DANISH VERNACULAR ARCHITECTURE: SUSTAINABILITY AS A PRESERVATION VALUE

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ABSTRACT:

New research has demonstrated that sustainable aspects were inherent in Danish preindustrial vernacular architecture. As a logical consequence of this knowledge and with the growing focus on sustainability, this paper investigates sustainability as a preservation value for the purpose of increasing sustainability in Danish architectural conservation. To achieve this objective, the paper presents a so-called thought experiment carried out as a critical case study in order to explore if and to what extent sustainable values are already part of architectural conservation. First, the theoretical base of adding sustainability as a preservation value and the analytical model is established. Next, the case study is carried out and then sustainability as a preservation value is discussed. Lastly, the paper outlines a number of recommendations for promoting sustainability in architectural conservation, including sustainability as a preservation value.

1. INTRODUCTION

At present, many efforts are made to accommodate social transformation towards sustainable development, for instance the adoption of the climate law to reduce 1990 emissions by 70% by 2030. Building is contributing to the problem of energy consumption and by implication, emissions, and hence, building regulations make heavy demands the energy consumption of buildings in the operational phase. That is, however, just one aspect of sustainable building. In fact, contemporary building has larger impacts on the environment in the construction phase due to e.g. the extraction, production and transportation of building materials than in the operational phase (Andersen, 2020). Furthermore, building also generates enormous amounts of waste and in the future building materials are predicted to be scarce and expensive (Lauring, 2014). Consequently, more researchers such as Thomas Sieverts argue that sustainability in buildings and built structures are strongly connected to long lifespans as in preindustrial time, for example through transformation into new uses (Sieverts, 2017). Equally, Bob van Reeth introduces the concept of the 'Intelligent Ruin', in which sustainability is measured on several levels including flexibility (Schoonjans, Van Sande, 2008).

Contemporary pilot projects explore different approaches to sustainable building such as plus-energy housing, breathable buildings or the application of recycled building materials. In keeping with this development, it is highly likely that multiple demands for sustainability will soon be made on future building and, subsequently, on architectural conservation as well.

In parallel to this, new research has investigated connections between Danish preindustrial vernacular architecture and sustainability. It appears that such buildings are particularly characterised by sustainability in the form of resource savings and prolonging the lifespan. Moreover, the research demonstrated and surveyed a variety of sustainable aspects. These range widely from e.g. building materials with a low ecological footprint (for instance reused or renewable materials) to design for disassembly, passive energy strategies, knowledge of materials, climate responsive design, flexibility and aesthetics, to name a few (Eybye, 2016).

This new knowledge of sustainability in preindustrial vernacular architecture adds to general knowledge of such buildings, just as it concerns the relation between architectural conservation and sustainability. For this reason, it appears relevant to examine how this knowledge can contribute to future architectural conservation. As a logical consequence of sustainable aspects being inherent in preindustrial vernacular architecture and the expected future demands for sustainability in architectural conservation, it seems reasonable to add sustainability as a preservation value. Therefore, possible, sustainable aspects should be surveyed and assessed as any other preservation value (such as e.g. architectural and historical value) when dealing with preindustrial vernacular architecture. Furthermore, adding sustainability as a preservation value is expected to promote sustainability in Danish architectural conservation.

2. OBJECTIVE AND METHODOLOGY

The objective of this research is to investigate the proposition that sustainability as a preservation value will increase sustainability in Danish architectural conservation. This proposition is elaborated into three additional presumptions. Surveying and assessing sustainable values in a building, for instance prior to an architectural intervention, is presumed to 1) secure that sustainable aspects are not overlooked and then disappear, 2) secure that the total intervention will be (more) sustainable and 3) maintain or perhaps even enhance other preservation values in the building concerned.

With a view to exploring the overall proposition, this paper presents a so-called thought experiment, which is carried out as a critical case study. First, the paper initiates the frame of the research, thus establishing the theoretical base and the analytical model of the study, including choice of value assessment method and definition of the concept of sustainability. In doing so, sustainability is operationalised into a preservation value for the thought experiment. Next, the thought experiment is executed with the purpose of examining to what extent sustainability/sustainable values is part of contemporary Danish architectural conservation.

