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In Search for an Epistemology for the Sciences of Built Environments

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Abstract

This article is a call for increased attention to the epistemological challenges in the scientific study of built environments. These issues are acknowledged, yet only superficially discussed, in the philosophy of architecture. While the philosophy of science has recently examined how environments shape human health, the specific problems raised by built spaces remain largely overlooked. However, it is crucial to address the epistemological foundations that underlie the ethical, aesthetic, social, and political dimensions of architecture. Evidence-Based Design illustrates this need: it aims to enhance scientific rigour in building design and improve performance. Based on a systematic review of design research, I argue that its methodological inspiration (Evidence-Based Medicine) is ill-suited to architectural contexts. A constructive update would incorporate insights from philosophy of science on experimentation, pluralism, and the role of theory in practical sciences. This case study exemplifies philosophical engagement with built environments and design research.

Keywords

Architecture; Evidence-Based Design; Evidence-Based Medicine; Applied Sciences; Philosophy of Science in Practice.

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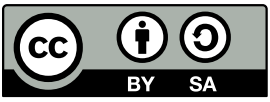
Introduction

We intuitively assume that built environments can have a potent influence on a range of outcomes related to the well-being of its users. For instance, a bright, well-ventilated room with a view of nature appears beneficial; a damp, underground room with dull colours and furniture would instead be detrimental. In this paper, I argue that translating these simple insights into scientific research and incorporating this research into design processes is a difficult, important and, above all, under-explored epistemological challenge.

In *Part 1*, I characterise existing research gaps in the philo-



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sophical literature. On the one hand, philosophy of architecture does not explicitly address the field's epistemological foundations. A discussion of the latter matters, as it underpins and interacts with the aesthetic, ethical, political or metaphysical dimensions of architecture. Conversely, philosophy of science does not engage with the specifics of built environments. This lacuna poses a problem, as scientific knowledge about the effects of built spaces is increasingly available, raising numerous epistemological issues, in a context of an applied science characterised by high expectations and high stakes. This article therefore argues that philosophers of science should more explicitly recognise and address the epistemological issues linked to the design of built environments. To illustrate this view, *Part 2* provides a critical discussion of Evidence-Based Design's (EBD) epistemological basis. In *Part 3*, I argue that improving EBD requires an interdisciplinary engagement, bringing philosophy of science into closer dialogue with philosophy of architecture and design research.

1. Research Gap: Architecture as an Epistemologically Neglected Field

Saul Fisher's introduction to the *Stanford Encyclopedia* entry on the 'Philosophy of Architecture' depicts a relatively neglected field of study

'Over the course of Western philosophy, includ-

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ing the history of aesthetics, architecture has largely failed to attract sustained, detailed attention – particularly as compared with other artforms.' (Fisher, 2015: 'Philosophy of Architecture,' URL = https://plato.stanford.edu/archives/win2016/entries/architecture/, E.N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy*)

It is interesting to notice how Fisher spontaneously considers architecture as a philosophical terrain for *aesthetics*. Discussions of 'architectural knowledge', instead, are relegated to a subpart of the entry within which – uncharacteristically to an encyclopedia entry – only three bibliographical references are mentioned. If the philosophy of architecture is a neglected field, then the *epistemology* of architecture appears even more relegated.

One could think there are good reasons for this neglect, namely, that architecture does not present worthy epistemological challenges. I argue, instead, that such challenges permeate Fisher's presentation and deserve explicit scrutiny. For instance, the vitruvian triad *firmitas* ('solidity'), *utilitas* ('utility') and *venustas* ('beauty') still stands as cardinal qualities to be held by built works. It raises, however, a host of questions that link epistemic dimensions with ethical, metaphysical and aesthetic considerations.

