoor environment quality measurements are achievable, but potentially limited, although the limitations may be valid depending on the intended concerned audience. This paper suggests that this scope could be extended and, using the interior architecture theoretical knowledge presented here, a more accurate name might be *interiority* environment quality. The risk with this is two-fold: first, the audience, architectural and building science, may not be fully aware of the breadth of interiority theory, and, second, though accurate, the use of another discipline-specific term may restrict future inter- and trans-disciplinarity.

An alternative term is *complex indoor environment quality*. This is indoor environment quality that is expanded to included variables that capture more of the complexity and richness of lived experience, including the pleasure of interior habitation, as described by interior architecture theory.

5.2. Future Development and Application

The next step is to refine the codes. This will include systematic searches of key peer-reviewed interior design journals to triangulate and confirm candidate code categories and descriptions, which can then be tested with pilot studies. This process will also need to be informed by the type of space and its intended use.

Currently, it is envisaged that there are three applications for an expanded IEQ variable set. The first application will expand indoor environment quality appraisal, possibly as fine detail to post-occupancy investigations (e.g., [93]). It is anticipated that there is a core variable group with additional clusters of variables based on interior spatial function, e.g., dependent variables, such as productivity and satisfaction, will vary from the residential to the workplace to other spatial classifications.

The second application aims to go beyond satisfaction and productivity and look for more complex relationships. This application aims to use codes in statistical analysis, such as inferential

statistics, factor analysis, and structural equation modelling to represent the constructs underlying interior environments, all as a companion to other qualitative methods. This is returning to early environmental psychology semantic differential approaches [39–41], but applied in naturalistic settings, using variables relevant to interior architecture appraisal.

The third application is as input for 'big data' analytic methods and, in particular, network patterns and data visualisation [94]. This latter approach offers a paradigm change in representing interiors since, rather than focussing on cognitive interactions of body- and neuro-typical occupants, large datasets allow for visualisation of occupant diversity. It is anticipated that these datasets can be created through location data and biophysical data available from wearables. In interior architecture the relationship of pleasure in occupancy to, say, productivity, can be investigated alongside typical IEQ measures. These large data sources provide naturalistic data for parameter relationship testing, as well as sources for inductive research to test emerging relationships between occupant, interior environment, and technology.

5.3. Conclusions

While architectural science and building science provide objective knowledge through physical built environment appraisal methods, this paper speculated that there are opportunities to extend our knowledge of habitable space through integrating subjective knowledge from interior disciplines, known as interior architecture, interior design, and spatial design. This syncretic perspective is intended to advance convergent methodologies and methods for the purpose of better understanding the occupation of interior space.

Using existing post occupancy evaluation and indoor environment quality exemplars, this paper reiterated these as convergent methodologies and positioned them as mode 2 knowledge, in which complex contextual problems require a network of experts and disciplines for resolution. It then positioned their research under the pragmatism knowledge claim. This then allowed discussion about the mixing of methods without the restriction of positivist and constructivist knowledge claims, and used abductive logic to relate objective research to subject research as a continuum, thus removing discipline exclusivity. It was then argued that POE and IEQ variables used come from intelligent practical observation of surprising phenomena using sequential methods.

Design and occupation occurs within a social structure, but also with user agency. This position of structuration provides a framework for understanding the interior architecture discipline. The IA theoretical knowledge base offers rich phenomenological and sociological interpretation of the experience of 'interiority', the nuanced sense of being within a defined space that privileges pleasure of occupancy. This paper proposed that this abstract experience and language of interiority could provide additional human factor variables for exploration.

The abductive coding process was applied to the interior architecture discipline. Two interior architecture teaching texts were mined for new perspectives of IEQ and presented here as a preliminary content analysis. These were further demonstrated using visual examples of a tertiary education building which is acknowledged as a Green Building to demonstrate how the codes could be interpreted. The candidate codes require further investigation and validation for use in quantitative IEQ research, which is a complement to rich qualitative work. This theoretical paper presented the start of this process and will form the basis for future work to integrate holistic experience into new complex indoor environment quality appraisal through statistical and 'big data' quantitative methods.