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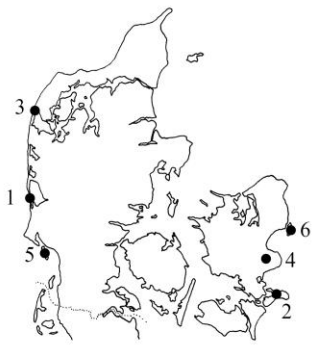
CASE SELECTION			CASE MAP	CASE STUDY'S FINDINGS
Geography/ Climate / Typology/ Context	Western Denmark Harsh climate	Eastern Denmark Mild climate		Democratic settlement patterns Climatic design Daylight and comfort Structural aspects Renewable materials Natural materials Reuse Knowledge of materials Democratic building techniques Maintenance and repair Flexibility Size of dwelling Passive energy strategies Social aspects Aesthetic aspects
Farm house Rural context	Abeline's Farm Sdr. Klitvej 87 Hvide Sande (1)	Hans Hansen's Farm Skullebjergvej 15 Stege (2)		
Village house Village context	Fisherman's House Toftevej 9, Agger Vestervig (3)	Trine's House Tåstrupvej 33 Klippinge (4)		
Town house Town context	Fanø Museum Skolevej 2 Nordby (5)	Vognmandsgade 4 Dragør (6)		

Figure 1. Left: Case selection criteria for the multiple case study of the PhD thesis. The three propositions geography, typology and context aimed to ensure heterogeneity and to secure a theoretical satisfactory dispersion among the six cases. Middle: Map of Denmark showing the positions of the cases. Right: The generated sustainable aspects of the case studies (Diagram by the author).

This part comprises case selection criteria, choice of case (the architectural conservation of Kaline's House at Læsø), case introduction, analysis and, lastly, the findings of the analysis. Then, the analysis and its findings provide a basis for the discussion, which is framed by the three presumptions outlined above. Lastly, the paper concludes with recommendations for future architectural conservation.

The main sources utilised in this paper are found in the author's PhD thesis 'Bæredygtighed i Danmarks førindustrielle bygningskultur og dens aktuelle relevans: belyst gennem studier af seks boliger' ('Sustainability in Denmark's preindustrial vernacular architecture and its current relevance: elucidated by studies of six dwellings'), for which the author obtained the PhD degree. This paper is partly based on a cultivation and elaboration of chapters four and five of the thesis. It is important to note that neither the PhD thesis nor any parts of it have been subject to publication before. For reasons of clarification, directly translated paragraphs and sections will refer to the relevant pages of the thesis. Furthermore, literature on value assessments in architectural conservation and other relevant literature, such as case study research have been applied. The case study comprises the author's empirical studies; an interview with conservation architect Søren Kibsgaard, literature on Kaline's House and the vernacular architecture of Læsø, photos, drawings and other sources, such as internet resources.

Finally, the translation of the Danish term '*bevaringspraksis*' have been somewhat difficult. The term derives from '*bevaring*', to keep or preserve, and '*praksis*', practice, to deal with. After consideration, *bevaringspraksis* has been translated into 'architectural conservation' despite that this translation is not an exact match. In the context of Denmark, more terms are used to describe the architectural field that deals with architectural heritage such as listed buildings as well as buildings and sites worthy of preservation. The prevalent term is '*restaurering*' (restoration). Originally, restoration describes a particular method, in which the building is not only brought back to its original state, but the intervention might be taken a further step with the aim of an ideal appearance. Danish comprehension of restoration has developed into comprising all sorts of (carefully deliberated and methodologically based) dealings with architectural heritage such as maintaining, repairing, preserving, renewing and restoring. For the purpose of illustration, the architectural conservation of Kaline's House is called a restoration in Danish, even though the building is not restored in the original sense of the word. Whereas we in the Danish context are well aware of this understanding of restoration, it often leads to confusion in an international context. In contrast to restoration, *bevaringspraksis* has no connotations. It includes a number of dealings aimed at securing the existence of a (heritage) building, yet is does not imply the character of the building nor the intervention.

3. ANALYTICAL FRAME OF THE STUDY

The objective of this section is to operationalise sustainability as a preservation value for the following thought experiment. First, the findings of the multiple case study of the PhD thesis mentioned above are elaborated into the theoretical base of this paper. Next, the value assessment methods of Danish architectural conservation are presented and, finally, the concept of sustainability is delimited.

