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Abstract

Buildings are responsible for approximately 30% of EU end-use emissions (Bettgenhäuser , et al, 2009) and are at the forefront of efforts to meet emissions targets arising from their design, construction and operation. For the first time in its history, construction industry outputs must meet specific energy targets if planned reductions in greenhouse gas emissions are to be achieved through nearly zero energy buildings (nZEB) (EC, 2010) supported by on-site renewable heat and power.

Where individual UK dwellings have been tested before occupation to assess whether they meet energy design criteria, the results indicate what is described as an 'energy performance gap', that is, energy use is almost always more than that specified. This leads to the conclusion that the performance gap is, inter alia, a function of the labour process and thus a function of social practice. Social practice theory, based on Schatzki's model (2002), is utilised to explore the performance gap as a result of the changes demanded in the social practice of building initiated by new energy efficiency rules. The paper aims to open a discussion where failure in technical performance is addressed as a social phenomenon.

Key words

Nearly zero energy buildings, social practice, sayings and doings, practical understandings, practical intelligibility, teleoaffectivity, general understandings.

Introduction

'Building' or 'construction' is a social practice where builders exhibit their ability to create new and refurbish existing buildings. For construction workers, the practice is underlined by mutual recognition as the carriers of knowledge and skills and for SMEs, the small builder, the continuity of practice provides evidence of a client base and successful economic survival. It is into this known practice of foundations, bricks and blocks, plumbing and electrics, bills of quantities and wages, that nZEB has been

moving inexorably since the early 2000s when EU member states began to tighten building energy standards. For most EU countries, current building regulations for energy are radically different from those of some 10 to 20 years ago, the time when many existing builders spent their formative years learning the practice of construction. Current tacit or shared presuppositions of normative construction techniques are no longer valid in a world of continuous insulation, thermal bridge-free construction, regulated air leakage and renewable technologies. Normative presuppositions, the bedrock of social practice, instead of acting as carriers of apposite technique, lock practitioners into ways of working that may no longer be appropriate.

Method

This paper attempts to apply social practice theory to understand the energy performance gap from a builder perspective in order to explore the nature of the disruption that low energy construction brings to existing practice and its potential resolution. The author is an engineer and therefore the use of social practice theory is tentative and no claim is made that the analysis is exhaustive, from Wittgenstein to Schatzki. It is instead an attempt to apply a social practice analytical perspective to building construction and the energy performance gap in recognition of the paucity of a simplistic 'need for skills and knowledge' dialogue (CITB, 2012) and the limitations of the term 'gap' as an explanatory concept.

Theodore Schatzki (2002:XI) proposes that to understand social practice – the site of the social – is to understand, "a specific context of human coexistence, the place where, and as part of which, social life inherently occurs. To theorize sociality through the concept of a social site is to hold that the character and transformation of social life are both intrinsically and decisively rooted in the site where it takes place. In turn …. this site-context is composed of a mesh of orders and practices. Orders are arrangements of entities (e.g., people, artifacts, things), whereas practices are organized activities. Human coexistence thus transpires as and amid an elaborate, constantly evolving nexus of arranged things and organized activities."

Construction is such a social practice, reflecting a world of people, artifacts and things in their organized activities. For Schatzki (2002:87), "a practice is a temporally

evolving, open-ended set of doings and sayings, linked by practical understandings, rules, teleoaffective structure, and general understandings."

The language of social science is as much jargon as any other discipline and therefore some attempt at explaining the 'doings and sayings' of social scientists is necessary, if only for my own part. Engineering is premised on the precise use of metric units and technical terms whereas: "[T]he social sciences, by contrast, have not expelled natural language concepts for social phenomena, despite their efforts to emulate their scientific brethren in this regard. Indeed, in this division of learning, most regularities are formulated with such concepts…. Orders perpetuated or brought about through actions premised on or explicitly employing fuzzy categorization are bound to exhibit the same fuzziness" (Schatzki, 2002:14-15). Gram-Hanssen (2008:4) in her study of 'everyday routines of energy consumption' begins by comparing Schatzki, Warde, Shove & Pantzar and Reckwitz in order to define the "key elements in understanding practices". Whilst there are some changes in terminology between the authors, the fundamental structure is much the same.