Funding: This paper received no external funding.

Acknowledgments: Photographs of the Jeffery Smart Building are used with permission, and acknowledge the University of South Australia as the client and owner of the building, and John Wardle Architects in association with Phillips Pilkington Architects as the building architects. The author thanks Zhonghua Gou, editor of the Special Issue: Human Factors in Green Building for the opportunity to develop the conference paper, and the Interior Architecture program staff at the UniSA School of Art, Architecture and Design for the rich discussions.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Edwards, C. *Interior Design: A Critical Introduction*; Berg: Oxford, UK, 2011.
2. Brooker, G.; Stone, S. *Basics: Interior Architecture: Form and Structure in Interior Architecture*, 2nd ed.; Bloomsbury: London, UK, 2016.
3. Plunkett, D. The profession that dare not speak its name. In *The Handbook of Interior Architecture and Design*; Brooker, G., Weinthal, L., Eds.; Bloomsbury Academic: London, UK, 2013; pp. 93–104.
4. ABS. Australian Census OCCU Occupation Group 232 Architects, Designers, Planners and Surveyors 2011. 2016. Available online: http://www.abs.gov.au/websitedbs/D3310114.nsf/Home/2016%20TableBuilder (accessed on 8 January 2018).
5. Moreno, S. Designing desire. In *The Handbook of Interior Architecture and Design*; Brooker, G., Weinthal, L., Eds.; Bloomsbury Academic: London, UK, 2013; pp. 364–378.
6. Myerson, J. The evolution of workspace design: From the machine to the network. In *The Handbook of Interior Architecture and Design*; Brooker, G., Weinthal, L., Eds.; Bloomsbury Academic: London, UK, 2013; pp. 213–225.
7. ABS. *8501.0 Retail Trade, Australia: Table 12. Retail Turnover, State by Industry Subgroup, Seasonally Adjusted*, 3/3/17 ed.; Australian Bureau of Statistics, Government of Australia: Canberra, Australia, 2016.
8. Theodorson, J. Energy, daylighting, and a role for interiors. *J. Inter. Des.* **2014**, *39*, 37–56. [CrossRef]