In the first place, one may wonder whether these virtues can be measured with scientific instruments. The challenge is to simultaneously account for the context specificity of built environments, as well as for the variable – and equally con-

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textual – subjective experience of individual users. It also matters to figure out, at a definitional level, whether these qualities are attributed to parts or to the totality of a built environment, and how parts are being individuated. The satisfaction of vitruvian qualities also poses possible trade-offs: can beauty, utility and solidity always be promoted together? How to characterise and manage possible conflicts between these values?

A recent essay invites reflection on the bioethical dimensions of seeing built spaces as therapeutic interventions (Anderson *et al.*, 2022, 'The bioethics of built space: health care architecture as a medical intervention', *Hastings Center Report* 52(2), DOI: 10.1002/hast.1353, pp. 32-40). While important, I argue that a sole emphasis on ethical aspects is insufficient. The reflections derived from a consideration of the vitruvian triad foreground the need to explore the epistemic aspects underpinning ethical, as well as aesthetical, metaphysical, and political dimensions in the built environment. This approach considers epistemic and ethical issues as *inherently interlinked*, as already proposed by philosophers of science (see Tuana, 2010, 'Leading with ethics, aiming for policy: new opportunities for philosophy of science', *Synthese* 177, DOI: 10.1007/s11229-010-9793-4, pp. 471-492).

Philosophy of science therefore has a distinct and important role to play in addressing the epistemological issues raised by the design of built spaces. In his encyclopedia entry,

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Fisher mentions a role for two types of scientific knowledge in the context of architecture: knowledge about materials relevant to the structural integrity of buildings, and environmental psychology. The latter identifies 'ways that environmental factors such as colour, shape, light, and circulatory pattern shape our visual reactions and behavioral patterns within and around the built environment' (Fisher, 2015). By scientifically investigating the pathophysiological reactions to built environments, environmental psychology bridges epistemic considerations with the aesthetic and subjective dimensions of architecture. It hence constitutes a valuable entry point to explore how philosophy of science can illuminate the epistemological foundations of design research and processes.

Throughout history, the notion of 'environment' has had multiple meanings, as a result of sustained interest arising from various scientific, philosophical and societal perspectives (Warde *et al.*, 2021, *The Environment: A History of the Idea*, Johns Hopkins University Press). Philosophers of science, in particular, have examined how environments have been conceived and operationalised in the historical, cognitive, and medical sciences, such as epidemiology, exposomics, and toxicology. To my knowledge, such scrutiny has yet to occur in environmental psychology. This analysis would help foreground the distinct epistemological stakes at play in the conception and operationalisation of *built* environments.

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This leaves us in a situation where architecture raises a variety of epistemological issues which underpin aesthetic, ethical, metaphysical, and political debates. These are sometimes acknowledged, but rarely addressed explicitly by philosophers of architecture. Likewise, disciplines exploring the effects of built spaces – such as environmental psychology – are lacking due consideration from philosophers of science. Because of the broad societal impact of architecture, it is important to tackle both these research gaps simultaneously. Doing so would increase awareness of how scientific knowledge is, and should, be constituted and used in design processes.

This does not mean that the existing philosophical literature is no help in undertaking this task. As discussed in *Part* 3, considerations drawn from general and discipline-specific philosophy of science provide crucial insights. But before that, I propose to ground my analysis on cases drawn from design and architectural practice, as these instantiate proposals which are concrete, relevant and actively debated in these fields. A critical and constructive engagement with such constructs can therefore prove both philosophical insightful and pragmatically useful. In what follows, I illustrate this approach through the case of 'Evidence-Based Design'.

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2. Case Study: Evidence-Based Design

Evidence-Based Design (EBD) is a term coined in 2003 by D. Kirk Hamilton, an American architect, as an approach to the design of built spaces, with a particular focus on healthcare infrastructure (Hamilton, 2003, 'The four levels of evidence-based practice', *Healthcare Design* 3-4: 18-26). It promotes the systematic production and sharing of scientific knowledge about the effects of built designs on users, and its widespread and transparent use to ground design decisions. This aspiration makes it a particularly interesting case for an exploration of the epistemic dynamics in the context of the built environment. EBD's main inspiration is Ulrich's work in environmental psychology. More particularly, a retrospective study, published in 1984, serves as proof of concept for the approach. This study observed clinically significant statistical differences between post-surgery patients depending on their window views (Ulrich, 1984, 'View through a window may influence recovery from surgery', *Science* 224(4647), DOI: 10.1126/science.6143402, pp. 420-421).