Practical understandings are expressed through practical intelligibility, that is the way of saying or doing a particular aspect of the social practice. Practical intelligibility is a personal expression of the practice and therefore need not be the most rational or normative although for a person immersed in a particular practice, it is likely to reflect the normative. For existing builders, schooled in traditional construction techniques, the advent of air permeability standards and the specifics of airtight construction offer an example of practical understandings that highlights the limitations of normative construction methods and practical intelligibility since these topics have not been historically part of the syllabus for construction education nor an on-site demand and therefore require a new perspective on everyday practice.

Rules govern what is allowed or what must be done. For builders we might consider changes to national Building Regulations with their emphasis on fabric energy efficiency as a set of externally imposed 'new' rules that demand new forms of practical understandings.

Teleoaffectivity (a compound of teleology and affectivity) represents working towards the end goal of the practice as expressed by the practitioner in their views and emotions. In terms of low energy buildings, recognition of the need to meet an air tightness standard affects all work on the building envelope whether that of the window fixer or those charged with sealing penetrations such as pipes and cables. The practice must relate not just to the immediate need to complete the task but also to recognizing its impact on the overall performance of the building envelope. Teleoaffectivity emulates the emotional heart of the practice since, without understanding the building envelope as a single thermal unit - the end goal, it becomes increasingly clear that normative teleoaffectivity and its practical understandings can lead to sub-optimal performance of the end product.

Schatzki, between his 1996 'Social practices' and his 2002 'The site of the social' adds one more element to his analysis of practices, that of the 'explicitization of general understandings'. In 'The site of the social' general understandings are described through the two case studies, the Shaker medicinal herb business and NASDAQ day traders. For the former, it is linked to the religious persuasion of the Shakers which impacts on all of their doings and sayings both within and outside the Shaker community, "as a renewal, palliative, reminder, or cudgel" (2002:243). For day trader practice, general understandings are expressed through "the wonders of the free pursuit of individual gain [which] serve principally to renew lagging spirits, to celebrate victory, or to articulate pride and a sense of belonging" (2002:243). In attempting to ground general understandings in the nZEB context, it is difficult to find an appropriate underlying and common context for builders, however, it should be appropriate to consider the self-esteem and peer recognition of the established builder in opposition to the amateur, the 'chancer', the 'cowboy'. Construction often suffers from the perception that it is the domain of the low skilled, poorly educated and avaricious (Proverbs, 2000; Holt & Edwards, 2005). Professional builders distinguish themselves for the cowboy through their self-image, their understanding and control of their practice. Unfamiliar new terminology and technical units along with new rules and the lack of teleological intent, undermine this positive self-image as builders struggle to understand and meet nZEB specifications. The shared practices of their peer group are challenged, new techniques are nebulous and failure to meet specifications could undermine self-esteem.

However, “[p]ractice organizations are not static. The understandings, rules, and teleoaffective structures that organize integrative practices frequently change. So, too, do the doings and sayings that constitute these practices. These two processes can be called ‘reorganisation’ and ‘recomposition’.” (Schatzki, 2002:240). Professional builders may utilize other practices to reorganize such as browsing the internet, seek continuing professional development, ask those they trust for technical help.

According to Schatzki (2002:105), “orders are arrangements of substances” [people, artifacts, organisms and things], “whereas practices are the organized activities that substances of one type [humans] carry out.” The existing social practice of building has been disturbed by new arrangements where the requirements for nZEB demands that work is no longer judged by existing norms - the design, the quality of finishes, the location, the cost - but also by the energy performance of the building envelope and its renewable technologies. Construction social actors must apply new ‘rules’ where existing ‘practical intelligibility’ is found wanting and where ‘teleo-affectivity’, that is understanding the end purpose, is limited by a lack of thermal or energy literacy.

