Design behaviour for sustainability

An international expert panel probes how engineers, architects and behavioural scientists can work together to learn about design behaviour for sustainability — and what all interested scholars and practitioners might learn from it.

Leidy Klotz, John Pickering, Ruth Schmidt and Elke U. Weber

Our era, the Anthropocene, is defined by the fact that human behaviour has become the dominant influence on the natural environment[1]. In this reality, behavioural science must inform our pursuit of sustainability (see Box 1 for definitions)[2]. Promisingly, behavioural science is being used to encourage more sustainable end-use behaviour: from learning generally why and when people act in more sustainable ways[3], to identifying specific ways to present information so that sustainable behaviour becomes more likely[4].

Our panel believes design behaviour, as defined in Box 1, offers untapped potential for similar impact. Whether the result is a new building or a new policy, design behaviour turns existing situations into preferred ones[5], at a large scale. Whereas end-use behaviour can determine what happens in a situation, design behaviour often determines the situation itself. Activating an office worker's pro-environmental behaviour, for example, may have them put on a sweater instead of turning up the thermostat. But the designer's pro-environmental behaviour can have that same office heated by the Sun's renewable energy, instead of a gas-burning furnace.

While there is certainly overlap between end-use and design behaviour, the latter cannot be understood by simply extending what has been learned about the former. Design behaviour for sustainability is part of an interdependent network of judgements and decisions, which are shaped by specific professional and socioeconomic contexts, and which must consider existing and preferred states of complex Anthropocene situations.

As an entry point to study design behaviour for sustainability, our panel focused on design of the human built environment. Such design shapes human quality of life, and it sets in place long-term patterns of climate changing emissions and other planetary impacts, for better or worse[6]. Within this context, our panel sought ways to learn about design behaviour for sustainability — ways in which built-environment designers and behavioural scientists might advance how we currently understand and practice design for sustainability. In addition, our panel sought opportunities to learn from design behaviour for sustainability — about design behaviours common to many sustainability challenges, beyond the built environment.

Box 1 | Guiding definitions for the panel

Behavioural science: systematic analysis and study of human judgement and decision-making and its influence on perception, memory, learning and action. While behavioural science often focuses on interventions that address individual instances of behavioural change, our panel also focused on behaviour at scale, as it relates to society and social systems.

Design behaviour: creating with intent, informed by an understanding of humans and relevant contexts, to go from how things are to how we want them to be. Our panel focused on design primarily as conceived and practiced by engineers, architects and planners, although the findings may also have implications for a much wider array of design and designers.

Sustainability: seeking the well-being of current and future generations within the limits of the natural world, balancing the ways in which short-term individual- and organizational-level interests enhance or are at odds with those of global systems and communities in the longer term. Our panel sought integrated consideration of environmental, social and ethical aspects of sustainability.

About design behaviour

The consequences of climate change are an example of how the large-scale systems humans have designed have brought about a situation that does not appear to be in our species' best interest. Economics[7] and law[8] have been able to broaden their theoretical foundations by rigorously incorporating behavioural science to extend and account for systematic deviations from 'rational' models of consistent thinking and behaviour. Embracing and applying analogous advances to the design of the built environment — and to designers themselves — can extend the boundaries of research and practice in design for sustainability[9].

Learning about designer behavior. Just as it is important to understand what makes end-users ride public transit, it is also important to understand what makes planners, engineers and elected officials propose, design and fund it in the first place. Panellists prioritized the need to understand: when is it appropriate (or not) to generalize from research on end-use behaviour? And, what are root causes of design heuristics[10] working for and against sustainability? By asking such questions, behavioural scientists will learn more about the contexts in which designers make their decisions. And designers will learn new ways to create more sustainable outcomes.

Learning about the design process. When presented with the exact same existing situation, one designer may produce a more sustainable outcome than another[11]. But looking at designer behaviour in isolation is inadequate, because the design process also shapes design outcomes[12]. The exact same designer, following a different design process, may produce a more sustainable new situation. To leverage this relationship, panellists prioritized questions such as: what are points of leverage in the design process? And, what are the drivers of successful sustainable design? Design behaviour occurs in the context of processes that both intentionally and tacitly shape the sustainability of outcomes.