9. Pearce, L.M. Sensory pleasure of interiority: Finding transdisciplinary research language for complex indoor environment quality. In *Back to the Future: The Next 50 Years, Proceedings of the 51st International Conference of the Architectural Science Association, Wellington, New Zealand, 29 November–2 December 2017*; The Architectural Science Association and Victoria University of Wellington: Wellington, New Zealand, 2017; pp. 573–582. Available online: http://anzasca.net/paper/sensory-pleasure-of-interiority-finding-transdisciplinary-research-language-for-complex-indoor-environment-quality/ (accessed on 14 June 2018).
10. Al Horr, Y.; Arif, M.; Kaushik, A.; Mazroei, A.; Katafygiotou, M.; Elsarrag, E. Occupant productivity and office indoor environment quality: A review of the literature. *Build. Environ.* **2016**, *105*, 369–389. [CrossRef]
11. Sakhare, V.V.; Ralegaonkar, R.V. Indoor environmental quality: Review of parameters and assessment models. *Archit. Sci. Rev.* **2014**, *57*, 147–154. [CrossRef]
12. Mallory-Hill, S.; Westlund, A. Evaluating the impact of green building on worker productivity and health: A literature review. In *Enhancing Building Performance*; Mallory-Hill, S., Preiser, W.F.E., Watson, C.G., Eds.; Wiley: Somerset, UK, 2012; pp. 167–178.
13. Preiser, W.F.E. *Building Evaluation*; Plenum Press: New York, NY, USA; London, UK, 1989.
14. Doan, D.T.; Ghaffarianhoseini, A.; Naismith, N.; Zhang, T.; Ghaffarianhoseini, A.; Tookey, J. A critical comparison of green building rating systems. *Build. Environ.* **2017**, *123*, 243–260. [CrossRef]
15. Baird, G.; Leaman, A.; Thompson, J. A comparison of the performance of sustainable buildings with conventional buildings from the point of view of the users. *Archit. Sci. Rev.* **2012**, *55*, 135–144. [CrossRef]
16. Newton, C.; Wilks, S.; Hes, D.; Aibinu, A.; Crawford, R.H.; Goodwin, K.; Jensen, C.; Chambers, D.; Chan, T.-K.; Aye, L. More than a survey: An interdisciplinary post-occupancy tracking of ber schools. *Archit. Sci. Rev.* **2012**, *55*, 196–205. [CrossRef]
17. Gifford, R. *Environmental Psychology: Principles and Practice*, 5th ed.; Optimal: Colville, WC, USA, 2014.
18. Wener, R.E.; McCunn, L.J.; Senick, J. Did that plan work? Post-occupancy evaluation. In *Research Methods for Environmental Psychology*; John Wiley & Sons, Ltd.: Hoboken, NJ, USA, 2016; pp. 249–269.
19. Zeisel, J. *Inquiry by Design: Tools for Environment-Behavior Research*; Cambridge University Press: Cambridge, UK, 1984.
20. Gosling, S.D.; Gifford, R.; McCunn, L.J. The selection, creation, and perception of interior spaces: An environment psychology approach. In *The Handbook of Interior Architecture and Design*; Brooker, G., Weinthal, L., Eds.; Bloomsbury Academic: London, UK, 2013; pp. 270–281.
21. Edgerton, E.; McKecknie, J.; McEwen, S. Building better schools: Methodological concerns and the need for evidence-based research. In *Architectural Quality in Planning and Design of Schools: Current Issues with Focus on Developing Countries*; Knapp, E., Noschis, K., Eds.; Colloquia: Lausanne, Switzerland, 2010; pp. 43–51.
22. Simon, N.S.; Evans, G.W.; Maxwell, L.E. Building quality, academic achievement and self-competency in new york city public schools. In *School Building Design and Learning Performance: With a Focus on Schools in Developing Countries*; Knapp, E., Noschis, K., Pasalar, C., Eds.; Colloquia: Lausanne, Switzerland, 2007.
23. Bluyssen, P.M.; Janssen, S.; van den Brink, L.H.; de Kluizenaar, Y. Assessment of wellbeing in an indoor office environment. *Build. Environ.* **2011**, *46*, 2632–2640. [CrossRef]
24. Lan, L.; Lian, Z. Use of neurobehavioral tests to evaluate the effects of indoor environment quality on productivity. *Build. Environ.* **2009**, *44*, 2208–2217. [CrossRef]
25. Menadue, V.; Soebarto, V.; Williamson, T. The effect of internal environmental quality on occupant satisfaction in commercial office buildings. *HVAC&R Res.* **2013**, *19*, 1051–1062.
26. Bedford, T. *The Warmth Factor in Comfort at Work: A Physiological Study of Heating and Ventilation*; Great Britain Industrial Health Research Board, His Majesty's Stationery Office: London, UK, 1936.
27. Rohles, F.H., Jr. The revised modal comfort envelope. *ASHRAE Trans.* **1973**, *79*, 52–59.
28. Rohles, F.H., Jr.; Milliken, G.A. A scaling procedure for environmental research. *Proc. Hum. Factors Soc. Annu. Meet.* **1981**, *25*, 472–476. [CrossRef]
29. ASHRAE. *Fundamentals: Si Edition; Chapter 9, Thermal Comfort*; American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc.: Atlanta, GA, USA, 2013.
30. Roaf, S.; Crichton, D.; Nicol, F. *Adapting Buildings and Cities for Climate Change: A 21st Century Survival Guide*, 2nd ed.; Elsevier/Architectural Press: Oxford, UK, 2009.
31. De Dear, R.; Auliciems, A. Validation of the predicted mean vote model of thermal comfort in six australian field studies. *ASHRAE Trans.* **1985**, *HI-85-09*, 452–463.