3.1 Sustainable aspects in preindustrial vernacular architecture

The PhD thesis 'Sustainability in Denmark's preindustrial vernacular architecture and its current relevance' investigated connections between preindustrial vernacular architecture and what we now know as sustainability through a multiple case study. As the aim was to generate a large number of different sustainable aspects, the case study design was based on three different propositions to ensure heterogeneity and to secure a satisfactory thematic dispersion of the empiricism among the cases. These included geography (east and west of Denmark), typology (farmhouse, village house and town house) and context (rural, village and town), which led to six different cases. Each case was analysed using two analytical models. Fifteen different aspects were generated, among which a certain number of aspects were common to all cases and another number of aspects were seen in several cases (Figure 1).

It is, however, interesting to note that the findings of the case studies were not as diverse as expected. Due to the geographical, typological and contextual dispersion of the six cases and following Helle Neergaard and Robert K. Yin, it is

argued that the findings can be used for analytical generalisation across cases (Neergaard, 2007; Yin, 2014). Consequently, sustainable aspects were prevalent in Danish preindustrial vernacular architecture transversely to types and regions as 'common sense' (Eybye, 2016).

3.2 Value assessment in conservation

In 1964, the Venice Charter laid out international standards of modern architectural conservation, followed by later charters. One of the acknowledged methods of Danish architectural conservation has been developed in accordance with these charters and it comprises five steps including survey, documentation, value assessment, choice of strategies for the intervention and, finally, the architectural intervention (Bock, 2013). The first steps are scientific, whereas the latter ones are artistic.

Values are the key issue in architectural conservation (Jokilehto, 1999), and the discussion of them has been going on since the 19th century. Furthermore, by studying the history of values-based conservation, it is clear that the number of values continues to expand. For instance, Aylin Orbasli lists 19 heritage values in her book called 'Architectural Conservation' and it is not an exhaustive list (Orbasli, 2008). In keeping with this development, values are for the present generally regarded as social constructs. In being so, they are not intrinsic to the building or site in question, but are ascribed to it as significance or as qualities by different individuals or groups, and are thus changeable (Australia ICOMOS, 2013, Pendlebury, 2013, Smith, 2006). Therefore, adding sustainability as a preservation value is possible on a theoretical level.

There are many methods of surveying and assessing values in heritage buildings and sites. In the Danish context, different methods have been developed and utilised. They include 'SAVE' (Survey of Architectural Values in the Environment), 'Vejledning til vurdering af fredningsværdier' ('Guidelines on assessing listing values') by The Agency for Culture and Palaces and, lastly, 'Analyse- og Værdisætning af BYGNINGER og deres omgivelser' ('Analysis and value-assessment of BUILDINGS and their surroundings') by Søren Vadstrup has been developed (Kulturarvsstyrelsen, 2011, Kulturstyrelsen, n.y., Vadstrup, 2017). In similar fashion to the number of values, the number of value assessment methods continues to develop.

The aim of this research is to investigate whether sustainability as a preservation value can with advantage be applied to architectural conservation. Moreover, this investigation targets all preindustrial buildings and not just the listed ones. Consequently, the *SAVE* assessment method seems to be the best point of departure for this study. *SAVE* has been prevalent within different parts of architectural conservation since the late 1980s, and more than 350.000 buildings have been assessed using *SAVE* according to the FFB-database (Slots- og Kulturstyrelsen, n.y.).

The building assessment of *SAVE* is based on five parameters, based on which an overall value is concluded. The five parameters are:

- *environmental value* assesses the situation of a building and how the building supports its surroundings.
- *cultural-historical value* comprises elements that include architectural style, vernacular characteristics, exemplar and symbolic value. A well-preserved smallholder's dwelling is likely to be ascribed exemplar value, whereas symbolic value often relates to a famous inhabitant or building owner, for instance the dwelling in which Hans Christian Andersen was born.
- *architectural value* concerns the architectural appearance such as proportions, façade rhythm, artistic treatment and interaction between form, function and materials.
- *originality* relates to the preservation of the original appearance of the building, and later changes must support this.
- *state* concerns whether the building is in good repair and whether maintenance has been carried out correctly (Kulturarvsstyrelsen, 2011).