Learning about how physical form influences end-use behavior. Behavioural

Box 2 | The University of Virginia–*Nature Sustainability* expert panel on design behaviour for global sustainability

Cities, nations and organizations around the world are increasingly using behavioural science to encourage more sustainable choices and actions among end-users. However, design behaviour for sustainability remains underexplored, in part because it requires spanning across academic disciplines and between research and practice. In response, *Nature Sustainability* and the University of Virginia established a ground-breaking expert panel on design behaviour for global sustainability. This Comment offers an introduction to the panel's work, highlighting the need to learn about, and from, design behaviour for sustainability.

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science has brought valuable insights into how social context affects sustainable behaviour[13]. In a similar way, the physical form of the buildings and infrastructure that designers produce can create a context that suggests or discourages sustainable behaviours among end-users. An office building that makes energy use transparent may encourage occupants to think about energy use in their homes, or even on their commutes. However, the effects of physical contexts are understudied[14]. As panellists noted, understanding which physical factors generally influence sustainable behaviour among end-users would give designers new ways to create a built environment that encourages this behaviour in other situations as well.

From design behaviour

Our panel focused on design of the built environment. At the same time, we agree with the designer, behavioural scientist and Nobel Laureate, Herbert Simon, who wrote that "everyone designs who devises courses of actions aimed at changing existing situations into preferred ones"[5]. For this reason, we expect that some questions and insights from built-environment design will be generalizable across situations, with potential to contribute to the behavioural dimension[15] of the emerging science of sustainability.

Learning about behaviours common to many sustainability challenges. Insights about design behaviour in the built environment will sometimes translate to design behaviour in other sustainability pursuits. A list of such behaviours has been documented in this journal[10]. One cross-cutting behavioural challenge, for example, is to align implicit time horizons with those required for sustainability. A homeowner who decides not to install solar panels because they plan to sell their home in a few years may be using a similar thought process to a mayor who is not motivated to support a policy which would create green jobs, because the jobs would not be filled until the next regime. Incentive structures or visioning techniques that help the homeowner expand their view may also be helpful for the mayor.

Learning ways to expand how sustainability is perceived. Our panel believes that studying design promises to extend how sustainability science is perceived and, therefore, pursued. One pressing need in built-environment design is to provide evidence and best practices for integrating environmental and social dimensions of sustainability. To do so, built-environment designers are seeking ways to rigorously consider beliefs and values in a way similar to how physical forces like structural loads and heat transfer are already considered. While the need for this expanded perspective is well-known to sustainability theorists[16], tangible examples from the built environment would help convey the need, and the benefits of meeting it, to a much wider audience.

Learning ways to more fully measure impact. For accountability and for transferability, both research and practice require systematic measurement of the effect of interventions intended to encourage more sustainable design behaviour. Doing so in the built environment presents challenges: the low frequency of interventions; the need to study behaviour in context (with communities and users); and the fact that individual decisions are made within systems of influence, and difficult to isolate. These challenges are common to sustainability, beyond design. Finding practical ways to evaluate low-frequency interventions, and to balance perfection and relevance, therefore promises transferrable insights to other areas of sustainability policy and practice.

Join us

By bringing together researchers and practitioners from an array of academic disciplines and occupations (see Box 2) around a common research challenge, this panel is integrating theories, methods and data across communities. Most importantly,

we have identified 20 high-priority questions that both define and advance our focus on design behaviour for sustainability[17].

Identifying convergent research questions is a milestone; albeit an early one. Going forward to pursue these, and other yet-to-be-uncovered questions, will require persistence and teamwork far beyond this initial panel. Going forward will require us to create even more porous boundaries between physical, formal, natural and behavioural sciences.

We are hard at work building and enhancing the network — to learn about and from design for sustainability through long-term interactions across multiple communities. Please contact any of the co-authors if you are interested in getting involved. We are eager to hear from you. ❐

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Competing interests

The authors declare no competing interests.