EBD serves as an anchor to various institutional developments in architecture and design, a field considered to be notoriously research-averse (Chupin, 2024, 'Le Ph. D. en architecture est-il un doctorat en design?', *Sciences du Design* 20(2), DOI: 10.3917/sdd.020.0172, pp. 172-188). It provides the basis, among other things, to a professional accreditation (*Evidence-Based Design Accreditation and Certifica-*

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tion, EDAC) and to the *Pebble Project*, an initiative gathering and fostering good practices in evidence-based healthcare design. The *Health Environment Research and Design* (*HERD*) journal, created in 2008, is a peer-reviewed publication dedicated to the sharing of EBD-inspired empirical work, and of discussions over the approach's conceptual and methodological foundations. *HERD* articles and textbooks (most notably Hamilton & Watkins, 2008, *Evidence-Based Design for Multiple Building Types*, John Wiley & Sons) thereby constitute precious sources to decipher EBD's epistemological proposals.

In what follows, I provide a brief summary of the results of a critical systematic review of the notion of EBD (Bonnin, under review, 'A critical assessment of Evidence-Based Design's knowledge base and inspiration: a systematic review'). The review particularly focuses on EBD's ambiguous relationship with its main epistemological inspiration, namely, Evidence-Based Medicine (EBM). In addition to bearing very similar definitions, EBD notably imports EBM's hierarchy of scientific methods as a way to discern the value of a given source of knowledge. The most authoritative knowledge, in this view, comes from the aggregated analysis ('meta-analysis') of results from randomised controlled trials, deemed the most reliable scientific method. EBD, like EBM, thereby favours controlled experimental knowledge, and openly seeks to downplay the authority of observational and anecdotal knowledge as well as expert

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opinions which are all purportedly prone to biases.

Simultaneously to these energetic efforts to reform design knowledge, some EBD practitioners are aware of the difficulty of importing epistemological standards from its medical counterparts. They call for amending the approach so that it accounts for the specificities of the design process, and for what distinguishes interventions on built environments from medical ones. The existence of this internal dissonance led me to make a systematic review of this critical literature (which includes 31 publications written by design and architecture researchers published between 2003 and now). My analysis of these arguments made clear that EBM's hierarchy of methods is not the right epistemology for EBD. This rejection is articulated over three reasons.

The first is that an inspiration from EBM amounts to a continuous *precarisation* of EBD's knowledge basis. In clinical medicine, producing a randomised controlled trial represents a noteworthy, but reachable, scientific achievement, as attested by the existence of the *Cochrane Library* which collects meta-analyses in clinical research. Experimental, controlled (not to mention randomised) knowledge about the effects of interventions on built spaces is, to the contrary, much harder to come by. In this view, EBD is thereby constrained to rely on 'lesser' – and more accessible – evidence sources. While being hard to reach, experimental evidence is also criticised for being practically weak. In other words, it is only considered capable of supporting small, in-

cremental changes in built designs, and thus cannot encourage broader innovations. Finally, and as already suggested by Fisher, 'we may ask whether an architectural object may be optimized by the lights of environmental psychology yet – and even *consequently*– deficient in some other, architecturally central respect' (Fisher, *ibid.*). In other words, design researchers doubt that the scientific optimisation of built spaces necessarily results in their increased aesthetic or moral values. In sum, emulating EBM's hierarchy of knowledge would entrench the weakness of EBD's knowledge basis with no guarantee of either sufficient or adequate improvements in the resulting built environments.