The challenge of nearly zero energy buildings

Fundamental to nZEB is the concept of the building envelope (the floor, walls, windows and roof that envelope the constructed space) as a single thermal unit even though it is composed of different elements. Insulation must be continuous in surrounding and encasing the opaque elements and each element must be wedded to those adjacent so that the finished envelope achieves a specific air tightness expressed in $m^3/m^2.h$ at 50 Pascals or, alternatively, as air changes per hour. Insulation, thermal bridge-free construction and air tightness are the fundamental requirements for a specific ‘fabric energy efficiency’ expressed as a technical, metric unit of kWh/m^2 per year. Thus nZEB introduce not only new orders of arrangements of artifacts and things into building social practices but also new terminology for this new social practice.

UK research into the energy efficiency of low energy envelopes has indicated an ‘energy performance gap’ (Johnston, et al, 2006; Zero Carbon Hub, 2014; Gupta, et al, 2015) where few building envelopes meet the design specifications, a clear indication of the failure of existing envelope construction and refurbishment social practices. Allied to these new technical and terminological practices is the recognition that a lifetime of practice has no answers to technical questions arising from new specifications, leading to a potential loss of self-confidence, and for those who question or challenge fellow builders, the risk of heterodoxy in what Bourdieu (1977) describes as ‘doxa’, the ‘common sense’ and opinions of the social practice, may lead to fear of ostracism from their peers.

Low energy envelopes need low energy building services. Low air permeability requires mechanical forms of ventilation in order to provide fresh air and remove smells, moisture, volatile organic compounds (VOCs), etc. Meeting nZEB targets often results in specifications demanding mechanical ventilation with heat recovery (MVHR or HRV), systems employing ‘renewable heat’ such as heat pumps and solar hot water (solar thermal), and renewable electricity (photovoltaics or PV). Research into heat pump, solar thermal and MVHR installations (Gleeson & Lowe, 2013; Bergman, 2013; Gupta, et al, 2015) also indicates a propensity for sub-optimal performance.

Building services performance is a complex amalgam of two sets of social practices, that of the designer/installer and that of the occupant. Social practices of occupants have been the topic of research for a number of social scientists (Warde, 2005; Gram-Hanssen, 2008, 2010a, 2010b; Bartiaux et al, 2014) whereas that of the construction worker appears to be largely missing from the literature. Where the role of the construction worker - the builder, plumber, electrician, is recognized – it is generally in terms of the need for enhanced ‘skills and knowledge’ (Construction Industry Training Board, 2012) or expressed through a comprehensive critique of current vocational education and training (VET), that contrasts narrow ‘task based’ assessment with the broader competences of ‘occupational capacity’ systems (Smithers, 1993; Clarke & Winch, 2004; Brockmann, et al, 2009; Clarke, Gleeson & Winch, ud). What also appears useful, in exploring the challenge to the construction industry of meeting nZEB specifications, is to consider nZEBs as a ‘disruption’ to

existing construction social practice and whether social practice theory can support a deeper understanding of the nature and resolution of this disruption.

Methodology

A single case study is proposed as an appropriate research method for an initial exploration of construction as a social practice. The study involves a small builder in Ireland who builds one or two houses per year, employing one or two skilled workers while subcontractors supply the plumbing, electrics and renewables. The study follows the early stages of the contract where the builder has realized the challenge of meeting new building energy regulations. The study is based on three meetings in December 2015, the first to discuss the specifics of the energy specification, the second a site visit to observe and discuss practical solutions, and a third to review the specification and solutions arising from the site visit.