Among the five *SAVE*-elements, environmental, cultural-historical and architectural value are considered to be the primary ones, whereas originality and state are connected to the time passed and are thus not considered as (relevant) values in this connection. Hence, this research focuses on environmental, cultural-historical and architectural values, to which sustainability is added. These values will be applied descriptively in relation to exterior as well as interior building parts.

3.3 Defining sustainability

Sustainability is acknowledged to be an essentially contested concept (Eybye, 2016), and, likewise, sustainable architecture is multitudinous. For instance, Simon Guy and Graham Farmer have identified six different so-called 'competing logics' of sustainable architecture. These logics approach sustainable architecture with emphasis on e.g. technologic, ecological, aesthetic, cultural, health and social aspects (Guy, Farmer, 2001).

Within this study, the aim is to apply a wide understanding of sustainability. An example of such is the 'three E's', namely Environment, Economy and social Equity. This definition is also known as the three P's (Planet, People, Prosperity), and Cradle to Cradle denotes the approach 'The Triple Bottom Line' (Guldager Jørgensen, Lyngsgaard, 2013). Consequently, the definition of sustainability applied by this paper takes its point of departure in these three elements and concretizes them into sustainable values comprising a low ecological footprint, economic aspects with an emphasis on resources and energy, and social and cultural aspects including community, democracy and retaining local identity. In doing so, sustainability has been operationalised as a preservation value.

4. A THOUGHT EXPERIMENT: SUSTAINABILITY AS A PRESERVATION VALUE

This section investigates sustainability as a preservation value through a thought experiment that has as its purpose to test the overall proposition (that sustainability as a preservation value will increase sustainability in architectural conservation). The thought experiment will be carried out as a case study. Therefore, this section presents case selection criteria, introduces the case and analyses it with the aim of exploring if and to what extent sustainability/ sustainable values were part of the architectural conservation in question.

4.1 Case selection

For the case selection it is a criterion that it must be a critical case, as such cases permit logical deduction in the form of *"*If it is (not) valid for this case, then it applies to all (no) cases*"*[1]. Hence, critical cases are particularly qualified for falsification or verification, but they are hard to identify (Flyvbjerg, 2006). To meet the two selection criteria for the critical case of this study, the chosen building must be an exemplar of a preindustrial vernacular dwelling, as the findings of the PhD thesis relate to such buildings. Second, the building in question must have been subject to a qualified conservation as outlined in section 3.2. According to Flyvbjerg, if sustainable values are not applied in this case, then they are most likely not applied in Danish architectural conservation.

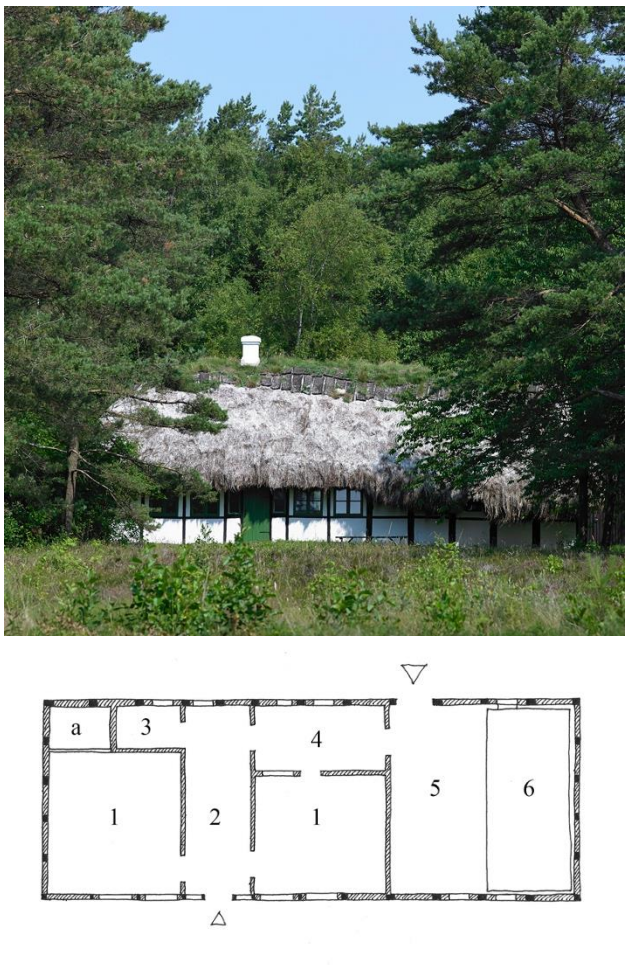


Figure 3. Layout of Kaline's House after the architectural conservation. Living rooms (1), kitchen (2), larder (3), scullery (4), outbuilding (5), new 'box' containing bath and bed recess (6) and bed recess (a). (Drawing by the author).