32. De Dear, R. Revisiting an old hypothesis of human thermal perception: Alliesthesia. *Build. Res. Inf.* **2011**, *39*, 108–117. [CrossRef]
33. Candido, C.; Kim, J.; de Dear, R.; Thomas, L. Bossa: A multidimensional post-occupancy evaluation tool. *Build. Res. Inf.* **2016**, *44*, 214–228. [CrossRef]
34. Carifio, J.; Perla, R. Ten common misunderstandings, misconceptions, persistent myths and urban legends about likert scales and likert response formats and their antidotes. *J. Soc. Sci.* **2007**, *3*, 106–116. [CrossRef]
35. Baird, G.; Field, C. Thermal comfort conditions in sustainable buildings—Results of a worldwide survey of users' perceptions. *Renew. Energy* **2013**, *49*, 44–47. [CrossRef]
36. Douglas, D.; Gifford, R. Evaluation of the physical classroom by students and professors: A lens model approach. *Educ. Res.* **2001**, *43*, 295–309. [CrossRef]
37. Osgood, C.; Suci, G.; Tannenbaum, P. *The Measurement of Meaning*; University of Illinois Press: Urbana, IL, USA, 1957.
38. Flynn, J.E.; Spencer, T.J. The effects of light source color on user impression and satisfaction. *J. Illum. Eng. Soc.* **1977**, *6*, 167–179. [CrossRef]
39. Rohles, F.H.; Wells, W.V. Interior design, comfort and thermal sensitivity. *J. Inter. Des.* **1976**, *2*, 36–44. [CrossRef]
40. Kasmar, J.V. The development of a usable lexicon of environmental descriptors. *Environ. Behav.* **1970**, *2*, 153–169.
41. Mehrabian, A.; Russell, J.A. *An Approach to Environmental Psychology*; MIT Press: Cambridge, MA, USA, 1974.
42. Szokolay, S.V. *Introduction to Architectural Science: The Basis of Sustainable Design*, 2nd ed.; Elsevier: Oxford, UK, 2008.
43. Repko, A.F. *Interdisciplinary Research: Process and Theory*, 2nd ed.; SAGE: Los Angeles, CA, USA, 2012.
44. Salter, L.; Hearn, A. *Outside the Lines: Issues in Interdisciplinary Research*; McGill-Queen's University Press: Montreal, QC, Canada; Kingston, ON, Canada, 1997.
45. Nowotny, H.; Scott, P.; Gibbons, M. Introduction: 'mode 2' revisited: The new production of knowledge. *Minerva* **2003**, *41*, 179–194. [CrossRef]
46. National Research Council. *Convergence: Facilitating Transdisciplinary Integration of Life Sciences, Physical Sciences, Engineering, and Beyond*; The National Academies Press: Washington, DC, USA, 2014.
47. Hyde, R. Convergent methodologies for architectural science. *Archit. Sci. Rev.* **2013**, *56*, 101–102. [CrossRef]
48. Teddlie, C.; Tashakkori, A. *Foundations of Mixed Methods Research*; SAGE Publications Inc.: Thousand Oaks, CA, USA, 2009.
49. Groat, L.N.; Wang, D. *Architectural Research Methods*, 2nd ed.; John Wiley & Sons: New York, NY, USA, 2013.
50. Greene, J.C. Is mixed methods social inquiry a distinctive methodology? *J. Mixed Methods Res.* **2008**, *2*, 7–22. [CrossRef]
51. Fox, W. *A Theory of General Ethics: Human Relationships, Nature, and the Built Environment*; The MIT Press: Cambridge, MA, USA, 2006.
52. Cohen, R.; Standeven, M.; Bordass, B.; Leaman, A. Assessing building performance in use 1: The probe process. *Build. Res. Inf.* **2001**, *29*, 85–102. [CrossRef]
53. Williamson, T.; Soebarto, V.; Radford, A. Comfort and energy use in five australian award-winning houses: Regulated,measured and perceived. *Build. Res. Inf.* **2010**, *38*, 509–529. [CrossRef]
54. Bryman, A. The debate about quantitative and qualitative research: A question of method or epistemology? *Br. J. Sociol.* **1984**, *35*, 75–92. [CrossRef]
55. Creswell, J.W. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 2nd ed.; Sage Publications: Thousand Oaks, CA, USA, 2003.
56. Teddlie, C.; Tashakkori, A. Major issues and controversies in the use of mixed methods in the social and behavioral sciences. In *Handbook of Mixed Methods in Social & Behavioral Research*; Tashakkori, A., Teddlie, C., Eds.; Sage Publishers Inc.: Thousand Oaks, CA, USA, 2003; pp. 3–50.
57. Talisse, R.B.; Aikin, S.F. *Pragmatism: A Guide for the Perplexed*; Continnum: London, UK, 2008.
58. Metcalfe, M. Pragmatic inquiry. *J. Oper. Res. Soc.* **2008**, *59*, 1091–1099. [CrossRef]
59. Baert, P. Towards a pragmatist-inspired philosophy of social science. *Acta Sociol.* **2005**, *48*, 191–203. [CrossRef]
60. Flyvbjerg, B. Phronetic planning research: Theoretical and methodological reflections. *Plan. Theory Pract.* **2004**, *5*, 283–306. [CrossRef]
61. Melles, G. An enlarged pragmatist inquiry paradigm for methodological pluralism in academic design research. *Artifact* **2008**, *2*, 3–11. [CrossRef]