To achieve an energy A-rated house built to current Irish Building Regulations, in addition to the structural demands, the foundations, drainage, radon treatment, etc, the builder is presented by the engineer (required to check structural and thermal compliance) with a specification that demands a “thermal bridging factor of 0.08 in compliance with Department of the Environment details” [Acceptable Construction Details] (Government of Ireland, 2008); specific insulation thicknesses along with their thermal conductivities and the u value for each envelope element; a maximum air permeability of 3 $m^3/m^2.h$ at 50 Pascals and heat recovery ventilation, expressed on the specification as “3 CUM (0.15 ACH/HR)”; and “HRV heat recovery system” respectively. For space heating and hot water, in addition to a condensing oil boiler, the specification requires a room sealed stove, solar hot water and integrated controls for the three heating systems. With regard to social practice, for the sake of simplicity, let us consider just the air permeability requirements.

Having never experienced an air leakage test, the builder asks his friend and colleague (also a builder with 30 years plus experience) who answers that he never bothers with air permeability details since failing the air leakage test will only result in a B-rating, something that will not impact on sale price and is of less interest to the buyer than the building’s location and look. Our builder is distinguished from his colleague by

considering failure of the air tightness target a negative reflection of his professionalism; his personal social practice reveals a difference in general understandings of professionalism. He applies alternative ‘doings and sayings’ by ‘googling’ air leakage, finding the meaning of 3 CUM and that special tapes and adhesives may be required to ensure air tightness. He visits the builders’ merchant, asks for advice and is given a manufacturer’s booklet (Siga, 2015) with photographs of taping around windows and builder’s openings (holes where services enter and leave the building envelope).

The engineer also tells him that an air barrier membrane must be fixed to the underside of the roof joists and counter-battened to provide a space for electrical cables above the ceiling, thus isolating them from the cold ventilated roofspace. Such a solution demands that cable runs are preplanned since they can no longer be run through the roof space to drop directly over switch and light fittings. However, the HRV unit has been located in the roofspace and requires the connection of supply and extract ductwork through the membrane to ceiling locations. The resulting holes in the membrane will then require sealing with proprietary tapes, a process qualitatively more disruptive of the air barrier than any penetration by cables. Furthermore, the pipework from the hot water cylinder (the primary flow and return) must also penetrate the ceiling air barrier membrane since the roofspace-mounted cylinder is on the outside of the membrane and the boiler on the inside. The role of the membrane in separating the ventilated roofspace from the inhabited rooms is therefore unintentionally compromised by both the HRV and hot water design solutions, each penetration requiring a taped sleeve.

The windows and doors fill holes in the envelope where the junction between their frames and the walls provides a potential air leakage zone. Our builder, having investigated sealant tapes asks the window supplier for advice. The supplier states that they supply the windows only and can offer no additional support. The adhesive tape manufacturer’s booklet (Siga, 2015) provides pictures of taping windows to walls, however for the builder, the techniques will demand some experimentation before resembling the illustrations and, in addition, the builder must apply the tapes amidst the dust and dirt of site conditions to adhere to wooden frames and adjoining concrete blocks.

Discussion

The challenge of meeting an air permeability specification arising from new rules, indicates that builders may need to radically expand their practical understandings and teleoaffectivity. Experienced low energy designers identify the air barrier on all construction drawings and prepare a ‘method statement’ for the site construction programme to ensure awareness and preservation of the air barrier throughout the build process. Neither of these practical understandings has been adopted since they are still relatively unknown in conventional architectural and construction social practice. Whilst the builder has learned to consider solutions for individual elements of the air barrier, there is still the search for a comprehensive teleoaffective overview of the air barrier as continuous and requiring a clear exposition of its installation and its maintenance during the construction process.

For construction employees, general understandings include and reflect employment conditions, whether, for example, they are directly employed, agency labour or self-employed and thus the relationship and commitment to the employer. The workplace is a ‘field’ of activity where construction workers apply their ‘social capital’ manifested physically and mentally even in their 'standing, speaking, and thereby [their] feeling and thinking' (Bourdieu, 1977). The construction worker carries a picture of the norm that informs their ‘doings and sayings’, including the alienation of wage labour and contradictions between the need for quality to meet specific energy performance targets and wages based on production output, whether bonus or piecework. In this context, teleoaffective emotions may be more focused on weekly earnings than concern for the low energy specification.