Kaline's House exemplifies the regional building culture of the island of Læsø and, as such, it is a preindustrial vernacular dwelling and thus meets the first criterion. Realdania By & Byg is a Danish foundation well known for philanthropic investments in the built environment, including architectural heritage, and its architectural conservation follows acknowledged methods. In 2010, Realdania By & Byg bought Kaline's House and, subsequently, started conserving the building.

The vernacular architecture of Læsø is especially known for its roofs made of seaweed, of which only a small number still exist. The decrease in the number of such buildings is mainly caused by seaweed being struck by a disease in the 1930s, for which reason seaweed disappeared from the Kattegat. The result being a lack of seaweed for thatching and repair at Læsø, thus leading to the decline in the number of such roofs (from circa 300 to 20 (Kibsgaard, 2012)) and, relatedly, the particular skills of seaweed thatching died out. As part of the conservation of Kaline's House, Realdania By & Byg decided to provide seaweed for thatching and to contribute to the revival of an extinct craftsmanship to prevent further decline in the number of buildings with seaweed roofs. Additionally, contemporary with the conservation of Kaline's House, Realdania By & Byg started another project called 'The Modern Seaweed House' on the neighbouring plot. The aim of this project was to explore seaweed as a future, sustainable building material due to its good qualities. Seaweed is renewable, non-flammable, resistant against insect attacks, absorbs carbon dioxide and only little energy is used for extraction and processing (Nielsen et al., 2013). Hence, sustainability is a main issue for Realdania By & Byg.

From what is outlined above the conservation of Kaline's House is of high quality. First, an acknowledged conservation method was applied and, second, the building owner made the necessary economical investments in the building, including the great expenses for the roof. Third, Kaline's House is a listed building and The Agency for Culture and Palaces has approved the conservation project. In addition, the owner deals with sustainable building. Therefore, the second criterion of the case selection is considered as having been met.

Objections to the selection of Kaline's House may concern the time of the conservation, as it took place from 2010 to 2012 and thus opts out later conservations. The field of recent, qualified conservations of preindustrial vernacular dwellings is, however, limited and Kaline's House is an exemplary conservation due to the standards and financial capability of the building owner. Furthermore, the conservation is well documented in the form of photos, drawings and a book publication. Consequently, Kaline's House is considered to be the best critical case in this context.

4.2 Case presentation

Kaline's House was probably built in the second part of the 18th century as a dwelling for a fisherman's family or an old couple. The dwelling is a 12 bays long, half-timbered construction. Before the extension to 12 bays, it was nine bays long. Moreover, it is possible that the original dwelling was only four bays long and was then gradually extended with a two-bay kitchen, later a three-bay best room to the west and, lastly, three bay outbuilding. Such a stepwise building process is in keeping with Læsø timber being obtained in relation to shipwrecks. Architect Søren Kibsgaard was in charge of the architectural conservation, and he describes the building *"as a very poor and simple dwelling, built of locally available materials"*[2]. At one time, maybe in the 1950s, the dwelling became a summer cottage and in 1989, the house was listed.

The architectural conservation of Kaline's House included repairs to and renewal of the seaweed roof, the removal of recent additions out of keeping with the identity and authenticity of the building and the addition of a 'box' with a

[1] Flyvbjerg, 2006, p. 230.

[2] Kibsgaard, 2012, p. 8 (translated by the author).

bathroom and extra bed recess in the outbuilding. Kibsgaard explains that "no attempts have been made to make things more neat than they were before"[3]. As an example, a board from a fish crate is preserved in the bed recess (Kibsgaard, 2012).