62. Roussac, A.C.; de Dear, R.; Hyde, R. Quantifying the 'human factor' in office building energy efficiency: A mixed-method approach. *Archit. Sci. Rev.* **2011**, *54*, 124–131. [CrossRef]
63. Gunay, H.B.; O'Brien, W.; Beausoleil-Morrison, I. A critical review of observation studies, modeling, and simulation of adaptive occupant behaviors in offices. *Build. Environ.* **2013**, *70*, 31–47. [CrossRef]
64. Yun, H.; Nam, I.; Kim, J.; Yang, J.; Lee, K.; Sohn, J. A field study of thermal comfort for kindergarten children in korea: An assessment of existing models and preferences of children. *Build. Environ.* **2014**, *75*, 182–189. [CrossRef]
65. Downton, P. *Design Research*; RMIT University Press: Melbourne, Australia, 2003.
66. Lawson, B. *How Designers Think: The Design Process Demystified*, 4th ed.; Architectural Press: Oxford, UK, 2005.
67. Sanoff, H. *Methods of Architectural Programming*; Dowden, Hutchinson & Ross Inc.: Stroudsburg, PA, USA, 1977.
68. Hillier, B.; Leaman, A. The man-environment paradigm and its paradoxes. *Archit. Des.* **1973**, *78*, 507–511.
69. Giddens, A. *The Constitution of Society: Outline of the Theory of Structuration*; Polity Press: Cambridge, UK, 1984.
70. Hillier, B. Space and spatiality: What the built environment needs from social theory. *Build. Res. Inf.* **2008**, *36*, 216–230. [CrossRef]
71. Awan, N.; Schneider, T.; Till, J. *Spatial Agency: Other Ways of Doing Architecture*; Routledge: Abingdon, UK, 2011.
72. Latour, B. *We Have Never Been Modern*; Harvester Wheatsheaf: Hemel Hempstead, UK, 1991.
73. Stengers, I. *Thinking with Whitehead*; Harvard University Press: Cambridge, MA, USA, 2011.
74. Vischer, J.C. Towards a user-centred theory of the built environment. *Build. Res. Inf.* **2008**, *36*, 231–240. [CrossRef]
75. Erzberger, C.; Kelle, U. Making inferences in mixed methods: The rules of integration. In *Handbook of Mixed Methods in Social & Behavioral Research*; Tashakkori, A., Teddlie, C., Eds.; Sage Publishers Inc.: Thousand Oaks, CA, USA, 2003; pp. 457–488.
76. Crouch, C.; Pearce, J. *Doing Research in Design*; Berg: New York, NY, USA, 2012.
77. Brooker, G.; Weinthal, L. *The Handbook of Interior Architecture and Design*; Bloomsbury Academic: London, UK, 2013.
78. Weinthal, L. *Toward a New Interior: An Anthology of Interior Design Theory*; Princeton Architectural Press: New York, NY, USA, 2011.