This state of knowledge paucity, according to critics, needs not be. In this view, an EBM-inspired evidence hierarchy bears with it a devaluation of important design knowledge. Its classification of methodologies is judged too rigid, thereby lacking context specificity. By this, design researchers recognise that experimental and controlled evidence, while potentially powerful, is not the most adequate for all purposes in the design process. For instance, as already mentioned, it is neither capable of strongly supporting innovative proposals, nor is it helpful – compared to ethnographic studies – with providing a rich contextual understanding. The latter methods are even given no consideration (not even negative) in broader EBM-inspired epistemologies (Cartwright & Efstathiou, 2008, 'Evidence-based policy and its ranking schemes: so, where's ethnography?', *Paper pre-*

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sented at the Conference of the Association of Social Anthropologists). Because the design process involves a variety of decisions, it can benefit from a similarly wide scope of knowledge sources. Enforcing a hierarchy of knowledge thereby feels contrived. EBD's current devaluation of anecdotal knowledge, while the latter is robustly documented as the central means of communication between different stakeholders in design processes, indicates a misfit of this epistemological proposal with actual practices.

A static hierarchical framework, which – inadequately, as we have seen – categorically parses out reliable and unreliable knowledge, is finally seen as diverting attention – and providing no solution – to some of the main epistemological issues raised in design processes. It says nothing, for instance, of how scientific knowledge could flow in a variety of communication means, including anecdotes, diagrams and physical simulations ('mockups'). The integration, or triangulation, of different sources of knowledge is similarly not discussed. Its means of adjudicating controversies – by giving precedence to the most reliable source of knowledge – is too coarse-grained for most situations – for instance the assessment of contradictory results stemming from a similar method – and too context-independent to be widely applicable. An EBM-derived hierarchy, while clear on the assessment of a method's *internal* reliability, does not indicate how to evaluate the applicability of such knowledge to practical decisions. The management of conflicting values held by

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different stakeholders, an intense topic of discussions at the intersection of science and policy-making (Elliott, 2017, *A tapestry of values: An introduction to values in science*, Oxford University Press) is similarly out of the scope of EBD's current epistemological proposal.

In short, this systematic review shows that EBD is still in search of its epistemological foundations. As recognised by several researchers, a strong leaning on EBM's hierarchical view of scientific methods (a) continuously places EBD in a precarious epistemic situation, while (b) neglecting large swathes of relevant knowledge and (c) diverting attention from important epistemological challenges.

This review, however, is more than the occasion to criticise 'native' epistemological frameworks. I mean, instead, this work to lay the groundwork for a constructive epistemological proposal for the contribution from scientific knowledge to the design of built spaces. EBD, in this sense, is heuristically useful to identify areas of further investigation, where existing proposals in philosophy of architecture and philosophy of science will prove useful.

3. Steps Towards a Constructive Proposal

While it is arguably crucial, for EBD, to shift away from a narrow and exaggerated valuation of controlled, experimental evidence, finding the adequate contributions for these methodologies remains to be determined. This is

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a topic central to other 'Evidence-Based' approaches, notably Evidence-Based Policy (Cartwright & Hardie, 2012, *Evidence-based policy: A practical guide to doing it better*, Oxford University Press), and even within EBM itself (Parkkinen *et al.*, 2018, *Evaluating evidence of mechanisms in medicine: principles and procedures*, Springer Nature). Experiments hinge their legitimacy on their ability to causally isolate, and intervene upon, a variable of interest. The possibility of such isolation harks back to protracted debates, in architecture theory, over the mereology of built spaces (Scruton, 1979/2013, *The Aesthetics of Architecture*, Princeton University Press). Epistemic tangles over causal inference from the environment are similarly visible in epidemiological research (Broadbent, 2013, *Philosophy of Epidemiology*, Palgrave Macmillan), notably once we consider the inextricable intertwining of biological and social factors (Krieger, 2024, *Epidemiology and the people's health: theory and context*, Oxford University Press).