4.3 Analysis of preservation values in Kaline's House

The following section explores how environmental, cultural-historical, architectural and sustainable values have been part of and are influenced by the architectural conservation. The analysis is based on the publication called 'Kalines tanghus på Læsø' ('Kaline's seaweed house of Læsø') and materials regarding the conservation, such as a building registration and an overall assessment of the state of the building, a project proposal, a regulatory compliance review and photo registration (Kibsgaard, 2010, Kibsgaard, 2011, Kibsgaard, n.y.). 'Læsø Byggeskik' ('Læsø style of building') by H.H. Engqvist adds to the general knowledge of the vernacular architecture of Læsø. All described values reflect the author's own valuation. The new 'box' is left out of account in this analysis.

4.3.1 Environmental value: Kaline's House is situated on an uncultivated site surrounded by tall trees. On the neighbouring plot, the Modern Seaweed House is situated. As both buildings are longhouses and employ seaweed as a building material, there are resemblances between the two dwellings.

On a large scale, Kaline's House is probably part of the eastern settlement of Læsø, which Hans Henrik Engqvist describes as later and primarily comprising of one-winged buildings and smallholders' farms (Engqvist, 1944). The architectural conservation of the house contributes to the preservation of Læsø's vernacular architecture, in particular the use of seaweed for thatching.

Figure 4. Scullery, kitchen and larder (Photographer Helene Høyer Mikkelsen / Realdania By & Byg).

4.3.2 Cultural-historical value: Kaline's House is one of the few preserved Læsø buildings with a seaweed roof. In the context of this conservation, importance has likely been attached to vernacular appearance such as seaweed roof, thrifty half-timbering and Læsø style colouring (wood-tarred half-timbering, whitewashed infills and chromium oxide green doors and windows).

The repair and renewal of the seaweed roof was carried out using traditional materials (seaweed, rye straw and turf for the ridge). In keeping with the lack of timber at Læsø of the past and the frugality of the dwelling, reused timber from another old Læsø dwelling was used for repairing the roof construction. The new panels in the living room are made of locally grown spruce and insulated with seaweed. The present use of local materials is probably connected with the original materials, of which almost all were local. Moreover, the (presumed) original layout is preserved along with some of the older building elements (Kibsgaard, 2012).

4.3.3 Architectural value: The architectural values of Kaline's House include the long, narrow building shape and the seaweed roof that exemplifies the vernacular architecture of Læsø. Interior values comprise sufficient room height and daylight due to the particular Læsø construction (Engqvist, 1944).

Despite the intention of not making the building any neater, the architectural conservation included removal of the tiles behind the stove, replacement of a concrete floor with yellow tiles and exchanging a laminated worktop for a pinewood one in the kitchen. On the other hand, wooden floors and tables made of pinewood are preserved (Kibsgaard, 2012). The architectural conservation seems to have emphasized an aesthetic appearance that takes its point of departure in simplicity and modesty, and, thus, materials and surfaces aim to appear authentic in relation to the original character of the house.

Figure 5. Older layers of seaweed has been preserved (Photographer Helene Høyer Mikkelsen / Realdania By & Byg).

[3] Ibid p. 33 (translated by the author).

4.3.4 Sustainable values: Kaline's House is primarily built from local materials such as seaweed, timber, earth, turf and stone. Timber and seaweed are even renewable resources, timber is reused and only a limited amount of energy is used for processing. The result being that all these factors contribute to the building having a low ecological footprint. In the present conservation, the roof has been repaired and renewed using traditional materials and, moreover, older, intact parts have been preserved. Repair on the roof construction was made with reused timber. Building parts such as the old kitchen range, the stove and a pinewood table are preserved. In rooms with a wooden floorboard, new constructions have been made for disassembly.

Economical management of resources is seen in more ways. For instance, the house is built of the readily available resources. Hence, there are many uneven building parts and components. Knowledge of materials find expression in adobes laid on a base of baked bricks. The layout of the dwelling is probably based on passive energy strategies with cooler rooms at the gables and living rooms facing south, whereas scullery and larder are to the north (see figure 3). Moreover, a seaweed roof has good insulation abilities, and estimates suggest that 120 mm seaweed insulation equals 100 mm mineral wool (Nielsen et al., 2013). Thatching and repair of the seaweed roof has been a very expensive part of this architectural conservation, yet a correctly thatched and maintained seaweed roof is likely to last for circa 300 years (Kibsgaard, 2012). By comparison, a roof made of reed is expected to last 20-50 years, depending on the orientation of the roof (Kulturstyrelsen, 2011). Consequently, the seaweed roof is considered sustainable due to its durability and other abilities as outlined above and in section 4.1. As part of the architectural conservation, all windows have been given secondary glazing and all panels in the living rooms have been repaired, supplemented and insulated. To conclude, it seems that resource saving was not an issue in the conservation.