79. Clemons, S.A.; Eckman, M.J. Exploring theories identified in the journal of interior design. *J. Inter. Des.* **2011**, *36*, 31–49. [CrossRef]
80. Power, J. Australian palawa buildings: Rethinking interiors and their representation. *J. Inter. Des.* **2016**, *41*, 15–32. [CrossRef]
81. Wang, Z.; Pukszta, M. Patient needs and environments for cancer infusion treatment. *J. Inter. Des.* **2017**, *42*, 13–25. [CrossRef]
82. Postiglione, G. Methods of research and criticality. In *The Handbook of Interior Architecture and Design*; Brooker, G., Weinthal, L., Eds.; Bloomsbury Academic: London, UK, 2013; pp. 59–69.
83. Sparke, P. Taste and trends. In *The Handbook of Interior Architecture and Design*; Brooker, G., Weinthal, L., Eds.; Bloomsbury Academic: London, UK, 2013; pp. 559–597.
84. McCarthy, C. Toward a definition of interiority. *Space Cult.* **2005**, *8*, 112–125. [CrossRef]
85. Attiwill, S. Towards an interior history. *IDEA J.* **2004**, *2004*, 1–8.
86. Taylor, M. *Interior Design and Architecture: Critical and Primary Sources: Sensory Engagement*; Bloomsbury: London, UK, 2013; Volume 2.
87. Popov, L.S. The social production of interiority: An activity theory approach. *IDEA J.* **2010**, 90–101.
88. Verghese, G.; Smith, D. The poetic language of interior materials and color. In *The Handbook of Interior Architecture and Design*; Brooker, G., Weinthal, L., Eds.; Bloomsbury Academic: London, UK, 2013; pp. 514–527.
89. Cantwell, C. Phenomenology and the senses in interiors. In *The Handbook of Interior Architecture and Design*; Brooker, G., Weinthal, L., Eds.; Bloomsbury Academic: London, UK, 2013; pp. 544–558.
90. Denscombe, M. *The Good Research Guide for Small-Scale Social Research Projects*, 5th ed.; Open University Press, McGraw-Hill: Maidenhead, UK, 2014.

91. GBCA. University of South Australia. Available online: http://www.gbca.org.au/members/university-of-south-australia/ (accessed on 22 January 2018).
92. Griffith Winton, A. Inhabited space: Critical theories and the domestic interior. In *The Handbook of Interior Architecture and Design*; Brooker, G., Weinthal, L., Eds.; Bloomsbury Academic: London, UK, 2013.
93. Kim, J.; Candido, C.; Thomas, L.; de Dear, R. Desk ownership in the workplace: The effect of non-territorial working on employee workplace satisfaction, perceived productivity and health. *Build. Environ.* **2016**, *103*, 203–214. [CrossRef]
94. Newman, M.E.J. *Networks: An Introduction*; Oxford University Press: Oxford UK; New York, NY, USA, 2010.