These debates can help design research build realistic expectations of the contribution of experiments from environmental psychology, together with other scientific methods and non-scientific forms of knowledge. In other terms, an improved framework for EBD must address the management of *epistemic pluralism*, not only at the *intra*disciplinary and *inter*disciplinary but also at a *science-transcending* level (Bschir & Lohse, 2022, 'Pandemics, policy, and pluralism: A Feyerabend-inspired perspective on COVID-19, *Synthese*

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200, DOI: 10.1007/s11229-022-03923-4, p. 441). The context specificity and iterativity that characterises proposals for inclusive and rigorous science-based policy-making contrast with the contrived neatness of EBM's evidential hierarchy (Bonnin & Giroux, in press, "Suivre la science' en temps de pandémie', *Lato Sensu: Revue de la Société de Philosophie des Sciences*).

Epistemological analyses of the sciences of the environment, from philosophers and practitioners alike, have also insisted on the importance of upholding a clear *theoretical framework*. Proposals include the 'ecosocial theory' and the 'exposome' in epidemiology, 'salutogenesis' in population health or 'eco-evo-devo' in evolutionary biology. These proposals include explanatory patterns and constraints to the interpretations of empirical works, provide a heuristic for empirical work, as well as priority topics to be investigated. On this respect, EBD is mainly driven by an epistemic (to ground design decisions on scientific evidence) and production (to make buildings that are measurably better) imperatives. Its theoretical basis includes contributions from individual, environmental and evolutionary psychology (Cushing & Miller, 2020, *Creating Great Places: Evidence-Based Urban Design for Health and Wellbeing*, Routledge). A critical assessment and a synthesis of these variegated, and possibly contradictory, contributions is thereby an important task ahead (see Menatti & Casado da Rocha, 2016, 'Landscape and Health: Connecting Psychology, Aesthetics, and

Philosophy through the Concept of *Affordance*', *Frontiers in psychology* 7, DOI: 10.3389/fpsyg.2016.00571, p. 571 for a recent proposal in this direction).

Conclusions

This paper has sought to demonstrate the fruitfulness of an explicit engagement with the epistemic issues raised by the conception of well-designed built environments. It opens a field that involves a complex interplay between, among other things, knowledge production, significant societal stakes, value trade-offs, and aesthetic considerations. Philosophy of science, I have argued, has a key role to play in clarifying the epistemic underpinnings of these issues. This task similarly requires a broader interdisciplinary engagement with philosophy of architecture, architectural research, and design practice.

In this context, the critical study of Evidence-Based Design, and the search for an improved proposal, provide an entry point to the broader epistemological interface between health promotion and built environments. Successfully addressing the therapeutic or pathogenic effects of built spaces has long been seen to require an integrative, interdisciplinary response (see Cartwright *et al.*, 2008, *Otto Neurath: Philosophy Between Science and Politics*, Cambridge University Press). The time is ripe to tackle these epistemological issues head-on.

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The case of EBD sheds light on challenges currently faced by architecture and design research more broadly. In this context, increased possibilities in data collection (through sensors) and data analysis (through artificial intelligence) promise to expand the role of scientific knowledge in the design and management of future facilities (for instance, see Capolongo *et al.*, 2020, 'COVID-19 and Healthcare Facilities: a Decalogue of Design Strategies for Resilient Hospitals', *Acta Biomed* 91(9), DOI: 10.23750/abm.v91i9-S.10117, pp. 50-60). In this context, the development of more robust epistemological frameworks is essential to support these technical developments.

A critical study of EBD can also be viewed in the context of the recent proliferation – in the wake of EBM – of 'Evidence-Based' approaches in a variety of applied fields, including education, law, policy, and nursing. The overarching reach and widespread tangible social effects of these approaches make it all the more pressing to understand the conditions for their successful development, at the epistemic, ethical, and societal levels (Bonnin, in preparation, 'Evidence-Based Approaches as Scientific Imperialism: the Case of Evidence-Based Design').

There are, therefore, a number of reasons to draw epistemological attention to the sciences informing the design of built environments.

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