Achieving nZEBs highlights the role of knowledge, skills and competence allied to the dynamics of industrial relations. How to proceed is contested, whether through access to ‘toolbox talks’, enhanced supervision and payment by results, or by a more radical transformation that recognizes construction work as a vanguard occupation for climate change adaptation and mitigation strategy and supported by appropriate initial and continuing VET. The current focus on the ‘performance gap’ and the call for additional ‘skills and knowledge’ is recognition that something in current practice is

going wrong and provides the agents of this social practice the opportunity for a transformation of construction.

Whilst it would appear that the solution for those engaged in construction is in improved vocational education and training (VET), there may be fundamental differences between construction employers and employees that Bourdieu describes as ‘habitus’. Bourdieu (1977:214) writes that “the word disposition seems particularly suited to express what is covered by the concept of habitus (defined as a system of dispositions). It expresses first the result of an organising action, with a meaning close that that of words such as structure; it also designates a way of being, a habitual state (especially the body) and, in particular, a predisposition, tendency, propensity, or inclination.”

The introduction of habitus raises a series of research questions that are not answered in the performance gap literature. What are the current views of construction workers with regard to quality? Is the pursuit of quality at work part of the habitus of construction workers? What change is expected and how is this change driven? What are the impediments to such a change? Is quality output imposed on workers and how? What are the penalties and or rewards?

Habitus is an internalised predisposition, mental and physical, so any change in quality outputs must address more than the technical specification.

Conclusion

Schatzkian analysis of building social practices has identified four aspects of social practice, rules, practical intelligibility, teleoaffectivity and general understandings, that require recognition in mapping the journey to nZEB. The social practice of builders has begun to change in response to new ‘rules’. Builders apply new forms of ‘practical intelligibility’, with all the limitations this implies, to provide site-based solutions. Their ‘teleoaffectivity’ begins to expand as a mental picture emerges of the envelope as a composite of structure, thermal and air barrier. Builders have agency. Where their ‘general understandings’ demand the professional standards associated

with A-rated buildings, we observe ‘reorganisation’ of these aspects of practice and ‘recomposition’ of the doings and sayings that constitute the practice.

The ability of builders to recompose practice to encompass thermal literacy is dependent on a range of influences that include education and civic awareness. Education provides the link to other social practices that cumulatively provide formal and informal knowledge, new practical understandings and the relevant teleoaffective vision. The call for comprehensive VET, initial vocational education and training supported by lifelong learning, recognizes nZEB construction as a departure from existing social practice, demanding new general understandings and thus new forms of practical intelligibility grounded in technical know-how, literacy and communication skills. The extent to which this is a radical departure from existing norms requires further research into the habitus of construction workers and its affect on the ‘doxa’ within which building workers operate. Swartz, in his study of Bourdieu’s sociology (1997:101-103) notes of habitus that it is:
“cultural unconsciousness, habit-forming force, set of basic deeply interiorised master-patterns, mental habit, generative principles of regulated improvisations, mental and corporeal schemata of perceptions, appreciations and actions." "Habitus is a 'structured structure' that derives from class-specific experiences of socialisation in family and peer groups.” “Habitus results from early socialisation experiences in which external structures are internalised. As a result, internalised dispositions of broad parameters and boundaries of what is possible or unlikely for a particular group in a stratified social world develop through socialisation.”

A deeper understanding the performance gap must recognize that both conscious and unconscious attitudes inform all relations between employee and employer, whether or not there is enhanced VET.

This paper attempts to open a discussion of the role of social science in understanding a technical failure in building performance. Further development may include organizational psychology, job satisfaction and work performance that explores deeply entrenched social relationships and supports a radical teleoaffectivity, renewed self-confidence and the potential for new general understandings, not just of nZEB, but also of the wider socio-political landscape.

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