Kaline's House is customer-owned and community-built, as circa 50-100 people would traditionally take part in the thatching of a seaweed roof (Engqvist, 1944, Kibsgaard, 2012). The flexible half-timbered construction has made expansions in line with owners' need and the obtaining of timber possible. For the conservation, local craftsmen were selected. Furthermore, the preservation of a seaweed roof equals cultural sustainability, as it manifests identity and cultivates the seaweed thatching tradition. (Section 4.3 and subsections 4.3.1, 4.3.2, 4.3.3 and 4.3.4 are translated from pages 115-120 of author's PhD thesis.)

4.3.5 Findings of the analysis: The analysis implys more aspects of sustainability in the conservation of Kaline's House. First, the aim to preserve a building with a seaweed roof conforms to cultural sustainability. In regard to the seaweed roof, environmental sustainability is noticed such as the use of renewable materials (seaweed, rye straw and turf). These materials are, however, most likely preferred due to tradition. The repair of the roof construction with reused timber from another Læsø building and locally grown spruce for the panels of the living rooms are considered as possibilities, which emerged during the conservation process and were then grasped by the architect and building owner due to their good comprehension of Kaline's House.

Finally, the employment of local craftsmen may be a token of social sustainability or it may be caused by the solitary location of Læsø. To conclude, sustainable values do not appear to have been surveyed or articulated in relation to the conservation of Kaline's House on an overall level.

Figure 6. The living room before the architectural conservation (Photographer Søren Kibsgaard).

Figure 7. Original infills are walled up with adobes (Photographer Søren Kibsgaard).

Figure 8. Knowledge of materials is seen in the adobes laid on baked bricks. Repair of post could have been made with reused timber for reasons of sustainability (Photographer Søren Kibsgaard).

5. DISCUSSION

The final part of the thought experiment discusses whether a survey and value assessment of sustainable aspects might have contributed to a more sustainable conservation and thus seeks to provide an answer to the presumptions of the proposition, see section 2.

Initially, it is very likely that a survey of sustainable aspects in Kaline's House would have provided a better overview of these. In this way, such values could have formed the basis for a

conservation with an emphasis on sustainability or could have articulated why sustainable aspects were left out of account. For instance, such a survey might have resulted in the use of reused timber for repairing the half-timbering as well as the roof construction or the repair and renewal of infills and inner walls with (locally produced) adobes, as seen in the original infills (Kibsgaard, 2012). Adobes possess lower U-value and better hygroscopic qualities than baked bricks. Such choices would probably have decreased the ecological footprint further and increased the comfort of the dwelling. Another example relates to the components of the original building, which are characterised by their ability to be disassembled. The conservation included new floor constructions, which are designed for disassembly, yet 100 mm concrete is cast in the kitchen. Moreover, kitchen floor tiles were laid in hydraulic lime mortar with tight-fitting joints of sand (Ibid.). Concrete is a stranger to preindustrial vernacular architecture, and a problematic material too, as it is difficult to reuse and is, consequently, often down-cycled into foundations for roads. Hence, alternative options for floor constructions might have been explored. Relatedly, floor constructions without the use of concrete were explored contemporary with the conservation of Kaline's House (Lykke-Nedergaard, 2015). The floor tiles might have been laid in sand only, as this is the traditional solution. In doing so, the elements of the floor construction could have been disassembled and reused in the future. Furthermore, building components have been removed as part of the conservation process, as these parts were assessed to not be in keeping with the simple, frugal identity of the original dwelling. Pursuing a strategy for disposal and ideally reuse of removed materials would have made the conservation more sustainable. For instance, such a strategy might have led to the reuse of the yellow floor tiles of room 4 as the new kitchen floor. Finally, a larger focus on social and cultural sustainability might have included the local community when the roof was repaired and thatched, so owners of other seaweed buildings, volunteers from museums, etc. could have practised their skills in maintaining and repairing seaweed roofs. Such an approach would have been consistent with seaweed thatching traditionally being a democratic or egalitarian building technique.

