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Dwelling renovation and spatial quality
The impact of the dwelling renovation on spatial quality determinants

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Abstract

Renovation of dwellings for energy efficiency has further implications other than only technical and economic dimensions, such as performance and cost reduction. This paper demonstrates how the renovation of dwellings for energy efficiency impacts spatial quality by crossing technical measures of dwelling renovation with the definition of spatial quality proposed in Acre and Wyckmans (2014). The results of this crossing are developed further into a spatial quality assessment. Spatial quality consists of the interaction between four determinants: (1) views, (2) internal spatiality and spatial arrangements, (3) transition between public and private spaces, and (4) perceived, built and human densities (Acre and Wyckmans, 2014). There are two main challenges in this work: first to demonstrate that energy renovation of dwellings affects spatial quality and second, to create a clear and generic way to indicate and assess this effect that also allows comparability between before and after renovation. The current state of the art in building renovation emphasizes technical performance and efficiency, costs and user responses to technology. However, there is a facet that is hardly explored in the current literature, which is how building renovation affects spatial quality.

This paper contributes both to the theory and practice in building renovation. First it emphasizes the relevance of non-technical dimensions such as spatial quality and of the need for a cross-disciplinary approach in energy renovation of dwellings. Second, the paper indicates that energy renovation indeed affects spatial quality in dwellings. The main contribution to practice that this article aims to bring forward consists of the spatial quality assessment for dwelling renovation. The technical measures of energy renovation for the building components of floors, internal and external walls, roofs, windows, mechanical services and controls, built area and the use of renewable energy options are considered in this study in relation to their impact on spatial quality. The aim is to identify and strengthen the connection between energy renovation and people's well-being through spatial quality. The inattention to the potential of non-technical dimensions such as spatial quality, by stakeholders involved in the energy renovation of dwellings, constitutes a lost opportunity to increase occupants' receptiveness to energy renovation. This receptiveness can be extended by strengthening the connection between renovation of dwellings for energy efficiency and benefits to occupants' well-being. This work follows the current European tendency of fostering energy deep renovation to reach Europe's 2050 aspirations (BPIE, 2011). Deep renovation is an ambitious building renovation strategy that encourages high energy savings measures and the whole building approach (BPIE, 2013). The paper is intended to benefit design professionals, and building owners such as individuals, corporate entities, public sector or real estate portfolio holders,

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because it points out underlying relations between energy renovation and spatial quality that are often not clearly considered in the renovation of dwellings.

Keywords: Spatial quality assessment; Dwelling renovation; Energy efficiency; Whole building approach; Existing residential buildings

1. Introduction

The paper explores the interaction between two components of sustainable development: dwelling renovation for energy efficiency and spatial quality. A spatial quality assessment is developed to assess the impact of energy renovation on spatial quality in dwellings. The goal is to contribute to connecting the benefits of energy renovation with improvements in people's well-being by improving spatial quality. This work is an answer to European incentives to deep renovation. Deep renovation consist of a strategy that aims to reduce energy demand and fossil fuel import dependency by high levels of energy efficiency achieved in the renovation of building stocks (Bettgenhäuser et al., 2014). Most of the actual renovations achieve around 20–30% of energy savings while deep renovations aim to make savings of at least 60% (BPIE, 2013). This strategy has a holistic approach in which the measures are interdependent and may affect the whole building and its context instead of only punctual interventions. Deep renovation is among the actions to reach Europe's 2050 aspirations (BPIE, 2011).

The article is organised in three main parts. First, the article starts by briefly introducing the spatial quality definition (Acre and Wyckmans, 2014) and presenting the assessment for the analysis of the impact of energy renovation in spatial quality. Second, current technical measures of building renovation for the diverse building components (Baker, 2009; Burton, 2012) are presented and their impact on spatial quality is analysed per building component. The questions to be answered here are whether spatial quality is affected by energy renovation and whether spatial quality concerns influence energy renovation in dwellings. Third, the results of the impacts' analysis are summarised and the framework for the spatial quality analysis is consolidated.

This paper indicates that dwellings renovation (technical dimension) considerably affects spatial quality (non-technical dimension). Therefore this work explores the potential of spatial quality to bridge technical and non-technical dimensions. The paper proposes that spatial quality can be an argument to increase stakeholders' openness towards energy renovation of dwellings because it has the potential to increase people's well-being.

Spatial quality is a complex concept to define due to the widespread definition of the both 'space' and 'quality'. However, Acre and Wyckmans (2014) found similarities among several authors in the definition of spatial quality for dwellings. A range of common determining factors for spatial quality was identified in the research literature: view, privacy, lighting, spatiality, spatial arrangements, the transition between public and private spaces, and perceived, built, and human densities.

There is a general awareness of the relevance of non-technical drivers such as organizational, social and behavioural issues, and of the need for a cross-disciplinary approach (Burton, 2012, Schweber & Leiringer, 2012, Patterson, 2012; ZenN, 2012, and Tweed, 2013). Schweber and Leiringer (2012) point out an increase in the number of publications on the topic of non-technical dimensions from 2003 to 2010. However the tendency is to concentrate research on occupant's behaviour, satisfaction, thermal comfort, and the users' potential to influence energy consumption and CO_2 emissions (Tweed, 2013). Schweber and Leiringer (2012) use the example of the social dimension of design that is primarily considered relating to thermal comfort, to argue that the limitation of the scope might be a consequence of the complexity of adopting a cross-disciplinary approach. The weak point of a primarily technical approach in dwellings renovation is that it emphasises energy efficiency, however many relevant issues remain untouched because they are not directly relevant to energy efficiency improvements (Tweed, 2013). The current challenge to reduce energy consumption and CO_2 emissions is an argument for promoting cooperation among technical and non-technical disciplines and diverse stakeholders.

The result of this work underlines the need for a joint effort among diverse stakeholders involved in dwelling renovation and it proposes a possibility of including non-technical dimensions in dwelling renovation. The spatial quality assessment presented can be particularly relevant to building performance assessment tools. This is because the assessment addresses issues that are not commonly considered in the tools such as spatiality and transition between public and private spaces. However, these issues influence the user's well-being and therefore the acceptance and success of the built environment.

2. Methodology and materials

2.1. Research strategy

The research strategy presents characteristics of two research types, namely the deductive research approach (Delanty and Strydom, 2003), and the correlational research (Groat and Wang, 2013). The deductive approach is characterized by an initial theoretical study, the development of hypotheses from the theory, and the collection and