The analysis points to good will towards sustainable aspects from the architect as well as the building owner, see section 4.3.5. Therefore, it is highly likely that an increased focus on sustainable values would have increased sustainability in the architectural conservation of Kaline's House. Furthermore, the analysis observes connections between cultural-historical, architectural and sustainable values in the architectural conservation of Kaline's House. For instance, the presumed original layout is preserved, thus maintaining cultural-historical and sustainable values in the form of passive energy strategies. Likewise, it clearly emerges from the analysis that materials in keeping with the simple, frugal identity of the dwelling were preferred (probably for aesthetic reasons) and materials not in keeping with it have been disposed of. The use of traditional materials with a low ecological footprint corresponds well not only with sustainable but also cultural-historical and architectural values.

5.1 Findings of the discussion

All together, the investigations of the thought experiment are considered to confirm the proposed proposition, namely that sustainability operationalised into a preservation value will promote sustainability in architectural conservation. Continuing on, the findings demonstrate that 1) surveying and assessing preservation values could with advantage include sustainable values, in order that such values not are overlooked or disappear. In doing so, 2) the overall architectural conservation of Kaline's House would most expectedly have had a more sustainable outcome and, finally, 3) have strengthened the cultural-historical and architectural values of the house, as all these values are connected to each other. Consequently, the three presumptions related to the main proposition are also considered to be confirmed.

6. RECOMMENDATIONS FOR FUTURE ARCHITECTURAL CONSERVATION

As mentioned, it is highly likely that the climate law to cut 70% of 1990 emissions by 2030 will make new demands on building, including architectural conservation. Therefore, this section outlines a number of recommendations for future conservation of vernacular architecture with a view to promoting sustainability in this field. The following recommendations are based on the previous sections of this paper.

- Value assessment methods already comprise a variety of different values in architectural heritage. With the increased focus on sustainability and in keeping with sustainability being inherent in preindustrial vernacular architecture, adding sustainability as a preservation value would be a logical consequence. This calls for the development of a new value assessment method, in which sustainable values are included and elaborated.

- Surveying values, including sustainable values, provides an overview of such values in the building in question, as seen in the thought experiment of Kaline's House. In doing so, the values are articulated, and informed choices in regard to sustainability can be made.

- Architectural conservation often concerns the addition or subtraction of materials. Strategies for added materials should not only be in keeping with e.g. architectural and cultural-historical values, sustainable values should be emphasized as well. The case of Kaline's House indicates that architectural, cultural-historical and sustainable values already support each other.

- Furthermore, solutions that opt for traditional materials with a low ecological footprint and design for disassembly are in keeping with sustainable aspects of preindustrial vernacular architecture and should, as such, be preferred in future architectural conservation.

- As to the subtraction or removal of materials, strategies for this should also be considered. With sustainability in mind, removed materials should ideally be applied another place in the building and if not reused in another building. This approach would correspond to the comprehensive reuse of building materials and components that took place in preindustrial vernacular architecture (Eybye, 2016).

7. CONCLUSIONS

Research in sustainable architecture mainly focuses on new building and, consequently, architectural heritage and sustainability reflect an area that has been, for the most part, under researched. The objective of this paper was to investigate the proposition of sustainability as a preservation value for the purpose of increasing sustainability in Danish architectural conservation. To achieve the objective, the paper has presented a thought experiment carried out as a critical case study in order to explore if and to what extent sustainability/sustainable values

were part of architectural conservation. First, the theoretical base of adding sustainability as a preservation value and the analytical model was established. Next, the case study was carried out and it was demonstrated that sustainable values had not been part of the conservation of Kaline's House. On the basis of the following discussion, the paper confirmed the proposition and its three presumptions. Lastly, the paper has outlined a number of recommendations for promoting sustainability in architectural conservation.

This paper is the author's initial research. It is suggested that further studies will lead to a more comprehensive understanding of sustainability as a preservation value with a view to developing and testing a new value assessment method that includes sustainable values. In relation this, sustainable aspects in buildings of the years 1850-1945 should be investigated as well, since industrial building techniques not worked fully through in Denmark until 1945.

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